

A BRIEF HISTORY OF DNA ELECTROCHEMISTRY

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ABSTRACT - DNA research has recently experienced a boom in the number of publications employing electrochemical methods, especially due to their advantages in terms of simplicity, speed and cost. Yet, the electroanalysis of DNA is much older, dating back to the late 1950's, when the first polarographic experiments on electroactivity of DNA were performed. This minireview briefly describes the early period during which some important findings were made, as well as more recent trends and applications of DNA electrochemistry in biomedicine.

Today, there are many diverse techniques for DNA analysis, especially when detecting specific DNA sequences in samples, studying their secondary and tertiary structures, interactions with other molecules or monitoring DNA damage. Some of these techniques, e.g. chromatography, gel electrophoresis or spectroscopy, became a routine part of the laboratories, while others are used less frequently and are applied only for specific purposes. Although electrochemistry belongs to those “other”, not so common techniques, it can be very useful if properly employed. Main advantages of the electrochemistry include simple and inexpensive instrumentation, relatively fast measurements and good sensitivity comparable to standard methods, thus making electrochemistry attractive also for DNA research.

Interestingly, Czech researchers played a very important role in the birth of DNA electrochemistry. At the very beginning, there was Johann Gregor Mendel and his discovery of elements of heredity (this happened in Brno only a block away from where this paper was written). Of course, Mendel had no idea that those elements were composed of DNA, and what is more, he could not have imagined how revolutionary his discovery was.

Then, at the beginning of the 20th century, Czech professor Jaroslav Heyrovský invented an instrumental analytical technique called polarography, which measured electric current as a function of potential at dropping mercury electrode. The method, for which Heyrovský was awarded the Nobel Prize in 1959, was suitable for the study of aqueous solutions where trace amounts of various substances could be determined and analyzed.

It is thus not surprising that the first successful application of polarography in DNA research was achieved by another Czech scientist, Emil Paleček, who in 1960 published a paper in the prestigious journal *Nature* describing reduction and oxidation of nucleic acid bases in chromosomal DNA and their degradation products (PALEČEK, 1960). By coincidence (or perhaps not), the paper was written in Brno and gave rise to a new branch of analytical chemistry. Paleček's work has been greatly facilitated by a newly developed oscillopolarograph bought by his supervisor Prof. Vladimír Morávek, after whom