Wireless Recording from Rat Hippocampus

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Present-day multi-channel recording is physically constrained by the wires that connect electrodes to a recording device. In studies of awake behaving animals, this restricts the subject’s movements to a small and enclosed two-dimensional arena. To overcome these constraints, we have developed a 64-channel wireless recording device. Here we describe pilot recordings from the hippocampus of a freely-moving rat.

The system consists of:
• (A) a 28-tetrode microdrive, to be mounted on the skull;
• (B) an integrated 64-channel amplifier/filter/multiplexer [1], connected to the microdrive;
• (C) a battery pack, mounted on the animal’s back with a harness;
• (D) a miniature 2.4 GHz FM transmitter;
• a remote FM receiver;
• a fast data acquisition card.

The head-mounted components weigh ~27 g, and the backpack ~50 g. Battery power is sufficient for 10 hours of recording. The transmitter operates with a range of >60 m at a signal-to-noise ratio of >200. Over the band of 10-2000 Hz, the noise introduced by the entire recording system is <5 µV rms, as referred to the electrode input. We compare the wireless recordings to conventional wired recording of the same signal, and discuss the quality of spike sorting from tetrode data. In addition to action potentials, the system can resolve low-frequency signals in the theta range.

The present instrument is suitable for recording from a variety of animal and human subjects. With modifications to the integrated circuit, smaller and lighter models are possible.