

# WITNESS AT CREATION: I.C.P.E.'s FOUNDING AND EARLY YEARS

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## Introduction

Dawn for the International Commission on Physics Education (ICPE) occurred at astronomical sunset. In a pleasant, late spring evening -- June 19, 1958, according to my notes -- Sanborn Brown and I were returning to my office from dinner at a New York City restaurant, deeply engrossed in the subject of our dinner-table conversation, when it occurred to us that physics education lacked international linkages. We had been talking about our responsibilities for the American Association of Physics Teachers (AAPT), especially the Committee on Apparatus for Educational Institutions, for which he and I served as chairman and secretary respectively. As we strolled across mid-town Manhattan, we realized that the U.S. problems we had been discussing were problems in almost every other country we knew anything about, but were almost never discussed in an international setting. Could anything be done to remedy this lack? We decided to try.

The present article is not a history of the Commission. Rather it is the testimony of a witness to the founding of this international body and an observer of its progress for fifteen years -- 1960 to 1975. During nine of those years I had an insider's seat. These remarks are based on my memory -- admittedly fallible -- and on my records -- unfortunately incomplete. Yet the reader may find them interesting, supplementing as they do the more systematic and complete treatments of the subject, such as French's fine "short history" (1). Heeding the charge given to me by the editor, I have tried to bring in the people involved in these events as much as possible. The period to be discussed is outlined in a short chronology (Table 1).

## The State of Physics Education

The spring of 1958 was a time of opportunity in physics education. The immediate post-World War II era, with its difficult problems of reconverting to a civilian economy, accommodating to veteran-enrollment surges, and rebuilding laboratories in war-damaged countries, was largely behind us, but the Sputnik era had arrived. When the Soviet Union had successfully launched the first Sputnik a little over six months earlier, the achievement had produced a profound shock throughout the world. Sending a satellite into earth orbit was a more technological achievement than a scientific one, of course, but in the mind of the public the two were indistinguishable. As the United States and other industrialized countries rose to the technological challenge, anxious questions were asked about whether national manpower resources and education were adequate in science and engineering. Many critics in the U.S. concluded that they were not. Whether or not the logical connection between the fact of the triumphantly signaling satellite overhead and the state of science education below was flawless, many physicists agreed with the critics. Some physicists were already working on improvements in physics education: projects of the AAPT can be cited, as well as the pioneering efforts of the Physical Science Study Committee (PSSC) to reform secondary-school physics. So Sputnik reinforced a concern and triggered national responses that promised -- and eventually delivered -- greatly enhanced resources for science educators, especially physicists. Opportunity was knocking - or rather, beeping.

A second factor in the physics-education situation was that physics itself was in a state of rapid and exciting growth of knowledge and support. Far from "ladling knowledge from a stagnant pool", physics teachers were hard pressed to keep up with the sparkling new physics that cascaded over

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**Table I. An ICPE Chronology: 1958-1975**

1958 Idea of an international conference on physics education,  
June 19.

1959 Meeting of Organizing Committee, Konstanz, June 30.

1960 International Conference on Physics Education, Paris,  
July 28-August 4.

IUPAP establishes Commission 14: Physics Education,  
Ottawa, September 9

1963 International Conference on Physics in General Education,  
Rio de Janeiro, July 1-6.

1965 International Conference on the Education of Professional  
Physicists, London, July 15-21.

1966 *Survey of the Teaching of Physics* published, UNESCO.

1968 International Seminar on the Education of Physicists  
for Work in Industry, Eindhoven, December 2-6.

1970 International Working Seminar on the Role of History of  
Physics in Physics Education, Cambridge, Massachusetts,  
July 13-17.

International Congress on the Education of Teachers of  
Physics in Secondary Schools, Eger, September 11 - 17

1972 *New Trends in Physics Teaching II* published, UNESCO.

*Source Book for Teaching School Physics* published, UNESCO.

1975 International Conference on Physics Education, Edinburgh,  
July 29-August 6.

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them and to incorporate it into their teaching. In every branch, discoveries poured forth: quantum optics, condensed-matter physics, nuclear physics, elementary-particle physics, relativity, astrophysics, acoustics, applications of physics to medicine and the earth sciences, the physics of the living cell. Financial support and public esteem kept pace, not enough to satisfy all needs, but lavish by earlier standards. Physics was "on a roll", and it was an exciting time to be a physics teacher. There was a feeling of confidence and pride in one's field, a sense of strong social support, and an awareness of growing rapport between teaching physicists and research physicists. As groups they had come together as seldom before. The researchers wanted to transmit the new knowledge; the teachers, to have help and not to be hesitant to ask for it. An era of innovation and curricular

reform began in physics education that would witness changes in almost every industrialized country and a striving for new levels of educational achievement in the developing countries.

A third factor -- demographic change -- was still latent, but would soon have a strong effect on physics education. In the late 1950's, realization was growing that large increases in the numbers of physics students lay ahead. The population surge that followed World War II -- the "baby boom" -- had begun to reach the secondary schools in the United States, and in the early 1960's would reach the colleges and universities. In other industrialized countries, the surge would be delayed for a few years, but it was on the way there, too. Developing countries knew all about population surges: their young people were already waiting in line to be students. In the United States, from 1958 to 1968, total undergraduate enrollments would rise from 3.4 millions to 6.7 millions; physics bachelor's degrees awarded annually would increase from 3900 to 5500; and the annual number of physics doctorates conferred would grow from 472 to 1325. Although the exact size of the bulge in any one field, such as physics, could not be predicted in 1958, its general consequences could be foreseen: lecture rooms and laboratories would be crowded, more physics teachers would be needed, new physics buildings would have to be constructed, and text books and instructional apparatus would find a rising market. Beyond all of this was the intellectual challenge of teaching the new physics. Would physics be ready for these changes?

If the physics community was conceivably ready for international discourse on educational problems, formal mechanisms for doing so were not. To be sure, ideas about teaching had often been shared when physicists from different countries met at research conferences or held teaching appointments while on visits or as exchange professors. Physics-education journals, such as the American Journal of Physics, occasionally carried papers written by physicists in other countries than those in which the journals were published. Most national physics-teacher organizations, such as AAPT, counted a few foreign colleagues among their members. But no equivalent to the frequent international research conferences, the active commissions of the International Union of Pure and Applied Physics (IUPAP), or the international linkages generated thereby existed in physics education. The international organizations were not averse to physics education; they had just not considered it. The question that Sanborn Brown and I were about to pose about the desirability and feasibility of an international conference on physics education had apparently not been asked.

### **The Impetus toward ICPE**

The officers and the Executive Board of AAPT were briefed in the months immediately following that June evening. Consultation was facilitated by Brown's position as treasurer of AAPT. The Association's reception to the idea was cordial. Although many questions needed to be answered

satisfactorily about logistics before final decisions could be made, AAPT opinions were favorable. The reaction of the American Institute of Physics (AIP), where I was serving as staff officer for education, also was favorable. AIP endorsement would encourage the support of the other Member Societies, and Elmer Hutchisson, the AIP director, could play a key personal role in promoting the education conference. He was not only a national leader in physics in the U.S., but also a well-known international figure because of his prominent role in physics-journal publication, abstracting, and documentation throughout the world. When we told him about our idea, "Hutch" responded with enthusiasm and energy. He began writing to colleagues in other countries and especially to the leaders of IUPAP, to whom he was well known. Brown also wrote to colleagues. He was already internationally visible in his field of plasma physics; he served as a U.S. delegate to the Second U.N. Conference on the Peaceful Uses of Atomic Energy and to the IAEA conference on Plasma Physics and Controlled Thermonuclear fusion. My own role in the early activities was to provide an informal secretariat at AIP that supported the initiative.

By the following summer, the initiative had been transferred to an ad hoc organizing committee. It met in Konstanz, Germany, on June 30, 1959, to outline plans for an international conference on physics education in 1960 and to elect a chairman and a secretary. Those attending the meeting were S.C. Brown (U.S.), Norman

Clarke (U.K.), P. Fleury (France), E. Hutchison (U.S.), T. Kinbara (Japan), W. Kroebel (Germany), E. Persico (Italy), and L. Weil (France). Brown was elected chairman of the committee and Clarke secretary. Good liaison with IUPAP was ensured by having Fleury, the Union's secretary-general, as a member. The task of this pioneering group set for itself at Konstanz and carried out in the event so successfully is best described in the words of the chairman and secretary (2):

*"This committee laid down the plans for the Conference, including topics to be discussed, methods of selecting delegates, exhibitions of teaching aids, and the most desirable place for the Conference to be held. The guiding principles agreed on were the following. The Conference should be given over largely to discussion, and should cover the whole range of physics education. So that real discussion should be possible, it was decided that the Conference should, if possible, be limited to 80 to 100 people, and the size of each delegation should be based very broadly on the number of contributory units donated to the International Union of Pure and Applied Physics, this being taken as a rough measure of the development of physics and physics teaching in the countries concerned. To stimulate formal discussion, formal papers would be submitted to the secretary before the Conference, to be printed and circulated at least a month before the Conference convened. UNESCO HOUSE in Paris was the preferred location because of the simultaneous translation facilities there."*

The work got under way with agonizing slowness in view of the size of the task of preparing for this first-time international meeting and the nearness of the proposed date of summer, 1960. On October 12, 1959, Brown, Clarke, Fleury, Weil (representing OEEC, the Organization for European Economic Cooperation), and V.A. Kovda and Hilliard Roderick (both representing UNESCO) met in Paris to work on the arrangements. Roderick was asked to join the organizing committee. Financial aid was discussed. IUPAP, OEEC, UNESCO, and several national science organizations, such as the National Science Foundation in the U.S., subsequently agreed to provide direct support, and various other organizations, such as the British Institute of Physics and the AAPT and AIP, to provide logistical support. A subcommittee for exhibits of apparatus, books, and films was formed, consisting of A. Marechal (France), W.C. Kelly (U.S.), G.R. Noakes (U.K.), and G. Saada (France). On November 26, UNESCO formally agreed to co-sponsor and support the Conference and to make the excellent conference facilities at UNESCO House in Paris available to it. IUPAP lent its sponsorship and financial support, announced the Conference, and invited expressions of interest from the thirty-four IUPAP member countries; by the end of May, 1960, twenty countries had declared an intention to participate and to send about a hundred delegates. (The final count would be twenty-eight countries and eighty-six delegates.) The papers and provisional program were transmitted to delegates on July 8, and the International Conference on Physics Education took place on July 28 to August 4, 1960, in Paris at UNESCO House.

Ample details about the Conference will be found in the proceedings (2) and in French's excellent paper (1). I will add here only a few personal comments as a participant in the Conference and as an observer of the long train of events that followed from it. The first is that enthusiasm, support, and level of involvement were extraordinarily high. People and organizations seemed to realize that this would be an historic occasion -- the opening of a new era of communication in physics education -- and they acted accordingly. Obtaining funds for the Conference was not difficult. Some \$7584 British pounds were raised in direct contributions, but that must be taken as a lower bound of support, not including the many forms of assistance in kind or support of travel costs of individuals by their home institutions. Most of the delegates were prominent figures in physics and were both nationally and internationally known. Many of them will appear later in this article as active participants in what became the Commission. The Conference produced many new friendships and collegial ties. The papers were not always interesting, but a high percentage of them were, illuminating a wide range of problems confronting physics education and identifying what subsequently became agenda for the Commission. The problem of achieving useful discourse about educational problems in countries with different kinds of educational systems proved to be not so difficult as it first had appeared. A few interesting ideas and models for educational change emerged and took on an international vitality that went beyond the Conference limits -- the PSSC comes to mind. PSSC activities were approaching a climax in 1960, and the presentation of the PSSC program for secondary schools by means of talks and exhibits at the Conference had a profound effect on many delegates. The model of close cooperation between "research physicists" and "teaching physicists" in PSSC was especially impressive and is believed to have stimulated such projects as the Nuffield Project and others

worldwide. The Conference exhibits, both those by commercial companies and those by universities and associations, were extensive and generally of good quality. The exhibitors outdid themselves in sending their products, some of which were excellent, a few of which needed to be retired, but all backing up the discourse that went on in the conference halls. Finally, dissemination of the results of the Conference by publication of its proceedings was handled efficiently by the writing team of Brown and Clarke, who retired to a quiet retreat -- The Swann Inn at Streatley-on-Thames in England -- surrounded themselves with papers, tape recorders and typists, and did not emerge until the manuscript had been completed. My notes indicate that they delivered the manuscript to the publisher on August 30, 1960, and that printed copies of the proceedings were available on January 6, 1961. This brisk style of preparing proceedings was followed at several later ICPE conferences and always seemed to me to be a good way of solving an otherwise troublesome problem.

### **ICPE Is Established**

The delegates recommended that continuing activity of the kind exemplified by the Paris Conference be provided for within IUPAP:

*"We recommend to the International Union of Pure and Applied Physics that it should take appropriate action, possibly in collaboration with other international organizations, to establish an international committee of professional physicists to accept responsibility for:*

- 1. The collection, evaluation, and coordination of information and the stimulation of experiments at all levels of physics education.*
- 2. The suggesting of ways in which the facilities for the study of physics at all levels might be improved in various countries.*
- 3. The collection and evaluation of information on methods used for the assessment of standards of performance of students of physics and for the evaluation of the qualifications and effectiveness of teachers of physics.*
- 4. The giving of help to teachers in incorporating modern knowledge in their courses.*
- 5. The promotion of the exchange of information and ideas among all countries by methods that would include the holding of international conferences.*

*III. We ask our Chairman, Professor Sanborn C. Brown, to accept on our behalf the invitation of the Secretary-General of the International Union of Pure and Applied Physics to attend the Ottawa meeting of the General Assembly of the Union, to present the resolutions and recommendations of this Conference, of which the Union was one of the sponsors, and in particular to ask the Union to accept the responsibility proposed in Resolution II."(2)*

Sanborn Brown did attend the Tenth General Assembly (Ottawa, 1960) and on September 9, 1960, IUPAP approved the establishment of Commission 14: Physics Education. It entered the ranks of IUPAP Commissions in the company of two other new Commissions: Nuclidic Masses and Atomic Constants, and Low Energy Nuclear Physics. To my knowledge, no opposition was expressed to this action within the General Assembly. Discussion centered on who and how. The successful holding of the Paris Conference had anticipated and answered any questions of feasibility and interest. What the outcome would have been if the events had been reversed and Commission status had been requested before the Conference was held is problematical; the outcome would have been harder to predict. But IUPAP had conferred its distinguished cachet on physics education, and that area of interest was now a certified concern of the physics community worldwide. International physics education had arrived.

"Who?" was answered by IUPAP's appointment of the following members of the Commission on Physics Education for 1960 to 1963: Sanborn Brown (U.S.), chairman; Norman Clarke (U.K.), secretary; P. Fleury (France); V.S. Fursov (U.S.S.R.); A.M.J.F. Michels (Netherlands); D. Sette (Italy); and J. Tiomno (Brazil). M.A. El-Sherbini (Egypt) and M. Valouch (Czechoslovakia) were named corresponding members. Fursov, Tiomno, and Valouch had not attended the Paris conference; the others all had, and Brown, Clarke, and Fleury, of course, had been three of the principal organizers.

"How?" was less easily answered, but IUPAP made available from its limited funds a small amount of travel money to help the Commission meet. A slight surplus from the Paris conference would also be available. For the rest, the Commission would be expected to make its way financially, as did all of the other Commissions, by soliciting funds to support its program activities.

Its success as a Commission would depend in large part on the ingenuity with which its officers and members met this requirement. The outcome proved that such talents were not lacking in ICPE, but fund-raising turned out to be a major problem. It showed up early as the Commission began to plan its first international conference.

### **Early ICPE Leaders**

Before turning to the Rio Conference, I want to describe briefly the kind of leaders that IUPAP provided for its new Commission.

Sanborn Conner Brown (3) -- "Sandy" as he was called by everyone who knew him for more than a few minutes -- combined high stature as a physicist and teacher, wide interests, capability for sustained work and great efficiency in organizing himself and others, and an engaging personality. He had been born in 1913 in Beirut, Lebanon, of U.S.-citizen parents; his father was a professor of physics and later dean at the American University in that city in a happier time than the present. Sandy came to the United States for the latter part of his schooling, majored in physics as an undergraduate at Dartmouth, and then went to MIT for his Ph.D., which he received in 1944. His doctoral dissertation was on the subject of Geiger-Müller counters. When I first heard that, since I had worked with G-M counters myself as a graduate student, the origin of Sandy's ability to master complicated, crotchety social systems immediately became clear. He was appointed to the faculty at MIT where he rose through the ranks, becoming professor of physics in 1962. His research interests were in gaseous electronics and plasma physics, where he made many contributions, personally organizing a research program to produce microwave cavity discharges and study the resultant ionized gas. Some fifty graduate students and other researchers passed through his laboratory during the eighteen years of its peak activity. His interest in good teaching displayed itself early in his academic career. In the early 1950's, he led an effort to overhaul the undergraduate physics laboratories at MIT, replacing outmoded traditional experiments by modern-physics ones. These interests brought him into contact with AAPT. I referred above to two of the many AAPT offices he held. He also served as a member of the school board in his home town of Lexington, Massachusetts. Sandy became interested in the history of physics as an undergraduate, specifically in the career of Benjamin Thompson, Count Rumford. He later dug deeply into the sources and published extensively on Rumford over a period of several decades, receiving international recognition, including election as a Fellow of the Royal Institution, for his scholarly work in that field. He also wrote a popular book on Rumford and even built a set of fascinating little models of Rumford's experiments -- the cannon drilling experiment, an improved fireplace, etc. Around the time that he became associate graduate dean at MIT in 1963, Sandy turned his attention to science-policy issues. One of these was the need to recognize that postdoctoral appointments in science -- at least as practiced in the United States - had become a whole new stage of academic research and career development, deserving greater attention by the faculty. He served as chairman of a committee of the National Research Council that carried out the first comprehensive study of postdoctorals. After his retirement in 1975 and near the end of his life, Sandy devoted much time to the affairs of the Institute on Religion in an Age of Science, a group of scientists and clergy who sought a scientific basis for humanity's sense of good and evil. As

evidence that he had not lost interest in lighter issues also, he wrote and published a book on brewing in colonial America, based, I understand, on basement experiments.

Brown pursued so many different interests that his contribution to ICPE, considerable as it was, was only an episode. He was driven, but apparently by a sense of noble purpose and good will, not by the need to prove himself. He possessed great stores of energy and was well organized and highly efficient. For example, he answered his voluminous correspondence promptly, often dictating replies into a tape recorder as he drove between his home in Lexington and the MIT campus. He had help, of course. This biographical note would be incomplete without acknowledging the part that Lois Wright Brown, his wife, played in his life. Participants in early ICPE conferences were so used to seeing Lois at those meetings, helping in many ways, that her presence was almost a *sine qua non*.

Norman Clarke, the ICPE's first secretary, brought great resources to the task from his position as education officer of the Institute of Physics and the Physical Society in London and from his earlier experience in the improvement of physics and mathematics teaching in Britain. The former gave him many international contacts, a first-hand knowledge of manpower problems in physics in a major industrialized country, and a secure base of operations; the latter provided wide knowledge and sharp insights into teaching problems in physics at every level. His diligent and skillful handling of the affairs of the ICPE office during these crucial years was an important factor in the young Commission's survival. He and Brown worked closely and amicably together -- another important plus for ICPE. The contribution of the British Institute of Physics to international education must also be acknowledged: by making available Clarke's time and office support it conferred no small benefit on ICPE.

Pierre Fleury, the senior member of ICPE, came to the Commission near the end of a long and productive period of service to IUPAP. A professor in the Institut d'Optique in Paris, he served as IUPAP's third Secretary-General from 1947 to 1963. Citing his services in the fiftieth-anniversary volume of IUPAP (4), the Union declared [in translation]:

*"Professor Fleury attended the meeting in Brussels in 1922 [IUPAP's founding year]. He was part of the French delegation in 1972. He did not fail to render service to the Union during any of these fifty years."*

Having strong educational interests as well as an influential post within the Union, Fleury was a key figure in the organization of the Paris Conference and in the action by IUPAP conferring Commission status on physics education. As we shall see later, Fleury was also one of the prime movers in launching a science-education committee within the International Council of Scientific Unions and served as its first secretary. He was well-connected in the world of international science and had easy entree into organizations such as UNESCO. Fleury was of the older generation of physicists, but -- attentive, optimistic, urbane, ready with suggestions -- he mixed easily with his ICPE colleagues. He was not a gifted linguist, however, and usually made his interventions in rapid, formal French in meetings in which everyone else was speaking colloquial English. This caused some problems for chairmen, but when everything was sorted out, the speeches Fleury gave turned out to make highly useful points -- sometimes the most important points -- for the discussion.

Daniele Sette, professor of physics at the Istituto di Fisica of the University of Rome, played a long and productive role in the Commission. An acoustical physicist, he took a prominent part in the discussions at the Paris Conference. He was appointed to the first Commission in 1960 and served as a member until 1969, after which he was a corresponding member, with no diminution of his contributions, until 1972. Sette brought to the Commission a wealth of experience and knowledge of education gained both in Italy and internationally in a wide variety of physics-education projects. In discussion at Commission meetings, he could be counted on to seize an idea, judge it for its soundness as education and physics, and carry it into the realm of the practical

by making helpful comments, suggestions, and caveats. He was a pragmatist who knew the world, but who also understood the importance of holding firmly to good basic principles of education and organizational conduct.

Jayme Tiomno of the Centro Brasileiro de Pesquisas Fisicas played a key role in organizing ICPE's International Conference on Physics Education in 1963, as will be related below.

A.M.J.F. Michels of the University of Amsterdam contributed to the work of the Commission an awareness of the important place of physics in general education, a zeal for seeing that that role was effectively played, and an uncompromising insistence on high educational standards. He and his wife, C.A. Michels-Veraart, who was also a teacher, were major figures in the General Education Conference of 1963.

V.S. Fursov of the Soviet Union was apparently unable to be an active member and was replaced by A.S. Akhmatov (U.S.S.R.) at the end of 1963.

M. Valouch was a faithful participant in ICPE meetings and conferences from 1960 into the early 1970s when ill health forced him to withdraw.

I was not acquainted with M.A. El-Sherbini, who was a corresponding member from 1960 to 1966.

### **The Conference on Physics in General Education**

The team that has organized the Paris Conference began to face in 1961, as an IUPAP Commission, the task of creating a three-year program of activities in international physics education. Meeting in Paris on April 24-26, 1961, and in Amsterdam on May 2-4, 1962, the Commission developed its priorities, considered its resources, and planned the first of the ICPE-sponsored conferences -- the International Conference on Physics in General Education, held in Rio de Janeiro on July 1-6, 1963. In doing so, ICPE heeded the call of the Paris Conference to restrict the range of topics to be discussed at future conferences. It took essentially one chapter of the Paris report and expanded it into the program of a full conference. It also recognized the importance of regional development of physics education by holding the Conference in a major Latin-American country. Interest in physics education in Brazil was keen, and several international organizations -- notably UNESCO -- were providing resources for physics education projects in Latin America. An international conference on the problems of improving physics teaching at the base of education could clearly do a great deal of good.

In spite of these favorable signs, organizing the Conference was not easy. The major problem was money. The enthusiasm and team spirit of 1959-60, which had gotten the Paris Conference off the ground, seemed to have abated, leaving the Commission with a limited range of options and sponsors. UNESCO took a long time to make up its mind before deciding in December, 1962, to be a sponsor and provide a modest subvention. As late as the end of April, 1963, UNESCO found it necessary to cancel its plans to support the exhibits at the Conference. In spite of the hard work of Tiomno and his Brazilian colleagues on the local organizing committee, local support was limited to space and hospitality. It was difficult to obtain travel funds for speakers from other countries, whose contributions were needed to make the Conference a success. In a crisis atmosphere not unfamiliar to planners of international conferences, "planning" meetings were held as late as May, 1963.

In the end, the arrangements worked out reasonably well, and the Conference was held successfully in the Palacio da Cultura in Rio de Janeiro with some 170 participants from twenty-eight countries in attendance.<sup>(5)</sup> The Brazilian contingent, of course, was the largest: the presence of so many Brazilian teachers and school officials, all clearly fascinated by what was going on, created a sense of special purpose at the Conference. International attendance was stimulated by the

holding of the Interamerican Conference on Physics Education on the same spot the previous week under the auspices of the Organization of American States. This made it possible for funding organizations to support the travel of many Latin Americans to Rio de Janeiro for both conferences: the OAS conference, which was global in topic, but geographically focused; and the ICPE conference, which had a more limited theme, but worldwide representation. Another major contribution to the success of both Rio conferences was the wholehearted support given by the Latin-American Center for Physics (CLAF).

I attended both of the conferences and came away with a feeling that the time had been well spent. Gerald Holton and Eric Rogers, two of the speakers, were in good form at the ICPE Conference and gave excellent talks. Jerrold Zacharias spoke on curriculum reform in the U.S., describing accomplishments of the PSSC; he had many interesting things to report to a fascinated audience. Other talks were also good. Some speakers floundered, however, in attempting to deal with "general education." There were enough problems of the latter kind to make credible the concern expressed openly by Richard Feynman who said he doubted whether anyone yet knew enough about teaching physics to nonspecialists to justify discussing the subject on an international basis. It *was* a sticky subject, and ICPE showed courage in taking it on as its first conference topic.

### **The Survey of the Teaching of Physics at Universities**

This project was first proposed to ICPE by UNESCO in January, 1961. It was accepted by the Commission about a year later, produced a composite international manuscript by the autumn of 1963, and was published as a 400-page report by UNESCO in 1966. The purpose of the Survey was to provide a factual basis, accompanied by informed comment, for judging the similarities and differences of national systems for physics teaching in six industrialized countries: Czechoslovakia, the Federal Republic of Germany, France, the U.S.S.R., the U.K., and the U.S.A. UNESCO's interest in this study derived primarily from its desire to provide models of physics education for consideration by developing countries. The survey procedure, as developed by ICPE and UNESCO, was to appoint a "national author" in each of the six countries to investigate in as much detail as possible the teaching of physics in that country, from the earliest presentation of elements of physics in schools through graduate study in physics. Each national author then wrote an essay with voluminous appendices, all of which material was compiled into an international report by a "coordinator". ICPE monitored the work and ensured that it met suitable standards. The national authors were M. Valouch (Czechoslovakia), W. Hanle (Germany), M.Y. Bernard (France), A.S. Akhmatov (U.S.S.R.), Norman Clarke (U.K.), and W.C. Kelly (U.S.). I also served as the coordinator.

This enterprise, in spite of familiar difficulties of international communications and educational incongruities, achieved a modest success. The format the authors adopted -- sitting as an editorial committee -- allowed the masses of factual information gathered to be juxtaposed well enough to

allow an attentive reader to make the desired comparisons. The accompanying comments were sufficiently judicious to allow mild quality judgments to be made. The reader was given a basis for deciding whether this method or that better fitted the model he was constructing. These evaluative comments were reinforced by a final chapter on the improvement of physics teaching, in which the authors made it clear that there were still a few educational problems to be solved. The Survey enabled ICPE to respond to its mandate for the "collection, evaluation, and coordination of information". The authors and a few readers learned a lot about comparative education. The report can still be read profitably, but it is not light bed-time reading.

### **Other Early Activities, 1960-1966**

The formative years saw another major ICPE conference and several other kinds of Commission activities. The International Conference on the Education of Professional Physicists was held in London on July 15-21, 1965. Some 93 delegates, representing 26 countries, attended. Unlike the preceding one in Rio, this conference dealt with a subject at the heart of the profession, a subject well understood by the physics community, and was held in a locale close to ICPE's base of operations. It could have been expected to encounter fewer difficulties of organization and execution, and this apparently was so. I was not able to attend and can add little to what is in the published report (7). One of the issues that was debated vigorously at the London Conference -- the proper education of physicists for work in industry -- was not disposed of for all time, however; it continued to stimulate discussion afterwards and was revisited by the Commission several years later.

In addition to holding the London Conference, ICPE sent out feelers in several directions, some of which led to significant educational enterprises, others of which were not productive. One of the successful ventures was the ICPE initiative in proposing to the International Council of Scientific Unions (ICSU) that it set up an Interunion Commission on Science Education to allow representatives of a growing number of education commissions of the different scientific Unions -- physics, chemistry, mathematics, astronomy, etc. -- to meet, work on transdisciplinary educational problems, and coordinate their efforts. ICSU responded positively, establishing the Interunion Commission in September, 1961. P. Fleury was appointed its secretary, and Sanborn Brown served as a member. The Interunion Commission was converted into the ICSU Committee on the Teaching of Science in 1968 -- to ensure more active participation by the Unions and more direct support by ICSU -- under which title it continues to this day. One of its interests has been the teaching of "integrated science", a subject on which it has organized a number of international conferences. An ICPE representative, usually the chairman or the secretary, has usually been a member of this committee. The association has been generally of benefit to both organizations, although ICPE has sometimes worried that the ICSU committee was competing too successfully for the educational funds of UNESCO.

Another project by ICPE that saw later results was the effort to improve international communications among physics teachers by instituting an international newsletter. Its first effort was to stimulate and then to assist AIP to publish *International News of Physics Education*. This was a four-page bilingual (French and English) newsletter that gathered information world wide about physics education projects and reported it quarterly, reaching about 1100 readers, the majority of them in the United States. At the end of its "funding lifetime" of about a year and a half, the newsletter went out of existence in 1967. About a decade later, as we shall see, an ICPE newsletter was successfully launched with UNESCO support and a more international readership and has managed to keep going. On another front, ICPE was involved in successful efforts to solicit AAPT donation of copies of its journals to developing countries through UNESCO channels. Other information initiatives by the early Commission did not succeed: a proposal for an international journal of physics education was explored and dropped -- largely for economic reasons -- and efforts to encourage Physics Abstracts to give greater coverage to educational articles in physics seem to have had only a transitory effect.

Other ICPE activities included: advising UNESCO on its publication program in physics education (see below) and on other UNESCO education projects, appointing representatives to various international educational organizations, and discussing with the International Commission on Mathematical Instruction the possibility of cosponsoring a conference on the coordination of the teaching of physics and mathematics.

## **Changing of the Guard**

By the time of the Twelfth IUPAP General Assembly (Basel, 1966), several of the ICPE members, including its chairman, believed it was time for a new group to take over the Commission's responsibilities. Almost all of the present members has served for six years, and new leadership and the rotation of membership seemed desirable. The General Assembly accepted this recommendation and appointed the following: H.H. Staub (Switzerland), chairman; William C. Kelly (U.S.), secretary; H.B.G. Casimir (Netherlands); W. Schaffer (South Africa); D. Sette (Italy); P. Fleury (France); and A.S. Akhmatov (U.S.S.R.). The following were named corresponding members: A. Harasima (Japan), W. Kroebel (West Germany), M. Pihl (Denmark), John Lewis (U.K.), M. Valouch (Czechoslovakia), and L. Pal (Hungary).

Hans Staub, the Commission's second chairman, was born in 1908 in Switzerland and educated there, receiving his doctorate in physics from the E.T.H. in 1933. He was a fortunate choice as chairman, representing the very best of the tradition of physics research and university teaching. He had the complete confidence of IUPAP, having served on several of its other commissions previously. He had been an active participant in the 1960 Paris Conference. Staub knew the world scene from the many international currents that could be observed in his home country and from a long period of residence in the United States. There he taught at Caltech and Stanford, became a staff member at Los Alamos during World War II, and returned to Stanford afterwards as a professor. Among the scientific achievements mentioned by Felix Bloch (8) in his obituary notice about Staub

were Staub's contributions to understanding the scattering of neutrons on helium and their polarization in passage through magnetized iron, improvements in particle detectors, and measurements of the neutron magnetic moment, including its sign, with high accuracy. In 1949, Staub returned to Switzerland where he became the director of the Physics Institute at the University of Zurich. According to Bloch, Staub "brought the Institute to modern standards, not only by installing a Van De Graaff accelerator in an excellent new building, but also by inspiring his colleagues and students with the free spirit of inquiry. His lectures were distinguished by the same lucid presentation that one finds in the textbook on atomic physics he wrote with Paul Huber." This combination of eminence in research and teaching, administrative experience, wide international acquaintance, and absolute integrity was put to good use by Staub in carrying out his ICPE responsibilities. His integrity was probably what impressed his colleagues most. Staub was a democratic chairman, presiding genially over what was sometimes a random-walk kind of discussion and letting everyone have his say. But whenever a matter of principle arose, whether one of good physics, good teaching, or good conduct, Staub was forthright and unequivocal. He expressed himself without niceties or glossing over the issues, saying what he thought was right. His fellow members knew that they had had "the word", and they never had occasion to regret having accepted it. Staub kept the Commission out of trouble that it might have encountered under a less astute and honest chairman.

I do not intend to draw a picture of an austere and distant leader. Hans was a friendly person, a warm personality, approachable and possessed of a wry sense of humor. He worked hard at the chairmanship and was always available, but was not given to overloading the mails with instructions. Like his pronouncements at meetings, his letters and cablegrams came when they were needed.

W.C. Kelly, the new secretary, has appeared before in this story, but now, unlike the days when he was on the sidelines, he was near the center of the Commission's work. Like all secretaries, he would have to bear the responsibility of seeing that ICPE affairs ran smoothly under the chairman's leadership and with as much democratic process and diplomacy as possible. By way of background: born in 1922 in Pittsburgh, Kelly at the time of his election was associate director -- and would soon become the director -- of the Office of Scientific Personnel of the National Research Council (NRC) in Washington. The NRC is an organization that begins to take shape in the mind of the reader if one explains that it is the "action arm" of the National Academy of Sciences and the National Academy of Engineering. One of ten major sections of the NRC, the Office of Scientific Personnel conducts research fellowship programs (both predoctoral and postdoctoral) and makes studies of needs and supplies of manpower in science and engineering, including physics. Earlier, from 1957 to 1965, Kelly had been the director of the department of education and manpower of the American Institute of Physics during its formative years and had worked on many different AAPT and AIP projects for the improvement of physics teaching. Still earlier, 1943-1957, he had taught and carried on research in beta-ray spectroscopy at the University of Pittsburgh, where he had received the doctorate in physics in 1951. He was the co-author of several widely used physics textbooks at the high-school and college levels.

While it was to be hoped that this experience and various personal qualities were factors in Kelly's election as secretary, it was clear that his position in an organization that had the means to support ICPE activities was not a trivial consideration. Here it is a pleasure to acknowledge the considerable assistance that the National Research Council gave ICPE during the nine years of my tenure as secretary and chairman. It was provided at every level. The two presidents of the National Academy of Sciences who served during this time -- Frederick Seitz and Philip Handler -- were very supportive. The staff of my office accomplished the typing, copying, and other tasks of keeping ICPE running: Shirley Davis, Irene Matthews, and Kathleen Drennan are names that should be remembered in this regard. The Business Office under B.L. Kropp helped keep ICPE financial records straight. The extent of the NRC subvention was never completely added up, but it was considerable.

H.B.G. Casimir, another new member, needs no introduction to physicists. Well known for his contributions to physics in the most exciting years of the quantum revolution, he had gone on to the leadership of research and development at Philips Research Laboratories in Eindhoven and to senior statesmanship in physics internationally. His autobiography (9) gives ample evidence of the many talents he brought to his participation in ICPE affairs. The Commission's successful Seminar on the Education of Physicists for Work in Industry,

held in 1968 in Eindhoven, was Casimir's principal contribution to the ICPE program, but his comments at Commission meetings -- always models of clarity, succinctness, and penetration -- were added benefits for his colleagues. His joining the Commission added a very important kind of representation also in that he came from industry, bringing a perspective that is very much needed in discussions of physics education and that is not always present.

W. Schaffer, professor of physics at the University of Cape Town, also joined the Commission at this time and contributed an acumen and a richness of academic experience that served ICPE well.

A.S. Akhmatov, who had joined the Commission in 1963 as a replacement for V.S. Fursov, was a professor at the Moscow Institute of Machines and Instruments. He had served as the author for the U.S.S.R. in the UNESCO-ICPE survey of the teaching of physics at universities.

Of the new corresponding members, A. Harasima of the International Christian University in Tokyo was an astute observer of physics education worldwide and an attentive participant in ICPE conferences and meetings from the earliest years; W. Kroebel of the University of Kiel, who had served as a member of the Organizing Committee for the Paris Conference, was one of ICPE's founding fathers; John Lewis of Malvern College became my successor as secretary in 1972; and L. Pal of the Physics Institute in Budapest was most helpful to ICPE in the organization of the International Congress on the Education of Teachers of Physics in Secondary Schools.

While we are on the subject of the ICPE membership, it should be noted that further changes in the membership took place in 1969, and the individuals appointed then participated in the work described below during 1969 to 1972. They were as follows: Staub and Kelly continued as chairman and secretary respectively; Schaffer continued as a member; W. Kroebel (West Germany), John Lewis (U.K.), M.Y. Bernard (France), L.S. Kothari (India), A.N. Matveyev (U.S.S.R.), and J. Werle (Poland) became members; and H.B.G. Casimir (Netherlands), P. Fleury (France), A. Harasima (Japan), E. Nagy (Hungary), D. Sette (Italy), and M. Valouch (Czechoslovakia) were named corresponding members.

Bernard, professor of physics at the Conservatoire National des Arts et Metiers in Paris, was well known to the Commission for his work as the author for France in the survey of the teaching of physics at universities; his later career included important assignments in the science ministries of the French Government. Kothari was a member of the Department of Physics and Astrophysics at the University of Delhi and had been active in the reform of physics education in India. Matveyev's earlier contacts with the Commission had occurred when he held the post of Deputy Assistant Director-General for Science at UNESCO; at the time of his appointment to ICPE he was professor of physics at the Moscow State University. Werle, of the Department of Mathematics and Physics at Warsaw University, was especially interested in the relationship between physics and mathematics and took a prominent role in the Commission's exploration of the problems in that area. Nagy, professor of physics at Eötvös University in Budapest, carried out two major assignments for the Commission: serving as chairman of the organizing committee for the International Congress on the Education of Teachers of Physics in Secondary Schools and as editor-in-chief of Volume II of UNESCO's *New Trends in Physics Teaching*.

## **New Lamps for Old**

The first meeting of the newly reconstituted Commission in Zurich on April 3-5, 1967, was the occasion for a widely ranging discussion of what ICPE had been doing, what new educational problems had emerged in recent years, and what the agenda for the next several years should be. One of the principal decisions was to abandon "sequential planning". Rather, having identified six areas in which international conferences on special topics in physics education seemed to be needed, ICPE would describe each of them in a "prospectus" and give all six circulation among the IUPAP National Committees at one time. This would not only make available to ICPE the opinions of a large segment of the world physics community, but would also allow parallel development of

plans for several of the most widely favored conferences at the same time. Another decision, made largely at Casimir's suggestion, was to encourage the holding of smaller meetings -- "seminars" or "workshops" -- on specialized topics on which the discussion of a group of 50-60 experts would be more productive than that of a conference group of over a hundred.

The three topics proposed for general conferences were the education of teachers of physics in secondary schools, the role of physics in the education of the non-physicist specialist (engineer, chemist, biologist, physician), and an open meeting of university physics teachers. The three proposed seminars were on physics and mathematics, the education of the physicist for work in industry, and physics education and the history of physics. Following the Zurich meeting, write-ups describing each of these meetings in rough outline were prepared and sent to the thirty-seven National Committees, a goodly number of which subsequently replied, prioritizing the topics and in a few cases expressing interest in being the hosts. At the same time, ICPE inquired directly of suitable host institutions and, after about a year of this kind of effort, had plans well under way for holding several of these meetings. Eventually, four of the six conferences and seminars were held; only the "open meeting of university teachers" and the "seminar on physics and mathematics" did not take place. However, there are currently some signs of a revival of interest in the "open meeting", and ICPE has joined from time to time in international meetings involving all the sciences and mathematics to discuss the science/mathematics relationship.

At the Zurich meeting, UNESCO was represented by Albert V. Baez, director of the Division of Science Teaching, who described UNESCO's plans in physics education and invited ICPE's cooperation. A number of joint publishing ventures were discussed, some of which came to fruition in the years following. UNESCO also offered its assistance in the holding of international meetings, although it was clear the UNESCO priorities were already working against support for such meetings.

So the Commission was launched on a new round of activities -- some new, some previously explored, most of them timeless. Since the conferences, seminars, and special publishing projects are represented by published documents in the physics literature, I shall confine my remarks here to certain aspects that I found interesting, remarks that may throw light into a few dark corners.

## **Conferences and Seminars, 1966-1972**

With Casimir serving as chairman of the organizing committee and the Philips Research Laboratories and the Technological University of Eindhoven as host institutions, worldwide interest in the International Seminar on the Education of Physicists for Work in Industry (Eindhoven, December 2-6, 1968) was a foregone conclusion. Sixty persons attended by invitation: physicists from industrial laboratories, physicist managers from industry, and academic physicists from major universities. Financial support was obtained without great difficulty from ten different sources -- companies, government agencies, and international organizations. The discussion was lively and is well reported in the proceedings of the Seminar and its companion volume of papers (10). Casimir's post-Seminar comments in the preface to the proceedings are, as usual, trenchant:

*"Industry is to a large extent based on physical research. Formerly the results of physics were usually first incorporated into engineering science and then applied by engineers to industrial processes. In recent years, however, physics has come to play a much more direct role and large numbers of physicists find occupation in industry. The question whether our universities provide adequate training for a physicist who is going to work in industry is therefore an important and timely one.*

*Yet a word of warning is not out of place. If we speak about the education of physicists for work in industry, we almost suggest that industry is an invariable quantity and has quite definite requirements. Although this may be the position taken by some industrialists, it is in my opinion entirely wrong. Perhaps we should some day organize a complementary meeting on 'education of industry for employment of physicists', where we could take the point of view that a physicist with his abilities, likes and dislikes, is a given being and that industry*

*should adapt itself so as to make optimal use of this rare and valuable class of person."*

This latter suggestion may direct attention to a topic that the Commission should revisit some time in the future. A final item must be reported: since the Seminar was meeting on Sinterklaas (St. Nicholas Day), its members should not have been surprised when the Saint himself showed up at one of the plenary sessions with a suitable fanfare of jingle bells, called Professor Casimir up front, and demanded to know why these people were engaged in business on his day. When Casimir explained what our purpose was, that we all possessed a Dutch work ethic, and that most of us had come great distances to be there, the Saint was mollified and departed, throwing candies to the group as he went.

The year 1970 -- the Commission's tenth anniversary -- was a busy one: plans for two international meetings came to fruition. The International Working Seminar on the Role of History of Physics in Physics Education was held at MIT on July 13-17, 1970, as the result of the efforts of an organizing committee chaired by Allen L. King of Dartmouth College and an editorial committee chaired by Stephen Brush of the University of Maryland. Thirty-three persons attended by invitation, ten of them noted historians of science, and the rest distinguished physicists and physics teachers. "Working" in the title signified an intent not only to discuss the central questions of whether and how to bring the results of the scholarly work of professional historians of science into the physics classroom, but also to put together from the assembled expertise lists of sources, films, historical course-content, etc. as a help to the physics teacher. Both purposes were served by the published reports (11), (12), but the last word was not said on the subject; ICPE returned to it at a later conference. A number of interesting new projects were suggested at the MIT Seminar, some of which were realized later, some not. One of the latter was the proposal to sponsor the writing of a history of physics, using the best sources. Although the Commission received this recommendation with interest and struggled with its implementation for a year or so, the project proved to be beyond the available resources and eventually died.

The second meeting in 1970 was the International Congress on the Education of Teachers of Physics in Secondary Schools, held in Eger, Hungary, on September 11-17 (13). Organized by a committee chaired by E. Nagy of Eötvös University with the assistance of a program committee chaired by Daniele Sette, the Congress, by its title, might have confined itself to the curricular details of educating secondary-school teachers of physics, but in fact was the occasion for a widely ranging discussion of the role of science education in modern society. The high point of the Congress for many participants was the keynote speech by P.L. Kapitza of the Soviet Union who reviewed the signs of growing social malaise in many of the industrialized countries and urged the Congress to think about changing education "in order to educate people properly in ways to use their leisure" or rather to obliterate the distinction between work and leisure by teaching people "to do creative work." His suggestions about how to do this in secondary schools made a deep impression.

A fourth international meeting conceived by the Commission in 1967 was not held until almost a decade later. This was the peripatetic conference that finally became the Conference on Teaching Physics for Related Sciences and Professions (MIT, June 27-July 2, 1976.) Early indications of interest and support had suggested that a meeting on this subject would be held in 1972. The organizers were forced, however, to cancel their plans because promised governmental financial support failed to become available. The Commission then negotiated with another host institution in another country; plans were set in motion, but again the organizers had to withdraw their invitation. A third time, the same thing happened. Each scheduling and cancellation caused a great deal of work and eventually much embarrassment for the Commission and the local organizers. The purpose of this recital, however, is not to engage in recrimination, but to give credit to those who, on the fourth pass, successfully organized the Conference and saw it become a reality. Anthony P. French of MIT, who by that time was serving as the Commission's chairman, is chiefly responsible for giving the wandering conference a home; E. Leonard Jossem of The Ohio State University, the present secretary of ICPE, served as chairman of the program committee. The attendance numbered 95 persons from 27 different countries. Although they did not include as many representatives of engineering, chemistry, biology, and medicine as had been hoped, a profitable discussion took place. The Conference rounded out the Commission's slate of important topics discussed at international meetings and produced a useful report (14)

## **Publications: Cooperation with UNESCO**

The period of Staub's chairmanship (1966-1972) saw the further development of a productive relationship with UNESCO that, as we have seen, began at the Commission's birth. Although ICPE conferences benefited from the relationship -- there was almost always a UNESCO subvention for the travel of participants from developing countries - jointly sponsored publications of several kinds were the usual modes of cooperation. Thus the UNESCO source book on the teaching of physics in secondary schools got under way in 1968 and was published in 1972; John Lewis served as editor-in-chief (15). A university-level compendium, *New Trends in Physics Teaching, Volume II* also was organized in 1968 and published by UNESCO in 1972; E. Nagy was editor-in-chief. The Commission's role in these projects was to nominate editors -- often ICPE members -- and thereafter monitor progress and offer advice. Although UNESCO would have preferred to negotiate contracts directly with the Commission for these services, Chairman Staub early on took a strong position against having ICPE get involved in contract administration and carried the Commission and eventually UNESCO along with him. Contracts for preparing these publications were subsequently written between UNESCO and the editors, and this in retrospect seems to have been the wiser course of action. A related matter, on which Staub had firm ideas, was the appropriateness of having ICPE take part in projects that were primarily concerned with course content in pre-university physics. He was uneasy about having the Commission -- a group largely made up of university physicists -- issue pronouncements about what should be taught in the secondary and primary schools. Here he was less successful in winning his colleagues over to his point of view, and ICPE did sponsor secondary-school projects, like *Teaching School Physics*, that turned out very well. Of course, the leadership given them by John Lewis made the difference.

It is appropriate to acknowledge the steadfast help given the Commission by UNESCO as an organization and by individual members of the UNESCO staff. At a time that has witnessed increasing criticism of UNESCO and the withdrawal of one of its largest members from its support, the world should remember that UNESCO has done and is doing many good things for the area represented by the E and the S in its name. Albert V. Baez, the director of UNESCO's Division of Science Teaching for many years, a physicist himself, was a firm supporter of ICPE

activities that were related to UNESCO's general program. His successor, Harold Foecke, an engineer, was also supportive, not hesitating to turn to ICPE on many occasions. Nahum Joel, whose interest in promoting better physics teaching worldwide was stimulated by his participation in the 1960 Paris Conference as a Chilean physicist, worked especially closely with ICPE during his long, productive career at UNESCO and was a *de facto* corresponding member of the Commission for many years. Berol Robinson and Sidney Passman had a similar good working relationship with ICPE at the university level. Therese Grivet and other members of the UNESCO staff also worked effectively with ICPE on various special projects. There were problems, to be sure: as members of a large bureaucracy, UNESCO staff members were never completely free to exercise their initiative as individuals, and UNESCO funds were never sufficient to meet its global responsibilities. But UNESCO was a rather constant star in the ICPE firmament, and the Commission never resorted to UNESCO without getting some form of help.

## **IUPAP: In Loco Parentis**

From time to time, the Commission dealt with IUPAP policy issues. At its meeting of 6 December 1968 in Eindhoven, ICPE discussed a question that had been referred to it by the IUPAP Executive Committee: How can the Union promote the integration of teaching and major research organizations? The issue had first been raised by the International Union of Biological Sciences, which had urged that teaching and research in the biological sciences be integrated to the greatest extent possible. The issue in physics, of course, had become prominent with the growth of "big science" at large laboratories, such as CERN, where a number of physicists

were permanent members of the staff who did no teaching. In the ICPE discussion, Sette suggested that CERN organize more summer courses in which the permanent staff members could teach. Staub commented that as a matter of principle teaching and research should always be combined; permanent staff at large laboratories should go back to university teaching from time to time. The Commission finally agreed on a resolution for submission to the Thirteenth General Assembly of IUPAP (Dubrovnik, 1969), which, after making small modifications, adopted it. (17) The operative sections were as follows:

*1. Research and education should be carried on in the closest possible association;*

*2. Any tendencies toward divergence between the activities of advancing and disseminating knowledge should be vigorously counteracted and efforts to improve the teaching of physics be encouraged;"*

These were followed by a number of sections dealing with possible ways to promote the integration of research and teaching. The resolution obviously had high importance for the Commission, and its adoption by IUPAP was gratifying. The problem of integrating research and teaching -- in the sense of the Dubrovnik resolution as well as in other respects -- is still very much with us.

Another policy issue had to do with the application of an IUPAP principle on the free circulation of scientists. Along with the other members of ICSU, the Union adhered to a long-standing declaration of principle on this matter. The relevant words (17) were as follows:

*"I.U.P.A.P. will not sponsor a conference if visas are refused for travel to it purely on grounds of nationality or citizenship.*

The Commission encountered this problem on one occasion when the host country refused to grant a visa to a participant in an ICPE conference. Although the grounds for refusal were not stated there were compelling reasons for believing that they had to do with citizenship in a country that was "non grata" to the host country. The scientific and professional qualifications of the participant were not an issue. The Commission immediately informed the organizing committee in the host country of the IUPAP principal and asked that a visa be granted. Stalemate ensued. The IUPAP Executive entered the fray, made strong representations to the host country through its National Committee, and asked the Commission to prepare to cancel IUPAP sponsorship of the conference. Seven days before the scheduled opening date, the signals turned favorable. A message from the conference hosts stated that a visa would be granted. The Commission thereupon reaffirmed its sponsorship, and the conference began as scheduled. But the person who had been excluded decided not to attend.

At the time of the fourteenth General Assembly (Washington, 1972) -- IUPAP's Fiftieth Anniversary -- the nine ICPE members attending held an informal luncheon meeting at the Cosmos Club in Washington to discuss some issues central to the Commission's mission and future role. The following questions were posed for discussion: Is it desirable for IUPAP to continue to have a Commission on Physics Education? Are there more efficient ways of planning international meetings, and of obtaining financial support for them than those the Commission has employed in the past? Should the Commission continue to distribute its efforts over a wide range of educational problems in physics, including secondary education and general education of non-scientists, or should it restrict its scope to physics education for future researchers and teachers of advanced students and to manpower questions in physics? The consensus concerning the first question was an affirmative answer, rejecting the feasibility of discontinuing the ICPE and throwing IUPAP's support instead to other international educational organizations, such as the ICSU Committee on Science Education. Such an action, it was feared, would cause the special educational concerns of physicists to be lost in transdisciplinary programs. Likewise the answer to the second question was a philosophical affirmative, but the group was not able to come up with any practical new suggestions; ICPE would continue to muddle along financially, but would seek to be active in its orientation towards problems, not passive nor purely consultative. Question three was answered in the affirmative to the first part and the negative to the second: the Commission would continue to assess educational problems and do what it thought was best, without arbitrary restrictions. Although the group arriving at these answers was not the one finally responsible -- IUPAP itself, through its Executive and General

Assemblies, would have to give the final answers -- the Commission members were a knowledgeable group, and it was good for ICPE to confront the questions of its existence from time to time.

Since we are considering various IUPAP matters here, it is useful to assess the Union as a parent organization. From ICPE's prenatal days of 1959 and 1960, the IUPAP Executive and successive General Assemblies had been generally interested, supportive, and benevolent toward physics education. Commission 14 had had its problems: unlike most of the other IUPAP Commissions, which usually dealt with crisp scientific problems and could tap the deep well-springs of research moneys throughout the world for support, ICPE had to separate educational problems from a complex, confused social substrate and to deal with them with very limited resources. ICPE had a significant number of partial failures on its record, along with a few undoubted successes. IUPAP, however, never wavered in its support. One of its principal contributions, of course, was the selection of members of the Commission and a procedure for regular turnover. Another was a modest financial contribution.

Some examples of the latter may be helpful. IUPAP's contribution to the direct support of the 1960 Paris Conference was \$1065 out of a total of \$7584. At the election of the Third Commission in 1966, ICPE was informed that it would receive a travel grant of \$375 per year for the triennium 1967-1970, could request the allotment for two years simultaneously if it wished, and could request the previous year's unused fund of \$375. That made available total funds of \$1125 for the Commission in 1967, since the previous Commission had bequeathed no non-IUPAP funds to its successor. This IUPAP contribution improved somewhat in later years. My notes show that for 1968-1969 (the fiscal year of the Eindhoven seminar) ICPE had available in its treasury - not including Seminar funds - \$4,452 (including \$2339 from IUPAP and \$2113 from all other sources), of which it spent \$2588 for travel grants to Eindhoven. To put the IUPAP contribution into perspective, the Union's financial report for 1968 (17) shows total income of \$56,546, of which \$28,450 was spent for IUPAP conferences and \$5,410 for the traveling expenses of its sixteen Commissions. As an example of ICPE need, however, the Commission estimated in 1971 the cost of the Conference on Teaching Physics for Related Sciences and Professions at \$18,000, toward which guarantees of only \$6000 were available. The reader will remember that planning for the Conference aborted three times before it carried to term in 1976. The Conference on the Education of Teachers of Physics in Secondary Schools (1970) was estimated in 1969 to cost \$14,000 (apart from the contributions of the host country), of which IUPAP was asked to contribute \$1,000.

But the largest contribution IUPAP made to ICPE -- and indeed to all of the IUPAP Commissions -- was the prestige and comfort of sheltering beneath the Union's wings and being part of a highly respected, democratically run, principled international organization. In its regular activities between General Assemblies, ICPE dealt mostly with the IUPAP Secretary-General and Associate Secretary-General: C.C. Butler of Imperial College in London served in the former position for many years and Larkin Kerwin of the Universite Laval in Quebec in the latter. In 1972, J.S. Nilsson of the Institute of Theoretical Physics in Göteborg became Associate Secretary-General when Butler and Kerwin moved up in IUPAP's executive succession. All three were interested in education, sympathetic toward ICPE, and ready with good advice when called upon.

### **The Fifth Commission**

At the 1972 General Assembly, the membership of the Commission was reconstituted as follows: William C. Kelly (U.S.) was named chairman and John L. Lewis (U.K.) secretary; other members included G. Delacote (France), E. Ferreira (Brazil), A.P. French (U.S.), A. Harasima (Japan), L.S. Kothari (India), W. Kroebele (West Germany), A.N. Matveyev (U.S.S.R.), E. Nagy (Hungary), and J. Werle (Poland).

John L. Lewis, who had already served two terms on the Commission, brought energy, astuteness, and a wealth of educational experience to the affairs of the Commission. A Cambridge University graduate in physics, he was the head of the Science Department at Malvern College and was expert in ways of making physics interesting to pre-university students from early schooling to the sixth form. He was a leader in the Nuffield Physics Project in the United Kingdom, which brought about a significant reform of physics teaching there and

in many other countries as well. Hypercharged and efficient, John exercised not only major responsibilities for his school and country, but a variety of others at the international level, of which the ICPE secretaryship was only one. He was active in the affairs of the ICSU Committee on Science Education, served as editor-in-chief of UNESCO's Source Book Project, became editor of the Commission's Newsletter when that got under way in the 1970's, and was one of the principal organizers of the Edinburgh Conference on Physics Education (1975).

Anthony P. French, who had now joined the Commission, deserves his own annals in ICPE history, because he served as chairman from 1975 to 1981. I cannot resist saying a few words about him, however. His acquisition was an ICPE triumph and his beneficial influence on the Commission was immediately felt. Born in 1920 in Brighton, England, Tony had earned three degrees in physics at Cambridge University. At the Cavendish Laboratory there, he had made some of the first studies of angular distributions of particles from nuclear reactions at low energies. During World War II, he worked at Los Alamos, returning to England after the war to take a position in teaching and research at Cambridge. He returned to the United States in 1955 to become professor of physics and eventually department chairman at the University of South Carolina. In 1962, he moved to Massachusetts Institute of Technology where he became professor of physics in 1964 and, later, executive officer of the physics department. Tony was a stimulating teacher and had long been active in the improvement of physics teaching; his textbooks were well known, and he had played a prominent role in developing the "post-PSSC" course of the Physical Science Study Committee. As a new ICPE member, Tony plunged into the Commission's activities and was soon chairing the Edinburgh Conference, representing ICPE at the Latin-American Conference on the Role of Physics Education in Economic Development in Venezuela in 1975, and -- as indicated above -- making the arrangements to salvage the Conference on Teaching Physics for Related Sciences and Professions. His later contributions to ICPE fall outside the scope of this report; they have been numerous.

Also appointed to the Commission in 1972 was E. Ferreira, professor of physics in the Pontifical Catholic University of Rio de Janeiro; he gave the Commission guidance in understanding the conditions of physics teaching in Latin America. H.H. Staub, I am glad to say, maintained his connection with ICPE by serving as a corresponding member in 1972-75.

During this period, the Commission successfully staged a major conference, explored the possibilities of holding conferences on several other topics, and saw further development of its joint publishing ventures with UNESCO. The major conference was the International Conference on Physics Education (Edinburgh, July 29-August 6, 1975) which had first been proposed to the Commission by Harold Foecke of UNESCO at the ICPE meeting of June 25, 1971. The attendance was the largest ever at an ICPE conference -- 330 persons from 73 countries. In a program planned jointly by ICPE and UNESCO, topics that had been discussed fifteen years earlier at the Paris Conference were consciously revisited and updated; it was a very eclectic kind of conference. Emphasis was placed on the participation of representatives of developing countries and, thanks to the UNESCO subvention, goodly numbers of such countries were represented. French (1) has given a summary of the program and an analysis of the attendance in the context of the impact of ICPE on physics education worldwide. The report of the Conference appeared in several journal articles (18),(19) and in one of the UNESCO New Trends volumes (20). A final, horticultural note: the reader will have noticed that the Commission and the Conference had the same acronym -- ICPE -- and will be pleased to learn that these letters were spelled out in begonias in the floral display on the side of Castle Hill in Edinburgh during the Conference.

ICPE during these years considered several other conference subjects that seemed interesting and important, but because of lack of resources eventually died of malnutrition. One was computers in physics education -- even then, in the days before mass use of microcomputers, a hot topic in physics. The Commission discussed a six-day conference on the subject to be held in late August, in 1975, in Paris, scheduled between the Edinburgh Conference and the International Conference on Computer Education in Marseille in September. It would be concerned mostly with computers in higher education and with course software in physics. An attempt was made to work out the scheduling with the international group (IFIP) arranging the Marseille Conference, but not to the satisfaction of the host institution for the ICPE conference, and the idea was dropped. A like fate befell the proposed conference on Examinations and Testing in Physics and one on Physics and Society.

Two other conference possibilities were discussed, but not realized until years later by other Commissions: a physics education conference in Japan and a conference on research in pre-university physics education.

Among the publications that emerged as a result of the work of the Fifth Commission were *New Trends, Volume III*, which contained the papers of the Edinburgh Conference, and an ICPE Newsletter. The latter was proposed by Harold Foecke of UNESCO at the ICPE meeting of March 27-28, 1973, as a project suitable for UNESCO support and likely to produce benefits for worldwide communication in physics education. The Commission warmly agreed, and planning got under way under the leadership of John Lewis, who subsequently served as the Newsletter's first editor. The publication has lived up to the expectations for it and is still in existence.

## Conclusion

At the Fifteenth General Assembly (Munich, 1975), the membership of the Commission rotated again, bringing A.P. French to the post of chairman and giving John Lewis another term as secretary. Delacote and Matveyev continued as members, and Y. Kakiuchi (Japan), A. Loria (Italy), G. Marx (Hungary), G. Mokhtar (Egypt), M.A. Moreira (Brazil), and R. Ronne (Sweden) were newly elected. My formal association with the Commission ended, but I have continued to follow its progress with interest and an insider's sympathy.

Summing up the first fifteen years of an organization that is about to celebrate its twenty-fifth anniversary and is still going strong is hardly possible, nor is it necessary. ICPE has performed valiantly for physics education and, as a result of the labors of its earlier and present members, will continue to do good things. It could have accomplished more in the past if it had had greater resources, but they were not available. Perhaps having to pinch pennies has not been entirely bad. I remember the remark of one of the senior statesmen of physics: "IUPAP Commissions generally do good. They don't have enough money to do harm." Be that as it may, some easing of the constant search for funds and some resources to seize opportunities in a more timely way would be beneficial. I applaud the efforts of the present ICPE leadership toward these ends. The work has gone well in spite of difficulties, bringing to reality that midsummer night's dream of so many years ago.

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