

BIOSENSORS



Biosensors

Pinnacle's enzyme-based electrochemical biosensors offer researchers the ability to monitor real-time, *in vivo* changes in glutamate or glucose concentrations in the brain. In addition, Pinnacle has teamed with Sarissa to offer their full range of sensors on Pinnacle's electrodes. When used in conjunction with Pinnacle's unique head or back-mounted wireless potentiostats, researchers are able to perform untethered measurements in conscious, freely-moving animals.



Advantages

Single probe implantation With Pinnacle's two-terminal potentiostat, only a working and reference electrode need to be implanted for recording. Pinnacle biosensors incorporate an integrated Ag/AgCl reference electrode that is wrapped concentrically around the platinum-iridium working electrode.

Low noise recording Pinnacle's wireless potentiostats eliminate noise and artifacts due to cable movement typically associated with tethered recordings.

Fast Response Pinnacle's biosensors achieve a 90% maximum response in less than four seconds.

High Specificity Pinnacle's biosensors employ an intricate membrane network to screen other endogenous electroactive compounds from the sensing surface.

Custom designs Need a longer electrode shaft or a smaller sensing cavity? Pinnacle can help you design the appropriately sized electrode for your specific application.

Warranty Standard Pinnacle biosensors have a 21-day warranty to the first precalibration.

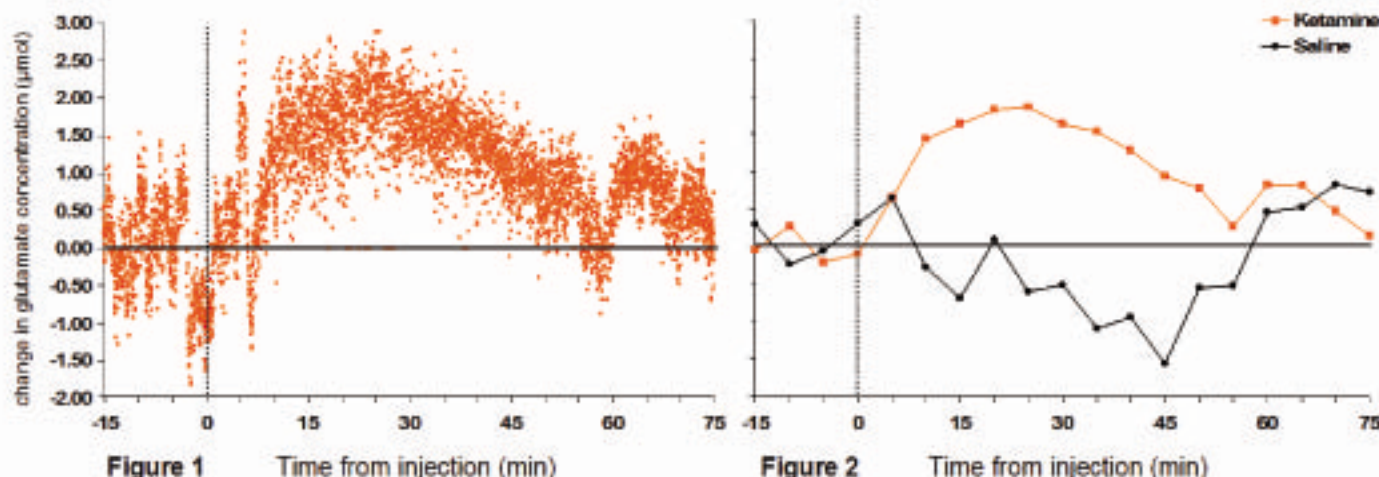
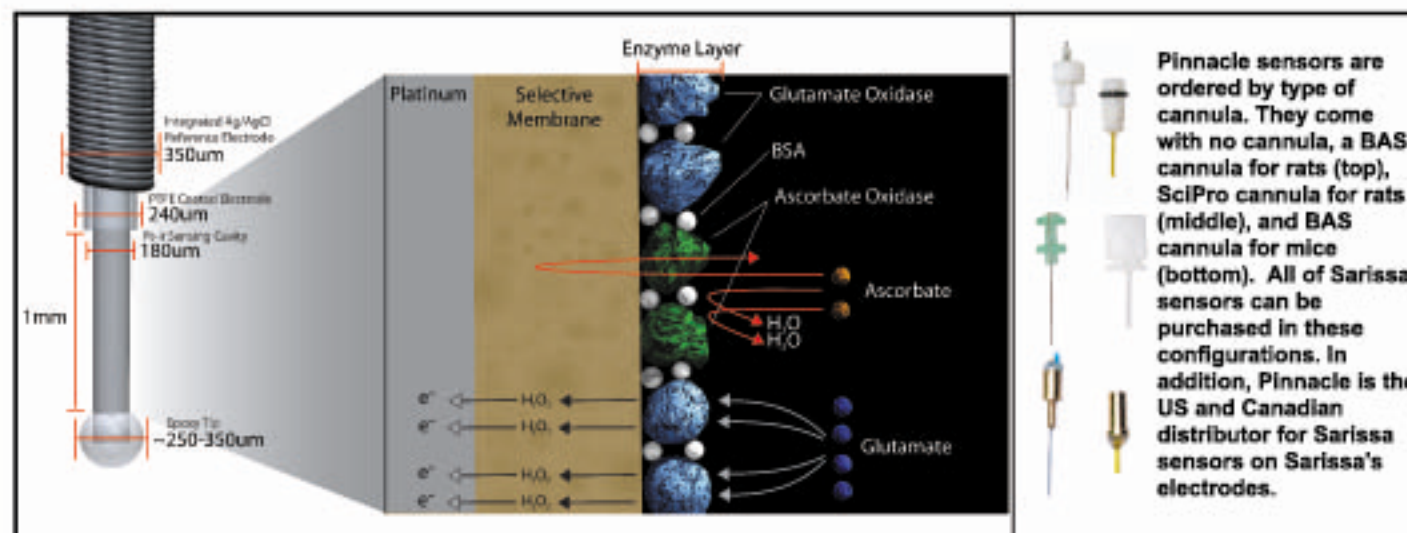


Figure 1 shows the change in glutamate concentration from baseline recorded from the nucleus accumbens of a male Sprague Dawley rat following a subcutaneous injection of ketamine (25 mg/kg, ip). Data were recorded in 1 second intervals using Pinnacle's wireless system. The same results are replotted in **Figure 2** averaged in 5 minute bins and compared to a saline injection in the same area.

Biosensor Overview

Analytes such as glucose and glutamate are not electroactive. Pinnacle biosensors rely on an enzyme, immobilized on a Platinum surface, to convert the analyte of interest into hydrogen peroxide. The enzymatically produced hydrogen peroxide is then oxidized at a PtIr electrode (at a constant potential of 0.6V) resulting in an oxidation current that can be measured and then related to changes in glutamate concentration. Because endogenous electroactive compounds present in the brain can interfere with the measurement, Pinnacle employs a network of selective membranes to inhibit the diffusion of interfering compounds to the electrode surface and to actively remove ascorbic acid (a major interferant) by ascorbate oxidase. By employing an enzyme to convert the analyte into a readily oxidized form, and protecting the sensing surface from endogenous electroactive compounds, Pinnacle is able to offer researchers a tool to monitor rapid changes in concentration in awake and freely moving animals.



Surgery

Using bone screws and dental cement, an intracerebral guide cannula targeting a specific region of the brain is fixed to the skull of the animal. After a recovery period of at least 5 - 7 days, the biosensor is inserted into the cannula (without the use of anesthesia) and the experiment can begin after a 4 - 5 hour equilibration period. Immediately following the experiment, the biosensor is removed from the brain for post-calibration to relate the observed *in vivo* current changes to changes in concentration.

Tethered Recording (Mice)

In order to eliminate signal artifact due to animal movement, a small head-mount is fixed to the skull (alongside the guide cannula). The head-mount acts as the point of attachment for Pinnacle's head-mounted biosensor preamplifier. A low-torque swivel, specifically designed for mice, is used to connect the preamplifier to the external 8401 data conditioning and acquisition system. Power and digital data transmission are via a single USB cable to a PC where Pinnacle's suite of PC software can be used to store, view and analyze the data. The data can also be easily exported for analysis by third party software.

Wireless Recording

Pinnacle biosensors can be used with any potentiostat, but they are specifically designed for simple plug-and-play use with the Pinnacle 2-channel, 24-Bit Wireless Potentiostat. The wireless potentiostat is designed to fit inside a head-mounted enclosure (an alternative 'back-pack' form is also available) to allow the animal freedom of movement and eliminate signal artifacts.

