

CHEMICAL ENGINEERING EDUCATION AND RESEARCH IN POLAND

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The present paper relates the activities of a visit made by the author under the auspices of the U.S. National Academy of Science to Poland. Essentially, a detailed description of chemical engineering education and research in Poland is given. In addition, a thorough analysis is made of these activities so that conclusions are reached with regard to quality, problems and future directions.

WARSAW I

UPON ARRIVAL IN Warsaw I met Drs. Zahorski and Ziabicki from The Institute for Basic Problems of Technology (IBPT). My general impression of the group in the Laboratory for Polymer Physics (headed by Dr. Zahorski) was that they were well qualified and involved in first rate research. They suffered, however, from a serious lack of laboratory equipment. Because of this, most of their research was theoretical. There were a large number of doctoral candidates working for both Drs. Ziabicki and Zahorski (about twenty or so). The background of these students was varied—some were physicists, some chemists, engineers and even biochemists. There appeared to be less restriction in changing graduate fields than in the United States. In fact, the boundary between engineering and scientific disciplines was much more fluid than in our country.

I was surprised to find that all doctoral candidates were handled within the Polish Academy of Science without involving a university. While some scientists are jointly appointed to PAN and a university, this is not very common; and consequently, the academy grants its own doctorates.

Next I spent some time with the Laboratory for Fluid Mechanics, also a part of IBPT. My contacts here were Drs. Herczynski and Szaniawski. This group had somewhat more extensive experimental facilities. The research program in the Fluid Mechanics Laboratory seemed to be directed toward esoteric problems. They were, for example, interested in shock tubes. There didn't seem to be any push toward industrial or applied problems. Generally, the Fluid Mechanics Laboratory seemed



Figure 1. The statue of Copernicus between the Polish Academy of Science and Warsaw University.

to be more isolated than the Polymer Physics Laboratory. Perhaps part of the problem was that the scientists in the latter group had been either in Polish industrial laboratories or overseas, while the Fluid Mechanics Group had essentially only their PAN background.

I also continued to discuss research topics with the Polymer Physics group. The principal efforts were being directed to polymer-solvent systems, viscoelasticity and statistical thermodynamics of polymers.

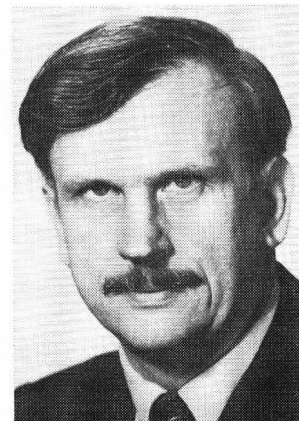
ON TO CRACOW

MY NEXT STOP was Cracow. I visited the Technical University and specifically Dr. M. Mrowiec, the Head of the Institute for Chemical Engineering, and an Associate Dean of the University.

In discussing Polish technical higher education, it became apparent that great emphasis was being placed on the training of engineers and applied scientists. There were no employment problems since the government provided jobs for all such graduates.

The Polish system is based on a five-year program which leads to the degree of Magister (i.e., Master's degree). The curriculum provides for either an industrial practicum or a university based project in the fifth year. In the applied chemistry and chemical engineering areas the course of study is essentially the same for the first two years. Then, during the third and fourth years the chemical engineering and applied chemistry programs diverge. The general impression that is given is that the chemical engineering degree is more rigorous and demanding. Course content appears to be more practically oriented than in American programs. There is, however, a strong emphasis placed on the basic sciences.

The faculty at Cracow were dedicated and appeared to be well qualified. Practically all of them were educated entirely in Poland. The principal exception was Dr. Mrowiec, who had received German graduate training. Students seemed to be bright and hard working. In Poland they are a somewhat privileged class since they receive free education, and special benefits such as trolley and bus passes and various discounts. An impressive feature was that the Cracow Technical University, although a fairly new institution, had several thousand students. In fact, it would have been larger than nearly all U.S. Colleges of Engineering.



Richard G. Griskey received his B.S. in Chemical Engineering from Carnegie-Mellon University in 1951. From 1951 to 1953 he was a First Lieutenant in the Combat Engineers of the U. S. Army Corps of Engineers. In 1953 he entered Carnegie-Mellon where he was awarded an M.S. (1955) and Ph.D. (1958).

The National Academy of Science appointed him as Senior Visiting Scientist to Poland in 1971. In the same year he was appointed Dean of the College of Engineering and Applied Science of the University of Wisconsin-Milwaukee as well as Professor of Energetics.

He has had industrial and consulting experience with DuPont, Celanese Fibers, Celanese Research, Phillips Petroleum, Thermo Tech Inc., Hewlett-Packard, Litton Industries and the U. S. Veterans Administration. He is a member of AIChE, Cryogenic Society, Society of Plastics Engineers, ASEE, and the Society of Rheology.

Dr. Mrowiec went into quite a bit of detail in describing Chemical Engineering education in Poland. He indicated that there were five other Institutes of Chemical Engineering located in the Technical Universities of Warsaw, Lodz, Gliwice, Wroclaw and Szczecin. The relative size of these Institutes and their heads are shown in Table II.

Generally the Institutes at Warsaw and Lodz are felt to be the best in Poland. It should be noted that Professors Ciborowski and Hobler are both members of the Polish Academy of Science, a prestigious recognition in Poland. Hobler is the "grand old man" of Polish Chemical Engineering, and although in his seventies, is still active.

One point of interest was that the Technical Universities all gave five year Master's programs as a first degree, despite considerable sentiment to return to the four year baccalaureate program as a first degree. The Technical Universities also had doctorate programs, although the effort in this area at Cracow was just beginning.

Dr. Mrowiec also mentioned that there was a rough Polish equivalent to the Bachelor of Technology degree now so much in vogue in the United States. The Polish program took four years and was apparently designed to produce personnel for

factory or field operations. None of the Technical Universities offered this program. Instead, institutions, apparently several steps below the Technical Universities, in locations such as Bialystok offer this curriculum.

NEXT STOP—LODZ

I LEFT CRACOW for the Institute of Polymers of the Lodz Technical University, where I met with Professor Dr. Marian Kryszewski. His operation at Lodz was quite interesting since he simultaneously was affiliated with Lodz Technical University and the Polish Academy of Science. Dr. Kryszewski's laboratories were very impressive. His equipment was highly sophisticated and the purchased items were of the best quality. In addition, he had modified many devices and in some cases fabricated novel experimental units. In many ways his experimental facilities were the best that I saw in Poland.

I spent two days at the Institute for Man-Made Fibers. This unit was a directly supervised facility of one of the ministries of the Polish government. In essence then, it was neither a university nor a unit of the Polish Academy of Science, but rather, a government laboratory. As such, the emphasis was heavily on applied areas. The laboratories were extremely well equipped with Japanese, West German, U.S., and English instruments. For example, they had a Hitachi electron microscope and a Siemens X-ray unit. The quality of the laboratory personnel was high.

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In fact, the scientists and engineers in the Institute would compare favorably with the best in the industrial laboratories of the United States.

One problem which seemed to retard their activities was a lack of direction from the government. There did not seem to be a clear notion of what fibers should be emphasized. Some of the research, while interesting, did not give data that would help those in the industrial area.

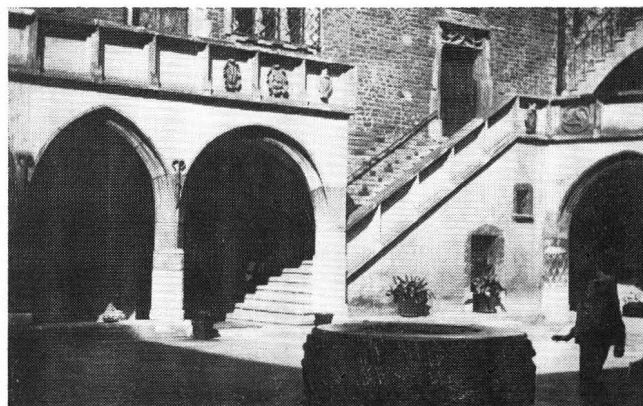


Figure 2. One of the oldest universities in the world, Jagiellonian University in Cracow, was founded in 1364.

RETURN TO WARSAW

FOR MY FINAL week I visited two institutions—the Institute of Chemical Engineering of Warsaw Technical University and the Institute for Industrial Chemistry (a government laboratory similar to the Institute for Man-Made Fibers in Lodz).

My host at Warsaw Technical University was Dr. Ciborowski, a member of the Polish Academy of Sciences, and one of the most prominent engineers in Poland. He has traveled widely and had just returned from Cuba prior to my visit. Dr. Ciborowski studied at M.I.T. just after World War II under the auspices of UNRRA. Because of this he had an excellent grasp of our system of technical higher education.

His Institute was most impressive. Unlike Cracow where there were space and equipment problems, his facilities were spacious and fairly well equipped. Much of his laboratory facilities were fabricated in one of the best machine shops I saw while in Poland. Dr. Ciborowski's sophistication also showed up in his curriculum and faculty.

The graduate program at Warsaw was most impressive. There was a real effort to build up sophisticated projects in such areas as chemical reactor design, scale-up and optimization techniques, and other areas of practical significance requiring thorough fundamental treatment.

I should mention two members of Dr. Ciborowski's faculty of note. One, Dr. Marcinkowski who was working on his Dr.(Hab) in the area of scale-up of chemical reactors. The sophistication and innovation displayed were impressive. The other, Dr. Selecki is a first-rate inorganic chemical engineer who has a wide variety of unusual inter-

ests relating to the application of inorganic chemistry.

Dr. Ciborowski himself should not be neglected. He has continued to carry out impressive research in the areas of heat transfer and fluidized bed behavior. As a general impression I would rank both the Institute of Chemical Engineering at Warsaw and Dr. Ciborowski most highly.

My final Warsaw visitation was made to the Institute of Industrial Chemistry. Dr. A. Plochocki, whom I had corresponded with over a number of years, was my host.

This Institute, a government laboratory, was most impressive in facilities and equipment areas. They had both excellent chemical engineering and plastics processing laboratories. In addition, they seemed to have a sense of direction. Much of their work was research that would directly benefit the Polish economy.

Dr. A. Cybulski was doing very fine work on chemical reactor systems, the utilization of which would benefit the Polish economy. Dr. Plochocki was doing the same kind of first class effort in the area of Plastics Processing. There was a real effort to bring about greater understanding so that the Polish plastics industry could grow in a meaningful way.

SUMMARY AND CONCLUSIONS

MY TRIP TO POLAND gave me an opportunity to survey the various types of laboratories in that country, the status of technical higher education and the general quality of research in the area of polymers.

There are three principal types of laboratories in Poland. The first are those under the jurisdiction of the government (such as the Institute of Man-Made Fibers in Lodz and the Institute for Applied Chemistry in Warsaw). These laboratories are well equipped and even have sizeable amounts of new and sophisticated units from hard currency areas such as the United States, Japan, West Germany, France and England. Their staffs are high caliber and have good esprit de corps.

The next category was the laboratories of the Polish Academy of Science. These units had probably the best technical people in the country. There was good rapport with the universities or with potential graduates through their own doctorate programs. Generally, however, the facilities were poor. The little equipment available came mainly from Russia, Czechoslovakia or East Germany.

Finally there were the laboratories in the universities which were probably the poorest in terms of facilities and equipment. There was a dangerous separation in some cases from the "real" world which has proven disastrous to graduate students in this country. Faculty were, however, of high caliber and were able to do excellent work when in contact with outside laboratories. There seems to be strong sentiment to make a four-year program the first degree. Interestingly, this is the opposite of current trends in U.S. engineering education.

A typical ChE curriculum resembles a strong traditional U.S. chemical engineering curriculum of about fifteen years ago. Such courses as chemical technology, machinery, and unit operations no longer in vogue in the U.S. are still part of the Polish curriculum. In spite of this, the program appears to be sound and perhaps better to be sound and perhaps better suited to Poland's needs than our courses of study.

Students in Poland are a privileged class since they receive free education, and special benefits such as trolley and bus passes and various discounts.

The curricula in polymers are essentially polymer chemistry with some physics intertwined. There is absolutely nothing that resembles the interdisciplinary U.S. programs which include engineering, chemistry, physics and materials science. A strong curriculum emphasizing polymer engineering is badly needed in Poland. Especially so if the polymer industries there are to progress.

One impressive feature of Polish technical higher education was the large number of female students. In some curricula they constituted a majority. There were large numbers who were not only doctorate candidates, but also active researchers. Perhaps the example of Marie Curie and a different societal viewpoint accounts for this.

I was very much impressed with the quality of the research being carried out in Poland. Despite equipment and facility limitations, the Polish engineers and scientists performed consistently at a high level. Particularly impressive were Drs. Ziabicki, Zahorski, Kryszewski, Cybulski, Plochocki, Selecki, and Ciborowski. It is my personal feeling that more scientific interchange would be beneficial to both nations. □