Primate

Primates are a diverse order of mammals. They are divided into the strepsirrhines, which include the lemurs, galagos, and lorisids, and the haplorhines, which include the tarsiers and the simians

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The primate visual cortex contains various regions that exhibit specialization for different stimulus properties, such as motion, shape, and color. Within each region, there is often further specialization, such that particular stimulus features, such as horizontal and vertical orientations, are over-represented. These asymmetries are associated with well-known perceptual biases, but little is known about how they influence visual learning. Most theories would predict that learning is optimal, in the sense that it is unaffected by these asymmetries. However, other approaches to learning would result in specific patterns of perceptual biases. To distinguish between these possibilities, Laamerad et al. trained human observers to discriminate between expanding and contracting motion patterns, which have a highly asymmetrical representation in the visual cortex. Observers exhibited biased perceptions of these stimuli, and these biases were affected by training in ways that were often suboptimal. They simulated different neural network models and found that a learning rule that involved only adjustments to decision criteria, rather than connection weights, could account for the data. These results suggest that cortical asymmetries influence visual perception and that human observers often rely on suboptimal strategies for learning [1].

Neurons in the primate lateral habenula fire in response to punishments and are inhibited by rewards. Through its modulation of midbrain monoaminergic activity, the habenula is believed to play an important role in adaptive behavioral responses to punishment and underlie depressive symptoms and their alleviation with ketamine. However, its role in value-based decision-making in humans is poorly understood due to limitations with non-invasive imaging methods which measure metabolic, not neural, activity with poor temporal resolution. Manssuer et al. overcome these limitations to more closely bridge the gap between species by recording local field potentials directly from the habenula in 12 human patients receiving deep brain stimulation treatment for bipolar disorder (n = 4), chronic pain (n = 3), depression (n = 3) and schizophrenia (n = 2). This allowed us to record neural activity during value-based decision-making tasks involving monetary rewards and losses. High-frequency gamma (60-240 Hertz) activity, a proxy for population-level spiking involved in cognitive computations, increased during the receipt of loss and decreased during the receipt of reward. Furthermore, habenula high gamma also encoded risk during decision-making, being larger in amplitude for high compared to low risk. For both risk and aversion, differences between conditions peaked approximately between 400-750 ms after stimulus onset. The findings not only demonstrate homologies with the primate habenula but also extend its role to human decision-making, showing its temporal dynamics and suggesting revisions to current models. The findings suggest that habenula high gamma could be used to optimize real-time closed-looped deep brain stimulation treatment for mood disturbances and impulsivity in psychiatric disorders [2].

Non-human primate functional MRI (fMRI) is a growing field in neuroscience. However, there is no standardized method for monkey fMRI data analysis, specifically for data preprocessing. The preprocessing of monkey fMRI data is challenged by several technical and experimental specificities

of the monkey research such as artifacts related to body movements or to intracranial leads. Here we propose to address these challenges by developing a new versatile pipeline for macaque fMRI preprocessing. We developed a Python module, Pypreclin, to process raw images using state of the art algorithms embedded in a fully automatic pipeline. To evaluate its robustness, we applied Pypreclin to fMRI data acquired at 3T in both awake and anesthetized macaques, with or without iron oxide contrast agent, using single loop or multichannel phased-array coils, combined or not with intracranial implanted electrodes. We performed both resting-state and auditory evoked fMRI and compared the results of Pypreclin to a previously employed preprocessing pipeline. Pypreclin successfully achieved the registration of the fMRI data to the macaque brain template in all the experimental conditions. Moreover, Pypreclin enables more accurate locations of auditory evoked activations in relation to the gray matter at corrected level in the awake fMRI condition. Finally, using the Primate neuroimaging Data-Exchange open access platform, we could further validate Pypreclin for monkey fMRI images that were acquired at ultra-high fields, from other institutions and using different protocols. Pypreclin is a validated preprocessing tool that adapts to diverse experimental and technical situations of monkey fMRI. Pypreclin code is available on open source data sharing platform [3)]

Primates are regarded as the most suitable animal models for SAH [4)].

Primate astrocyte

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Laamerad P, Awada A, Pack CC, Bakhtiari S. Asymmetric stimulus representations bias visual perceptual learning. J Vis. 2024 Jan 2;24(1):10. doi: 10.1167/jov.24.1.10. PMID: 38285454.
2)
Manssuer L, Qiong D, Zhang Y, Gong H, Liu W, Yang R, Zhang C, Zhao Y, Pan Y, Zhan S, Li D, Sun B, Voon V. Risk and aversion coding in human habenula high gamma activity. Brain. 2022 Nov 29:awac456. doi: 10.1093/brain/awac456. Epub ahead of print. PMID: 36445730.
3)
Tasserie J, Grigis A, Uhrig L, Dupont M, Amadon A, Jarraya B. Pypreclin: An automatic pipeline for macaque functional MRI preprocessing. Neuroimage. 2019 Nov 16:116353. doi: 10.1016/j.neuroimage.2019.116353. [Epub ahead of print] PubMed PMID: 31743789.
4)
Gules I, Satoh M, Clower BR, Nanda A, Zhang JH. Comparison of three rat models of cerebral vasospasm. Am J Physiol Heart Circ Physiol 2002;283(06):H2551–H2559