MEETING ABSTRACT



Open Access

Fear learning induces structural and functional plasticity at GABAergic synapses in the basolateral amygdala

Yu Kasugai¹, Elisabeth Vogel², Markus Hauschild³, Ramon O Tasan¹, Yvan Peterschmitt^{1,5}, Andreas Lüthi², Ryuichi Shigemoto⁴, Werner Sieghart⁵, Nicolas Singewald³, Günther Sperk¹, Francesco Ferraguti^{1*}

From 17th Scientific Symposium of the Austrian Pharmacological Society (APHAR). Joint meeting with the Hungarian Society of Experimental and Clinical Pharmacology (MFT) Innsbruck, Austria. 29-30 September 2011

Background

Previous work has suggested that alterations in GABAergic function within the amygdala underlie fear learning. In particular, it has been shown that Pavlovian fear conditioning induces a downregulation of benzodiazepine binding sites as well as transcripts for gephyrin and some GABA_A receptor subunits in the basal nucleus of the amygdala (BA), which were restored to control levels after fear extinction.

Methods

We have undertaken a combined anatomical and physiological approach to examine whether these alterations distinctively involve GABA_A receptors in synaptic or extrasynaptic areas. Specifically, we analyzed – in the BA of mice that underwent fear conditioning as well as extinction – miniature inhibitory postsynaptic currents (mIPSCs), mRNA levels by *in situ* hybridization, and the density for the GABA_A γ 2 subunit by means of the freeze-fracture replica immunolabelling technique (SDS-FRL). SDS-FRL also allowed to precisely measure the size of GABAergic synapses.

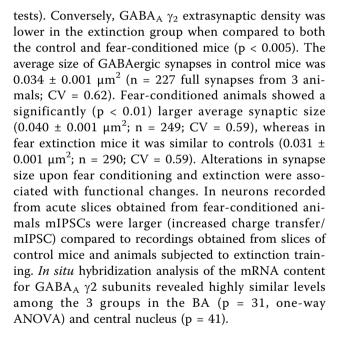
Results

A significant decrease in labelling density for the GABA_A $\gamma 2$ subunit could be detected in the synaptic area in fear-conditioned mice as compared to the control group and mice that had undergone extinction (p < 0.01; Kruskal-Wallis and Dunn's multiple comparison

* Correspondence: francesco.ferraguti@i-med.ac.at

¹Department of Pharmacology, Innsbruck Medical University, 6020 Innsbruck, Austria

Full list of author information is available at the end of the article



Conclusions

Our results indicate that, in the BA, fear conditioning produces a reversible enlargement of GABAergic synapses and an increase in mIPSC charge transfer with no change in the overall number of synaptic GABA_A receptors.

Acknowledgements

This work was supported by the FWF grant S10720 to F.F.

Author details



© 2011 Kasugai et al; licensee BioMed Central Ltd. This is an open access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/2.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

¹Department of Pharmacology, Innsbruck Medical University, 6020 Innsbruck, Austria. ²Friedrich Miescher Institute for Biomedical Research, 4058 Basel, Switzerland. ³Department of Pharmacology and Toxicology, Institute of

Pharmacy, and Center for Molecular Biosciences Innsbruck (CMBI), University of Innsbruck, 6020 Innsbruck, Austria. ⁴Division of Cerebral Structure, National Institute for Physiological Sciences, Okazaki 444-8787, Japan. ⁵Department of Biochemistry and Molecular Biology, Center for Brain Research, Medical University of Vienna, 1090 Vienna, Austria.

Published: 5 September 2011

doi:10.1186/1471-2210-11-S2-A42

Cite this article as: Kasugai *et al.:* **Fear learning induces structural and functional plasticity at GABAergic synapses in the basolateral amygdala.** *BMC Pharmacology* 2011 **11**(Suppl 2):A42.

Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

BioMed Central

Submit your manuscript at www.biomedcentral.com/submit