

Nobel Prize in Chemistry 1959



Jaroslav Heyrovsky

The Nobel Prize in Chemistry 1959 was awarded to Jaroslav Heyrovsky *"for his discovery and development of the polarographic methods of analysis"*.

RESEARCH INFORMATION:

Analytical chemistry is a science, fundamental not only to the other branches of scientific chemical research, but also to applied chemistry, the chemical industry. Further it is important for the other natural sciences, both within inorganic and organic Nature, for medical research, and for many humanistic and even jurisprudential sciences.

The striving of analysts is not only to develop methods yielding accurate results, but even more important for practical work is that the analysis can be carried out rapidly, that it can be done using as small samples as possible, and that very small percentages of various substances can be detected and ascertained.

Polarography is one of these micro-methods which are available to the modern analyst. Professor Bohumil Kucera of Prague once suggested to the young Jaroslav Heyrovsky that he should study certain irregularities in connection with the capillarity of mercury and attempt to disclose their origin. This was one of the innumerable small problems constituting science. Heyrovsky let the mercury flow through a glass capillary and weighed the drops. It was a slow and tedious method, and he resolved instead to

measure the electric current obtained when he put a tension between the mercury in the capillary and that collecting at the bottom. The glass capillary does not terminate in the air, but in a solution, through which the current now will flow.

Heyrovsky found that this device could be used for something much more important than the original problem. It could be used for ascertaining very small quantities of the most diverse substances dissolved in the water, and moreover, to measure their percentages.

Important new discoveries are found where they are not expected. Spectacular advances in our time have been achieved by great teams, and some people are saying that only teamwork is worth-while, whereas a single scientist nowadays can do nothing. Well, teamwork can be efficient, and is organized when you have been able to set an aim for the work. But the new discoveries are made by some scientist who noticed something strange, possibly by two, independently and in different countries. Then it is important that future team leaders and authorities granting funds do not keep him too strictly to attend his job, but give him a chance to pick up the unexpected new things, in spite of the chance of finding them being diminutive. When Heyrovsky put a small electric tension between the dropping mercury and that collecting at the bottom, he found in accordance with earlier experience that the current increased by steps when the tension was raised over certain fixed values. Earlier people usually introduced the current into the solution by means of a platinum foil. But various substances will stick to the surface of a solid, disturbing the course of the experiment. Because the mercury drop is falling off after a few seconds and a new one then will be forming, this method always ensures us a new clean surface against the solution, and disturbances are avoided.

The current will increase perceptibly even at very small percentages of such substances that will undergo a chemical reaction at the surface of the mercury drop when the current passes. The increase will not be unlimited, but is proportional to the percentage. The tension needed is a characteristic of each substance, and therefore the

method gives us information concerning both which substances are present in the solution and their quantities.

Heyrovsky together with his Japanese collaborator Shikata built an apparatus which registered how these electric currents varied with the tension applied. This apparatus, named the polarograph, traces a curve, from which can be read both place and height of the various steps.

About a decade elapsed before the method found some use outside Heyrovsky's own laboratory. But when this at last happened, people found that for example impurities of a metal sample could be easily and accurately ascertained. Earlier, this problem, of great importance to industry, often was very laborious, time-consuming and the results uncertain. Heyrovsky and his collaborators, at home and abroad, disclosed the theoretical foundations of the methods and worked out its applications to more and more types of problems. Almost all chemical elements can be analysed with the aid of the polarographic method and in Organic Chemistry it is equally useful for the most diverse groups of substances.

Heyrovsky also has elaborated modifications of his method which are extremely valuable for special kinds of investigations. For example, it is possible to squirt a jet of mercury into the solution instead of dropping it and the registration will be effected with an oscillograph. But, when speaking of polarography, one primarily thinks about the classical polarograph and its step curves. A great number of instrument makers the world over are producing these recording instruments, which are nowadays found in every well-equipped analytical laboratory. In contrast to certain other versatile instruments employed in modern analysis, they sell at a reasonable price. Thousands of polarographs scattered over the world facilitate chemical and medical research, and in the industrial laboratories they contribute in cutting prices of both necessities of life and of more advanced results of material production.

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