

## Acknowledgements

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## Platinum Electrodes in Choline and Acetylcholine Sensor

Acetylcholine is one of the substances in mammals that is responsible for the transmission of impulses between nerves, especially in the parasympathetic nervous system (which slows down activity in the glands and smooth muscles, but increases digestion) and in the brain. Acetylcholine is released when a nerve cell is stimulated, and this in turn stimulates an adjacent nerve cell which also releases acetylcholine, and so transmits the nerve impulse. Immediately after acetylcholine has finished stimulating an adjacent nerve cell it must be deactivated by hydrolysis, into choline and acetic acid, by the enzyme acetylcholinesterase. Any interference with this deactivation short-circuits the nerve impulse transmissions and rapidly results in paralysis or death.

Choline is a strong base which is present in bile; in the brain it is combined with fatty acids or lecithin, and it regulates fat deposition in the liver. As both choline and acetylcholine are found in the central and peripheral nervous systems, they have an important role in human neuropsychological and neuropsychiatric disorders; therefore a convenient simple detector would assist in the study of diseases such as Alzheimer's, dementia and other neuro disorders.

However, the detection of these substances within the body is not easy as they are not oxidisable and do not have attached groups that can be recognised. The most common method of determination has been via high performance liquid chromatography, followed by a post-column enzymatic reaction with acetylcholinesterase and choline oxidase. Hydrogen peroxide, released by the enzymatic reaction, is detected electrochemically at a platinum electrode, or by chemiluminescence.

Biosensors, which allow the enzymatic con-

version and the electrochemical detection of hydrogen peroxide to occur in the same physical device, offer a suitable alternative. Such devices use choline oxidase/acetylcholinesterase enzymes immobilised on membranes or trapped in some other way. However, most of these sensors are not usable in high performance liquid chromatography as they do not conform to requirements of fast response time or sensitivity, or they are not adaptable to cell geometry.

Now, however, researchers at the Università della Basilicata and the Università degli Studi di Bari, Italy, have reported on an amperometric biosensor, in which the enzymatic conversion and the electrochemical detection of hydrogen peroxide occur together in a stable and highly sensitive device (A. Guerrieri, G. E. De Benedetto, F. Palmisano and P. G. Zamboni, "Amperometric Sensor for Choline and Acetylcholine Based on a Platinum Electrode Modified by a Co-crosslinked Bionzymic System", *Analyst*, 1995, **120**, (11), 2731–2736). In their detector choline oxidase/acetylcholinesterase enzymes are immobilised on a platinum electrode by co-crosslinking with the bovine serum albumin (BSA) and glutaraldehyde. The immobilisation can be adapted to the working electrode and cell geometry typical of electrochemical detectors. The electrochemical cell, of conventional design, has a platinum rod counter electrode, a Ag/AgCl reference electrode and a platinum working electrode made by sealing a platinum disc in a glass body. The co-crosslinkage with BSA produced a very thin enzymatic layer which adhered strongly to the platinum surface and was mechanically highly stable. The sensor had detection limits in the sub-micromolecular range and a response time of around 1 second.