Opto-fMRI of the Locus Coeruleus

Christina Grimm a,g,e,f,* , Sian Duss b,g,* , Mattia Privitera b,g, Brandon R. Munr c,d, Daniel Razansky e,f,g, Nicole Wenderoth a,g, James M. Shine c,d, Johannes Bohacek b,g, and Valerio Zerbi a,g,e,f,* 

1. Neural Control of Movement Lab, Department of Health Sciences and Technology, ETH Zurich, Switzerland 2. Laboratory of Molecular and Behavioral Neuroscience, Institute for Neuroscience, Department of Health Sciences and Technology, ETH Zurich, Switzerland. 3. Centre Systems Research Group, The University of Sydney, Sydney, NSW, Australia. 4. Brain and Mind Centre, The University of Sydney, Sydney, NSW, Australia. 5. Institute for Biomedical Engineering, Department of Information Technology and Electrical Engineering, ETH Zurich, Switzerland. 6. Institute of Biomedical Imaging (EBIL), Technical University of Munich and Helmholtz Center Munich, Germany. 7. Neuroscience Center Zurich, ETH Zurich and University of Zurich, Switzerland. 8. School of Engineering, University of Melbourne, VIC, Australia. 9. Center for Biomedical Imaging (CIBM), Lausanne, Switzerland.

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BACKGROUND
Nonadrenergic (NA) release from the brainstem norepinephrine (LC) changes activity and connectivity in neural networks across the brain, thus modulating multiple behavioral states. NA release is mediated by both tonic and burst-like neuronal LC activity. However, if neuronal unknowns of functional MRIs in rats, we show that tonic and burst LC-firing patterns exist between rhythms that are specific to the activation dynamics and temperature pattern. Tonic activation of the LC evokes neuronal responses in particular, slow, and parallel regions. In line with the proposed involvements between LC activity and behavior. We further demonstrate that LC activity enhances network integration and acts as a facilitator of brain state transitions, favoring increased brain flexibility. Together, these findings reveal how the LC-NA system achieves a neuronal regulation of global circuit operations.

METHODS

RESULTS (1) - Pupillometry

RESULTS (2) - Photometry

RESULTS (3) – LC Opto-fMRI

RESULTS (4) – Energy landscapes

CONCLUSION

- Different LC-NA firing patterns and frequencies evoke different physiological responses
- LC-NA activity influences brain activity depending on firing patterns and frequency
- LC-NA activity changes brain dynamics and facilitates brain state changes

REFERENCES