Neural representation of head motion in the vestibulo-cerebellum of the macaque

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Spatial orientation, locomotion and equilibrium rely on the brain’s ability to estimate head orientation relative to gravity. Studying this function provides an excellent model of how the brain tracks the motion of more complex body parts such as the arms, a process in which the cerebellum plays a key role. The otoliths, which are gravity sensors located in the inner ear, are also sensitive to head translations: they detect the gravito-inertial force, which is the sum of gravity and linear acceleration. As an analogy, one can compare them to a pendulum swinging relative to the head when it tilted or accelerates. Behavioral studies suggest that the brain resolves this ambiguity by using an internal model of head motion. This model integrates over time head rotation signals provided by the semi-circular canals and allows maintaining an internal estimate of the orientation of the gravity vector relative to the head which is subtracted from the otolith signal to compute an internal estimate of acceleration. In support of this theory, we have identified populations of cells which selectively encode head translations and head tilt in the vestibulo-cerebellum of the macaque monkey. We will present the response of these cells to a variety of motion paradigms which address various aspects of vestibular information processing. Their responses conform to current theories and can be accurately simulated using a simple mathematical model.

Monday, July 18, 2011, 9.45am
Seminar Room Mondi 2, Central building, 1st floor

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