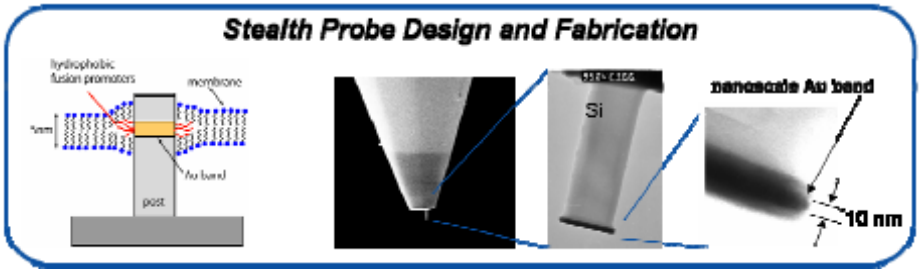
Stealth Probes that Fuse into Lipid Bilayers

Controlling access into and out of a cell is difficult due to the lipid bilayer membrane that surrounds and protects the cell. Engineered devices for penetrating the cell are generally destructive and have poorly-defined interfaces with the membrane. Nicholas Melosh and Ben Almquist of the Stanford–IBM Center for Probing the Nanoscale have designed and built a nano-functionalized probe that can specifically insert into the core of a lipid bilayer. The design is based on biological transmembrane proteins and consists of a thin, 5 to 10 nm hydrophobic band formed by molecular functionalization of a gold layer. Using nanolithography and focused-ion beam milling "Stealth" probes, these were fabricated and tested using atomic force microscopy. The results show that insertion into the bilayer is spontaneous, and the adhesion force depends on which molecule is used to make the metal band hydrophobic. Further development of this architecture will lead to new drug delivery and cell monitoring techniques.



Stealth electrodes are made with a thin hydrophobic band to insert into the lipid bilayer. Focused ion beam milling followed by metal deposition created the 10-nm thick gold band seen here. Atomic force microscopy tests confirmed these probes immediately inserted into the bilayer core, with adhesion strengths up to 4 nN. Credit: Stanford University.

Patents and other steps toward commercialization:

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