

A LOOK AT ANALYTICAL CHEMISTRY

The first impression of Professor Carol Hollingworth Collins is that of a person in love with Analytical Chemistry. And the last impression, too. Her academic and professional background – as wide as her passion – developed during 50 years of work in the United States, Belgium, Taiwan, the Philippines, and Indonesia. She settled in Brazil in 1974, the year she came to State University of Campinas to work in Radiochemistry. She became a Brazilian citizen and a full professor of Analytical Chemistry at Unicamp Chemical Institute, a position she held until her retirement. “Retired, but not inactive,” she hastens to say. Currently, she dedicates most of her time correcting and translating to English over 200 articles every year written by her Chemistry Institute colleagues, for publication in journals indexed abroad. During this interview she recalls a little of the history of Analytical Chemistry and talks about the future trends of this science.



Photo by Admilson Cerqueira

Professor Carol Hollingworth Collins, in her office at State University of Campinas: more than 200 articles corrected per year

IS IT POSSIBLE TO DEFINE ANALYTICAL CHEMISTRY?

No. Overall, Analytical Chemistry is the development and application of methods for determination of organic and inorganic constituents of samples. I use the word determination because it may be qualitative or quantitative, but this is what differentiates analytical chemists from physical chemists whose main function is to develop equipment.

WHEN DID THE FIRST RESEARCHES IN THIS AREA BEGIN?

Analytical Chemistry was virtually the first science within the wide Chemistry area, obviously not with that name. It was born with the alchemists around 1600, with the beginning of the first pharmaceutical formulas which mixed natural products. From these products originated the first medical drugs, extracted from plants and, sometimes, even from inorganic matter. In reality, it started as a branch of Organic Chemistry which we can define today as Analytical Chemistry.

WHEN DID THE GREATEST ADVANCE START OCCURRING?

No doubt since the 1950s. The number of procedures employed in Analytical Chemistry determinations increased more than tenfold in comparison with the previous period. I used the first spectrophotometer purchased by my university in the US in 1951, during the last year of my Bachelor's degree. The equipment already existed before that, although not in small universities. But the development did not occur in Chemistry only, but in all areas, as a function of the advance in the computing area. For instance: computers, which were initially built during the 1940s for military applications, were restricted to government labs in the Soviet Union, the US and Europe and occupied entire rooms. When we received the first mass spectrometer at Unicamp, it came coupled to a minicomputer the size of a counter. So, I would say that the greatest advance was in this field, since today you only have to turn a computer on and it will do the readings you need.

DON'T YOU BELIEVE IN MAN'S INCREASING DEPENDENCE ON MACHINE?

Any researcher sees these technologies literally as a means to help them make their projects real. Today there is less human influence on processes, which is positive since there are fewer errors, but it is important to say that human participation is essential for data analysis and interpretation. A very well trained, experienced professional is necessary to develop the programs that allow us to correctly interpret the data. A sharp mind is required to benefit most from the technology in order to improve results in any area, be it Analytical Chemistry, Medicine, Engineering and so on. The computer provides the results, but the correct application of these results depends on the mastery of man over the tool he uses day by day.



Photo by Admilson Cerqueira

Carol Hollingworth Collins lives in Brazil since 1974

In the academic environment this dependence is a little lower than in the industrial sector, where processes are more automated.

WHICH EVENT DO YOU DEEM WAS MOST RELEVANT?

In the chromatography area, where I now work, I believe it was the acceptance, in 1930, by organic chemists, that Chromatography does work. In 1906, a Russian botanist, Michael Tswett, published several papers describing a process he employed to separate organic compounds extracted from plants. The chemists did not accept his theory, saying that what he did was Biology, not Chemistry; however, his findings were very important, and were finally accepted by organic chemists during the 1930's. By the end of the 1930s, inorganic separations had begun, mainly for isolation of the rare earth elements and, later, of uranium and occasionally plutonium. Then the study of chromatography in the separation by adsorption of organic compounds, as well as ion exchange chromatography for the separation of inorganic compounds, allowed a huge leap in research.

CONCERNING PROFESSIONALS, IS THE ACADEMIC FORMATION APPROPRIATE?

Undergraduate training is relatively standardized all over the world and involves qualitative and quantitative evaluation and use of the various instruments available. At the graduate level, Analytical Chemistry is so diversified that a generic evaluation would be hard to make. Also, there is an aggravating problem: no dialogue exists among researchers and few know what is being done in the different research lines. An electrochemist does not talk like someone who studies spectrophotometry; and when one talks about spectrophotometry the studies are quite diverse, from UV and visible spectrophotometry, through the infra-red region, then atomic absorption and ICP systems. We also have mass spectrometry, which studies organic compounds, whose researchers do not dialogue with those who do ICP, who study inorganic compounds. A good example is right in the room next door from where we are talking now: those working in the liquid chromatography lab do not allow access to those working in the gas chromatography lab for fear that they will push the wrong button (laughs) and vice versa.

IS THE NUMBER OF GRADUATE PROGRAMS SATISFACTORY?

In 1981 we had the first Brazilian meeting on Analytical Chemistry in Rio de Janeiro. At that time only six universities had graduate programs – two for Master's degree and four with Master's and Doctor's degrees. Today there are more than 40 graduate programs in Brazilian Universities. It is an impressive advance, more than in any other area of Chemistry and presents an interesting contrast to the U.S. and Europe, where Analytical Chemistry is subsumed into Physical Chemistry or Organic Chemistry, with very few graduate programs offering degrees in Analytical Chemistry, which I view as a great mistake.

IS THERE INTEGRATION BETWEEN THE ACADEMIC SECTOR AND THE INDUSTRIAL SECTOR?

The barrier between academics and industry has always been huge. In the United States, for exam-

ple, rarely does the industry interact with academics, although this is better than in the past, since the sources of public sector resources are decreasing, making American universities and companies feel the need to approach each other. In Brazil, where public financing still meets the most of the demand, university-level research depends on public resources and there is not too much interest in approaching industry. Also, there is a cultural issue

with Brazilian scientists, who see this relationship as somewhat unethical. There are a few joint projects, but contact is still very slight. I think that higher integration would be beneficial to all of us.

WHICH IS THE PREFERRED PROFILE OF PROFESSIONALS IN INDUSTRY?

That depends on its needs. The industry will often hire people with a bachelor's degree to

receive specific training on a given equipment; however, for other more complex activities, such as chromatography or ICP, companies prefer specialists with master's and doctor's degrees, since most of them have practical experience in the different types and brands of equipment in the market. This is usually a differential at the time of hiring.

IN YOUR OPINION, WHAT CHANGE IS NEEDED TO MAKE THE FUTURE OF ANALYTICAL CHEMISTRY MORE PROMISING?

I would like to see Analytical Chemistry less vulnerable to influences that I consider negative, such as immediacy, for instance. We live in an instant world that requires immediate application for everything. The time to complete a master's degree is two years, and a little more generous to complete a doctor's degree, which is three to four years. We need to have a project with immediate answers, and most research institutes require that their researchers and their graduate students publish partial results of their work during its development. Also, there is a generalized hurry, sometimes even a requirement, to publish before defending a master's or doctor's thesis. I would like to see things being done more calmly. I see research lines as a building, where each researcher adds a brick to improve it. ■

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