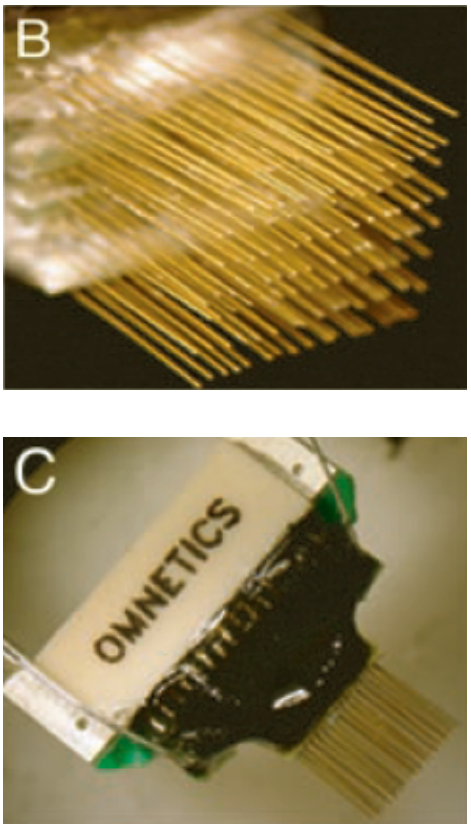
Monitoring circuit dynamics in the brain with arrays of chemical sensors

Recording on single unit electrical activity in the brain has provided detailed insight into processing of specific tasks in discrete brain regions. An example array is shown below:



Nicolelis et. al, *PNAS*, **2003**, 100, 11041

Chemical sensors in the form of microelectrodes are now becoming available for specific neurotransmitters (Wightman, Science, 311, 1570 (2006). The use of these devices in an array format will provide new insight into the role of chemical messengers in this central part of brain processing.

Neuronal basis of the BOLD fMRI signal

Functional magnetic resonance imaging (fMRI) provide a noninvasive way to observe brain activity in humans. Blood oxygen level dependent (BOLD) fMRI signals from a change in paramagnetism when oxygen is displaced from hemoglobin. However, it is not clear what neuronal factors regulate this signal. Thus, an important goal in animal models is to examine these control points that include metabolic rate, blood vessel dilation, and the action of neuronal messengers. A detailed evaluation of all of the underlying factors that effect this signal would ultimately lead to a more comprehensive model to interpret these changes. The following graph from Thompson et al., Science, 299, 1070 (2003) illustrates a correlation between neural activity and tissue oxygen levels.