Reconstructive surgeons have attempted to patch or rebuild tissue deficiencies arising from congenital malformation, traumatic injury or oncologic resection. The success of these surgeries relies on transferring well-vascularized tissue into the defect, especially when transferring tissue to compromised recipient beds that harbor infection or radiation injury. Post-operative monitoring of the transferred tissue is a major challenge. A device that could measure indicators of transplanted tissue viability, such as oxygen partial pressure or lactate buildup, would be of significant clinical value.

The long-term goals of the project are to 1) fabricate a microprobe that can assess real-time values of $pO_2$ and lactate concentration in tissue transplants; 2) test the probe in vivo using flap models of arterial and venous insufficiency and 3) apply and test the device in clinical trials involving human free tissue transfer.

Fabrication process: Prototypes are fabricated on silicon wafers using plasma enhanced chemical vapor deposition to deposit 500 nm of silicon dioxide. Then a 30 nm adhesive layer of titanium by vacuum evaporation. This is followed by deposition of 130 nm of platinum, which forms the active electrode material. The electrodes are defined by a lift-off process to generate a 3-electrode array. The last step involves more chemical vapor deposition to form a 400-nm thick layer of silicon nitride as a capping layer. The sensitive areas of the electrodes are exposed by plasma etching and the surface is dipped in Nafion. We are currently characterizing the probe voltametry.

Microelectrode Probe implant

**Application:** To monitor oxygen tension and metabolite buildup in tissue.

**CNF Device:** Platinum microelectrodes with connecting wires

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CNF Project # 1195-04
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Figure 1: Prototype test device with connecting wires. Dimensions of chip are 9.6 mm by 5.2 mm. The sensitive areas of the electrode are on the left (shiny area). Bonding pads are connected to the 3 wires by soldering.