Functional networks of the awake rabbit brain

The brain constantly transmits signals whether during idle wakefulness (i.e., “at rest”) or different behavioral states like cognitively-demanding tasks. Studies using functional magnetic resonance imaging (fMRI) in humans have consistently observed neural networks of coherent activity within and between brain structures subserving some functional purpose or neuronal processing. Utilizing functional connectivity to study clinical populations eliminates potential issues associated with task-related performance and has the potential to determine the potential efficacy of treatment and might provide biomarkers for the identification of specific abnormal brain function related to psychiatric disease.

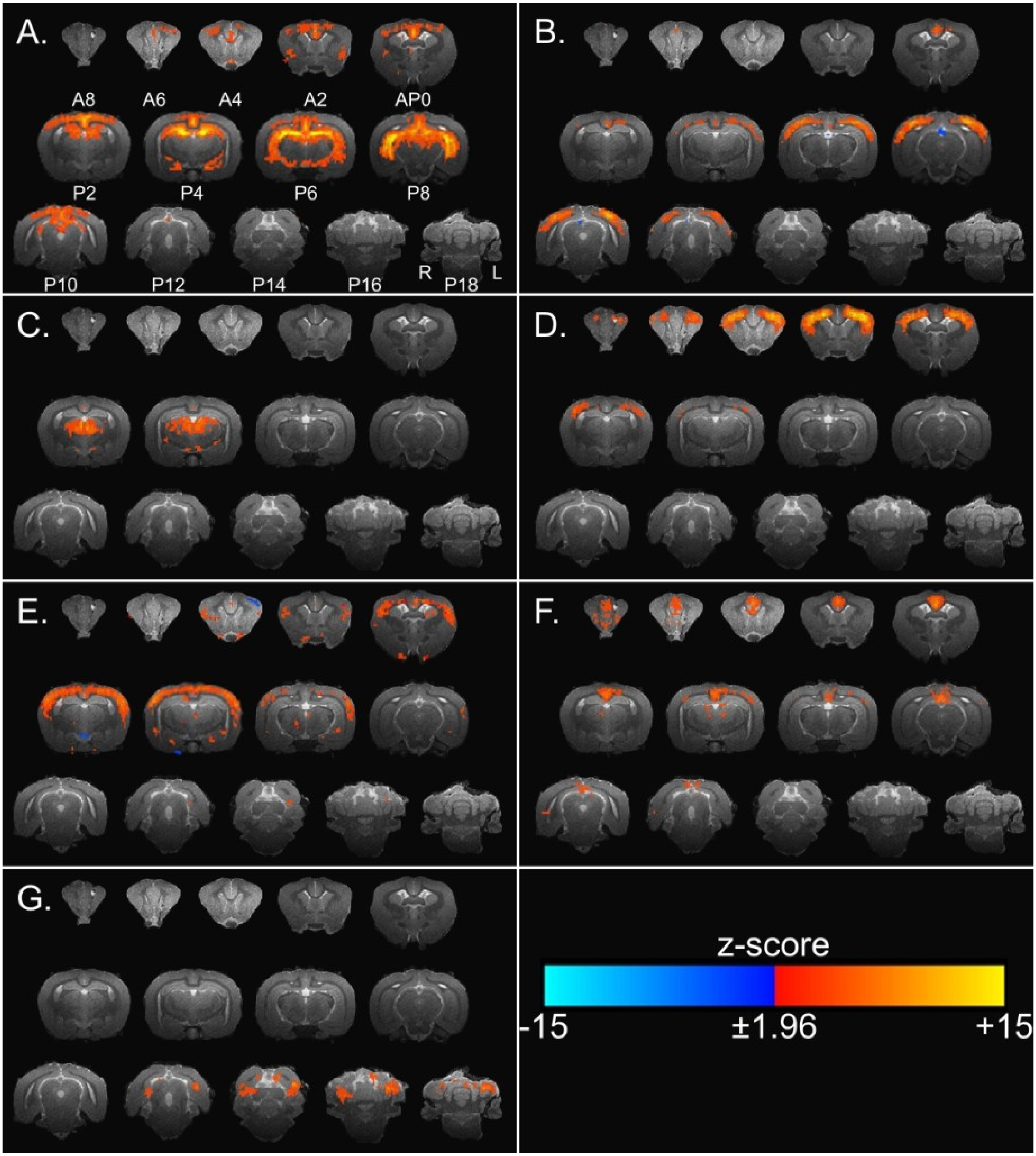

Fig. 1. ntrinsic connectivity networks of the rabbit brain identified using MELODIC group ICA. A. Component C1, Hippocampal network; B. C2, visual network; C. C3, thalamic network; D. C4,

sensorimotor network; E. C5, parietal cortical network; F. C6, default mode network; G. C11, cerebellar network. Color bar represents the z-score of each component.

Some experimental manipulations are difficult to perform in humans but animal models are better suited to investigate this topic. However, many animal models require sedation or anesthesia to be imaged which can significantly alter functional networks. Rabbits are a species that can undergo MRI scanning in an awake and conscious state, preserving the intrinsically active neural networks and allowing for greater translatability to humans.
In this study, we characterized the intrinsic connectivity networks of the resting New Zealand White rabbit brain for the first time using BOLD fMRI data. Group independent component analysis revealed seven networks related to the hippocampus, default mode, cerebellum, thalamus, and visual, somatosensory, and parietal cortices that are similar to previously observed networks in humans, non-human primates and/or rodents.

The intrinsic functional networks of the resting rabbit brain have been elucidated demonstrating the rabbit's applicability as a translational animal model. Without the confounding effects of anesthetics or sedatives, future experiments may employ rabbits to understand changes in neural connectivity and brain functioning as a result of experimental manipulation (e.g., temporary or permanent network disruption, learning-related changes, drug administration, etc.).

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