Lightweight Bidirectional Wireless Neural Recording and Control Microsystem

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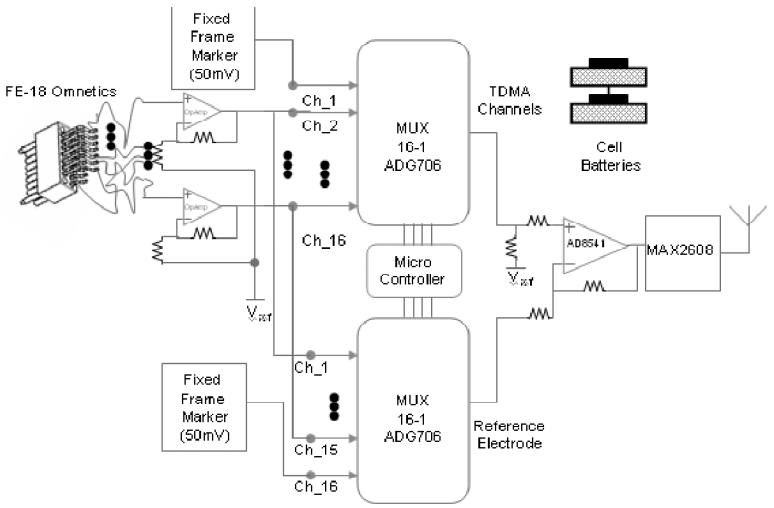

Block diagram of a 16-Ch bio-telemetric microsystem.

To understand the role of experience in modifying the brain, biological information from freely flying songbirds and specifically from the Zebra Finches should be collected. To collect the desired information, extra-cellular neural activity recorded by electrodes implanted in the host's forebrain, should be processed and then wirelessly transmitted out over a wireless link to a remote receiver by a lightweight, low-power, and long-range transceiver capable of both sending and receiving data. The performance of an earlier system has been improved and both *in-vitro* and *in-vivo* tests are completed. By improving the back-end software, in the *in-vivo* testing on a marmoset monkey, biopotentials were recorded on three channels wirelessly for the first time and the system was further characterized through extensive experiments. A high-level Simulink model of the entire system is developed which is employed in designing a 7-channel hybrid system aimed at preliminary biological data collection and wireless link characterization. This Simulink code models all the non-idealities of the entire signal path from implanted electrode's thermal noise to the limited receiver bandwidth. The 7-channel hybrid system is being tested *in-vitro* and *in-vivo* and will next be designed for full integration to reduce size and power dissipation. This project is being supported by the NIH, and through a subcontract from University of Pennsylvania in collaboration with Professor Marc Schmidt in the Department of Biology.