Minimally invasive electrodes for Brain Machine interfaces

Outcome: Researchers in CELEST, an NSF-funded Science of Learning Center, have developed ultra-small electrodes for brain-Machine interfaces. Neural recordings from these electrodes are highly stable, opening up new avenues in the study of learning in behaving animals.

Impact/Benefits: Studies of learning benefit from tracking single neuron firing patterns across time in behaving animals. In small animal models such as mice and songbirds, this is rarely possible due to cortical tissue rejection of the large electrodes that are commercially available. Tissue rejection of electrodes also severely limits the longevity of human brain machine interfaces. This research is leading to new experiments in the study of learning in animal models, and may lead to more stable human brain interfaces. The long term goal of a human implant is to allow patients to control external devices directly, even if they cannot control their own muscles due to spinal injury or other diseases.

Explanation: Ultra-small carbon fibers are individually insulated and bundled together to form a 16 contact electrode. This bundle is smaller and more flexible than many single-wire electrodes used at present. Single neuron firing patterns are shown to be stable over a time-scale of 23 days in a singing bird. Each dot in the image below is a spike. Previously, these cells have not been stably recorded for more than a few hours.