5 Diverging neural pathways assemble a behavioural state from separable features in anxiety.

Kim SY, Adhikari A, Lee SY, Marshel JH, Kim CK, Mallory CS, Lo M, Pak S, Mattis J, Lim BK, Malenka RC, Warden MR, Neve R, Tye KM, Deisseroth K

Nature. 2013 Apr 11; 496(7444):219-23

Recommendations:

Exceptional **15 Apr 2013**

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NEW FINDING

DOI: 10.3410/f.717995182.793473782

This important article from the Deisseroth laboratory is chosen for evaluation because of its direct relevance to understanding the complexity of anxiety control. The authors demonstrate with optogenetics that anxiety is not associated with a single circuit or brain area, but rather involves several interacting brain circuits that can modify anxiety. For example, this investigation demonstrates that distinct subregions of the bed nucleus of the stria terminus exert opposing consequences on anxiety by way of projections from these distinct sites. An article from the Stuber laboratory on extended amygdala circuits associated with emotion in this Nature issue (see {1} and my evaluation thereof {2}) is complementary to this contribution. Johansen, in this issue of Nature, has provided a summary of these confirmatory contributions {3}.

References

1. **Distinct extended amygdala circuits for divergent motivational states.**
Jennings JH, Sparta DR, Stamatakis AM, Ung RL, Pleil KE, Kash TL, Stuber GD. Nature 2013 Mar 20;
PMID: 23515155 DOI: 10.1038/nature12041
2. **F1000Prime Evaluation of [Jennings JH et al., Nature 2013 Apr 11; 496(7444):224-8]**
Breese G, F1000Prime, 15 Apr 2013
DOI: 10.3410/f.717995183.793473783
3. **Neuroscience: anxiety is the sum of its parts.**
Johansen JP. Nature 2013 Apr 11; 496(7444):174-5
PMID: 23515160 DOI: 10.1038/nature12087

Disclosures

Add a comment

Very Good **16 Apr 2013**

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CONFIRMATION | NEW FINDING

DOI: 10.3410/f.717995182.793474379

The amygdaloid region of the brain has long been implicated in the modulation of emotional processes. However, less attention was paid to the projecting regions of the amygdala, in particular the bed nucleus of the stria terminalis (BNST). This study used optogenetic tools to unravel the role of the BNST in modulating anxiety behavior in mice. The authors demonstrate, for the first time, that two subregions of this brain structure, each having distinct downstream projections, exert opposite effects on anxiety-related responses: one promoting fear responses (i.e. oval BNST) and the other reducing the expression of these behaviors when activated by optogenetic stimulation (i.e. anterodorsal BNST). This study illustrates further the complex and subtle mechanisms underlying anxiety behaviors.

Disclosures

None declared

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Abstract:

ABSTRACT

Behavioural states in mammals, such as the anxious state, are characterized by several features that are coordinately regulated by diverse nervous system outputs, ranging from behavioural choice patterns to changes in physiology (in anxiety, exemplified respectively by risk-avoidance and respiratory rate alterations). Here we investigate if and how defined neural projections arising from a single coordinating brain region in mice could mediate diverse features of anxiety. Integrating behavioural assays, in vivo and in vitro electrophysiology,... more »

respiratory physiology and optogenetics, we identify a surprising new role for the bed nucleus of the stria terminalis (BNST) in the coordinated modulation of diverse anxiety features. First, two BNST subregions were unexpectedly found to exert opposite effects on the anxious state: oval BNST activity promoted several independent anxious state features, whereas anterodorsal BNST-associated activity exerted anxiolytic influence for the same features. Notably, we found that three distinct anterodorsal BNST efferent projections-to the lateral hypothalamus, parabrachial nucleus and ventral tegmental area-each implemented an independent feature of anxiolysis: reduced risk-avoidance, reduced respiratory rate, and increased positive valence, respectively. Furthermore, selective inhibition of corresponding circuit elements in freely moving mice showed opposing behavioural effects compared with excitation, and in vivo recordings during free behaviour showed native spiking patterns in anterodorsal BNST neurons that differentiated safe and anxiogenic environments. These results demonstrate that distinct BNST subregions exert opposite effects in modulating anxiety, establish separable anxiolytic roles for different anterodorsal BNST projections, and illustrate circuit mechanisms underlying selection of features for the assembly of the anxious state.

DOI: 10.1038/nature12018
PMID: 23515158

Comments:

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