DEVELOPMENT OF A NEW BIOTELEMETRY SYSTEM FOR REAL-TIME MONITORING OF NITRIC OXIDE, GLUTAMATE AND ASCORBIC ACID IN THE STRIATUM OF FREELY MOVING RATS

Gaia Rocchitta[a], Giulia Puggioni [a], Sonia Dedola[a], Gianfranco Bazzu[a], John P. Lowry[b], Robert D. O'Neill[c], Pier Andrea Serra[a,]

[a]Department of Pharmacology, Medical School, University of Sassari, Viale S. Pietro 43/b, 07100, Sassari, Italy.
[b]Department of Chemistry, National University of Ireland, Maynooth, Co. Kildare, Ireland.
[c]UCD School of Chemistry and Chemical Biology, University College Dublin, Belfield, Dublin 4, Ireland.

Medical telemetry may be defined as the measurement of a biomedical parameter using a wireless device with a very low discomfort. Telemetric devices can be coupled with microsensors or biosensors that generate electrical signals related to electrochemical processes. Nitric oxide (NO) is a water-soluble free radical gas that readily diffuses through membranes and its actions in SNC are largely studied. While low concentrations of NO modulate normal synaptic transmission, excess levels of NO may be neurotoxic. The constant-potential oxidation of NO occurs on Nafion-$_P$OPD-coated carbon fibers at +865 mV vs Ag/AgCl with a good selectivity against electrochemically oxidizable anions. Glutamate (GLUT) is the most common excitatory neurotransmitter in the brain. The long term potentiation in the glutamatergic transmission determines an increasing of GLUT and NO concentrations in the extracellular compartment with excitotoxic effects. Direct electrochemical oxidation of GLUT is not possible in standard conditions so an oxidase-based biosensor has to be used for its detection; the enzyme reaction byproduct, H_2O_2, is measured at +700 mV vs Ag/AgCl on a Nafion-$_P$OPD-coated platinum cylinder. Ascorbic Acid (AA) is a water soluble vitamin that plays a key role as reducing agent and antioxidant in the SNC. AA exhibits a scavenger action against NO overproduction and it is implicated in the protection against GLUT excitotoxic effects through the AA-GLUT hetero-exchange. AA is oxidized at very low potential (+100 mV vs Ag/AgCl) on electrochemically pretreated carbon fibers. In this study, a new telemetry system for amperometric sensor applications has been developed. We describe a fully automated multi-channel biotelemetry system, derived from a previously published apparatus (1) which can be used with microsensors/biosensors for the measurement of NO, AA and GLUT both *in vitro* and *in vivo*. The apparatus, constituted by a potentiostat, a three channel I/V converter, a microcontroller unit and a signal transmitter, was designed, constructed, and tested using an automated dummy cell. The amperometric linear response of NO, AA microsensors and a GLUT biosensor kinetic were determined *in vitro*. At this stage of the development process the system exhibits high stability, low noise and good linear response. The choice of low power CMOS technology makes the electronics suitable of further improvements such as the reduction of the operating voltage and the power consumption. The use of SM components and careful PCB design will make it possible to miniaturize the circuitry and to assemble a transmitter unit suitable for *in vivo* applications on freely moving rats.

1 Serra P. A., Rocchitta G., Bazzu G., Manca A., Puggioni G. M., Lowry J. P. and D. O'Neill R. D. (2006). Sens. Actuat. B: Chem., In Press, Available online 27 June 2006.