ELECTROCHEMISTRY AT THE FACULTY OF SCIENCES OF PORTO

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Almost forty-six years ago, in October, 1943, the late Professor Humberto de Almeida received his doctor's degree with a thesis entitled

"Polarografia. Subsídios para o seu Estudo e Aplicação à Análise do Vinho do Porto"

which can rightly be considered the beginning of Electrochemistry at the Faculty of Science of Porto, although a very indirect beginning.

At the time there were no facilities to carry out electrochemical research in Porto. With World War II in full swing, practically all research was directed to the war effort. Under these circumstances, Professor Almeida went to Madrid where he did all the experimental work for his thesis with the help of Professor Ramon Portillo.

Immediately after the end of the war, Instituto do Vinho do Porto (Port Wine Institute) acquired a photorecording polarograph for its laboratories. Professor Almeida, a member of the staff of the Chemistry Department,, was appointed a consultant of the Instituto do Vinho do Porto and placed in charge of the polarographic work. There he carried out all his research, and published seventeen articles between 1946 and 1969, all connected with the polarographic application to the solution of problems related to the Port Wine trade and its quality control. These articles were published in a practically unknown journal

Anais do Instituto do Vinho do Porto
(Annals of the Port Wine Institute)

which denied his work the recognition it deserves.

For complete lack of facilities, Humberto de Almeida never had the chance to do research work in his own Department.

A few years later, another member of Department, J.O. Cabral, was given a scholarship by the British Council to carry out research work in Great Britain. Leave of absence for the academic year 1949/50 was also granted. He spent that year at the Textile Chemistry Department of the Manchester College of Science and Technology, the Faculty of Technology of the University of Manchester (now, UMIST). There he worked under H.A. Turner on the polarographic analysis of azo dyes. On this work was based his Ph. D. thesis

"Análise Polarográfica de Corantes Azoicos"

which was successfully submitted at the University of Porto in 1951. This thesis later gave origin to an article published in the Journal of the Society of Dyers and Colourists.

Three years later, in 1953, under the Foreign Student Summer Project programme, J.O. Cabral spent five months at M.I.T., where he carried out some research work on polarography under David N. Hume. This work was continued by Leonard Newman for his Ph.D. thesis, and an article on it was published in the Journal of the American Chemical Society.

For unknown reasons, Electrochemistry was not very popular at the Chemistry Department of the Faculty of Science of Porto, although two members of its staff had some qualifications both for teaching and research in certain aspects of Electrochemistry. Even at the undergraduate teaching level, the only piece of equipment worth mentioning was an old Kohlrausch's apparatus for conductivity measurements.

Fortunately, in 1964 a far-reaching change in the syllabus of Chemistry courses was officially established nationwide. This new syllabus could not be implemented without equipment. Consequently, limited funds were made available which allowed the purchase of modular equipment (ARF and EEL), including some modules for electrochemistry, but only suitable for teaching purposes. This purchase took place between 1966 and 1970; curiously enough, some of those modules are still being successfully used at undergaduate level.

In spite of its limitations, this equipment made possible for five final--year students to do their seminar (small research project) on polarography in the academic year 1969/70, the first time such work was carried out in this Department.

From then on, the interest in Electrochemistry advanced at an increasing pace. In 1972, the first polarograph (Sargent XVI), mainly suitable for analytical studies, was received and in 1975 the first equipment for research (P.A.R.) was purchased.

It was soon realized that progress in Electrochemistry required the help of skilled scientists from abroad. With the invaluable assistance of the British Council, three scientists from the U.K. visited us for short periods of time.

In 1973, Dr. G. J. Kakabadse (UMIST) spent two weeks in Porto. During this time, he not only delivered a short course of lectures on

"Ion Selective Electrodes. Their Scope and Limitations"

but also supervised some experimental work on this subject. Thus began our fruitful research on ion selective electrodes.

In 1978, Dr. J. Grimshaw (The Queen's University of Belfast) also spent two weeks in Porto, with a similar pattern of activities: a short course of lectures on **"Cyclic Voltammetry"**, as well as some practical sessions.

This visit paved the way to our active research on voltammetric studies, mainly cyclic voltammetry, of coordination compounds.

Given the success of this kind of visits, a third one was arranged in 1982, with Dr. A.G. Fogg, of the Loughborough University of Technology. This time the subject was

"Voltammetric Methods of Analysis"

with special emphasis on synthetic colouring matters used in the food industry.

In all these three initiatives, and subsequent research work carried out in Porto, only applied aspects of Electrochemistry were covered, fundamental aspects were obviously missing. The situation changed in 1980, when A. Fernando Silva returned to Porto after having obtained his Ph.D. with a thesis entitled

"**Electrical Double Layers**"

at the University of Southampton, under the supervision of Graham Hills.

From the shaky beginnings of the late sixties and early seventies to the present time progress has been remarkable. Heavy investment both in qualified and enthusiastic personnel, including some final-year students, and in specialized equipment, with various degrees of sophistication, paid its dividends. The electrochemical laboratories of the Department became one of the best in Portugal and the research work coming out of them has reached a reasonable good degree of international recognition.

One of the most positive aspects of this investment was the possibility of carrying out in Porto, wholly or mostly, research work leading to doctor's degrees. In chronological order, the following three have already been successfully submitted

1983 - Maria Teresa Vasconcelos
"Determinação Potenciométrica (pH e pM) de constantes de Formação de Complexos"

1986 - Aquiles de Barros
"Controlo Analítico de Corantes Orgânicos Sintéticos em Medicamentos e Cosméticos"

1986 - José L. Costa Lima
"Eléctrodos Selectivos de Iões com Suporte de Resina Condutora"

and at least an equal number are presently at several stages of preparation.

The research is not limited to the preparation of Ph. D. theses, many other research projects, some with international collaboration, are under way. Some representative examples are given below:

1. Voltammetric study of coordination compounds, especially of biological relevance

2. Voltammetric study of purines

3. Properties of interface

4. Analytical quality control by voltammetric methods

5. Response properties of ion selective electrodes

6. Immobilized enzyme electrodes.

In conclusion, it can rightly be said that patience and perseverance for almost four decades finally had their reward.