

# Electrochemical detection: an historical perspective

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## Introduction

In the 1970's, Ralph Adams recognized that electrochemical methods would be useful for the detection of a variety of neurotransmitters including the catecholamines and serotonin. From this insight came the development of liquid chromatography with electrochemical detection (LCEC) as well as *in vivo* electrochemistry [1]. LCEC proved to be sufficiently sensitive that it enabled the mapping of neurotransmitters in discrete subregions of the brain [2]. Furthermore, it enabled quantification of the minute quantities sampled by microdialysis probes [3]. Today LCEC is a widely used technique in 100's of neurochemical laboratories.

In contrast, *in vivo* electrochemistry had a much more difficult time becoming established. The method provided the intriguing opportunity of observing neurotransmitters doing their job of relaying information from structures deep within the brain in a behaving animal. Furthermore, the possibility of real-time observations were inherent to the method. The chief concern was selectivity—could a compound be distinguished from others in the complex environment of the brain? Many thought selectivity could be achieved by the use of selective pharmacological agents. You can imagine the surprise of the *in vivo* community when Gonon showed that **ascorbate** as well as dopamine changed following administration of amphetamine [4]. This seminal experiment convinced all of us that every means to achieve selectivity needed to be used including chemically modified electrodes [5], various voltammetric methods [6, 7], and electrical stimulation of specific pathways [8]. These methods improved the reliability of the technique. Furthermore, as shown by Millar and coworkers, real time concentration changes could be followed while at the same electrode single unit activity could be monitored [9].

Today, through the combined use of all of these approaches, *in vivo* electrochemistry is providing unique information on the role of dopamine in a variety of behaviors [10]. Efforts are underway to expand the approaches used for dopamine detection to other electroactive neurotransmitters [11]. Furthermore, selective enzymes are being used with amperometric sensors to allow detection of neurotransmitters such as glutamate [12] and acetylcholine [13], molecules that are not electroactive. Thus, despite the rocky start, *in vivo* electrochemistry is an important and reliable neurochemical tool [14].

## References

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