

# A Debt Repaid. Ernest L. Eliel's Life Made Possible by Five Years in Latin America\*

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**Abstract.** A review is presented of Ernest L. Eliel's contributions and dedication to chemists and chemistry in Latin America, in general, and México, in particular. During his long and productive career as a successful academic (and member of the U.S. National Academy of Sciences), Eliel taught many students from Latin America. During an equally long and productive 'extra-curricular' professional career, Eliel was Chairman of the Board of the American Chemical Society (ACS), president of the ACS, and chair as well as a member of a number of ACS committees dealing with international activities. It was through those associations as well as through his scientific achievements that he was able to have great influence and positive effect on the chemistry in developing countries, in general, and in México, in particular.

**Keywords:** Ernest L. Eliel, Stereochemistry, Chemical Societies, Chemistry in Latin America.

**Resumen.** Se relatan las contribuciones del Dr. Ernest L. Eliel para apoyar el desarrollo de la química en América Latina en general, y en México en particular. En efecto, además de su extensa y fructífera labor académica, que lo llevó a ser miembro de la Academia de Ciencias de los Estados Unidos, Eliel participó en la formación de muchos estudiantes latinoamericanos. Además, Eliel fue Coordinador del Consejo Directivo de la Sociedad Estadounidense de Química (ACS por sus siglas en inglés), Presidente de la ACS, y coordinador de varios comités de la ACS dedicados a asuntos internacionales. A través de estas actividades y también como resultado de la calidad e impacto de sus logros científicos, Eliel tuvo una notable influencia y un impacto muy positivo sobre el avance de la química en países latinoamericanos, en particular en México.

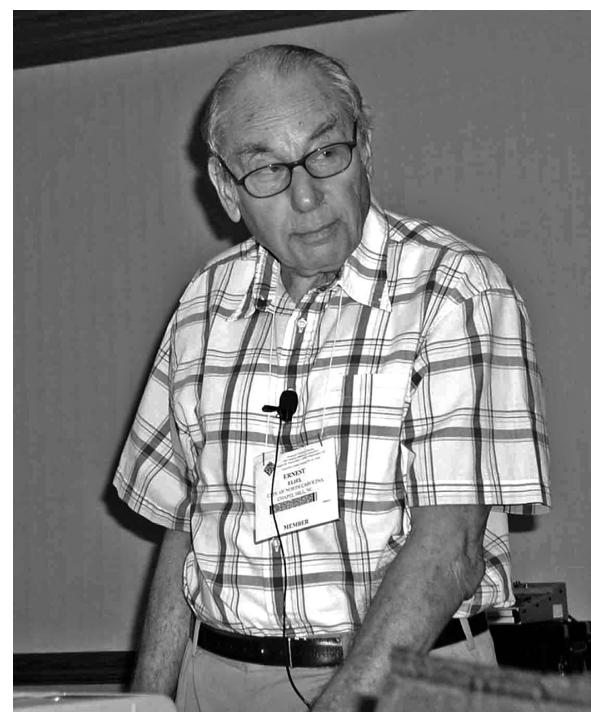
**Palabras clave:** Ernest L. Eliel, estereoquímica, sociedades químicas, química en América Latina.

## Introduction

Ernest Ludwig Eliel passed away quietly on September 18, 2008 at the age of 86 in Chapel Hill, North Carolina. An eminent scientist and educator, Ernest was also a serious participant in his professional communities for his entire scientific career. He had written his autobiography, *From Cologne to Chapel Hill* [1], nearly 20 years previously. I was his editor as well as his biographer [2], his admirer, his student, his colleague, the recipient of his largess, and most important, his friend for over 30 years. I did not then, and do not now, wish to admit his passing. In fact, Ernest will never really pass from my life. And so, it is with this preamble that I pick up the pen—the keyboard—once again on his behalf.

Ernest [3] once wrote of his hidden advisor, namely Derek H. R. Barton. By "hidden advisor," Ernest was acknowledging that many individuals contribute mightily to the success of others while gaining little recognition for their efforts. This is the way of life, not only the way within the scientific milieu. Ernest was one of my hidden advisors. His name does not appear on any official university document of mine nor does my name appear along with his as co-authors of a single publication. Yet Ernest made many contributions to my own career.

Two years before Ernest's death, Holden Thorp, then Chair of the University of North Carolina's Department of Chemistry and now Chancellor of UNC, asked me to ready Ernest's office —his files, his papers and his books—for



**Fig. 1.** Ernest giving what was to be his last lecture at an ACS National Meeting and may have been his last scientific lecture. At the 230<sup>th</sup> ACS National Meeting, Washington, D.C., August 29, 2005. The title of his lecture was "Textbooks of stereochemistry – an author's perspective." The lecture was given in the Division of History of Chemistry of the ACS. His previous two ACS National Meeting talks were "Cuba and the United States: 100+ years of tension?" in 2002 and "What is the U.S.-México Foundation for Science and what does it do?" in 2001. Photograph courtesy of Jeffrey I. Seeman.

\* This article is dedicated to the memory of the author's good friend, colleague and hidden advisor, Ernest L. Eliel (December 28, 1921-September 18, 2008).

their ultimate fate, a fate which had not then been determined. Venable Hall was soon to be demolished, asbestos and all. I arrived to discover a deserted building, a shell of a building soon to face the wrecking crew. It was an empty and disheveled silence, the last moments of what had been the scene of decades of productivity, careers made, the launching pad of thousands of students.

I will not argue who put UNC on the map: Dean Smith and his basketball teams filled with the likes of Michael Jordan; or eminent scholars and members of the National Academy of Sciences such as Ernest and Bob Parr. It just depends on your perspective and, perhaps, whether it's basketball season or not. But in my two days of completely organizing Ernest's papers and books, I had an even better measure of the fullness of his life, the richness of his experiences, and the gifts that he had given to his profession. One of these "gifts" was his commitment to the international brotherhood of scientists with an especial focus on developing countries, Latin America in particular. That shall be the focus of this report.

Ernest was a man who made many contributions to his profession that went way beyond his own research career. Yes, as evidenced by his numerous publications and books, Ernest was one of the pioneers in the Golden Age of Organic Chemistry. His seminal research in stereochemistry and conformational analysis are the underpinnings of the use of those fields by chemists, especially synthetic organic chemists, today. His textbooks on stereochemistry were and continue to be used by generations of graduate students and professional chemists around the world. They, combined with his 10 articles in *The Journal*

of Chemical Education, are the mark of an educator.

Ernest's most visible contributions to his profession are his term as Chairman of the Board of the American Chemical Society (ACS) followed by his election to be President of the ACS in 1992. His receipt of the Priestley medal in 1996 (Figure 2), the highest award given by the ACS "to recognize distinguished service to chemistry," [4] is testament to his professional life. The Priestley medal is the most prestigious award in chemistry in the United States. It is given annually by the American Chemical Society "To recognize distinguished services to chemistry." It is intended to honor much more than seminal science. Eusebio Juaristi and I were privileged to sit with Ernest and his family that night at the awards banquet table.

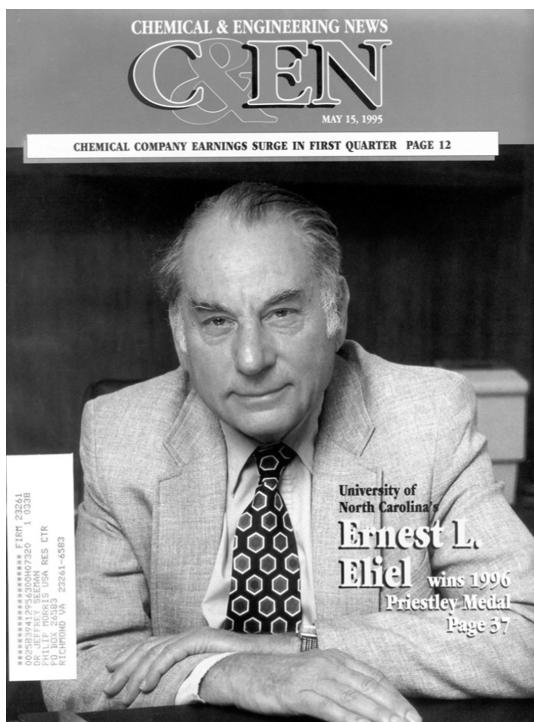
In 2007, Ernest gave all of his professional files to the Chemical Heritage Foundation (CHF) in Philadelphia. I was pleased, then, to facilitate the actualization of that gift and the transfer of 57 linear feet of files [5] to the CHF. When I was invited by Eusebio Juaristi to submit a manuscript to this special issue of *The Journal of the Mexican Chemical Society* and to join in this lovely celebration of Ernest's life, I immediately thought: What could be more perfect that to provide an overview of Ernest's commitment and interest in fostering chemistry and the chemical profession in underdeveloped countries. I am even more pleased today to use those files that I helped organize those days in 2007 to report on Ernest's work on behalf of chemists less fortunate than himself, especially those who reside in Latin America and, in particular, in México [6].

Latin America played a role in saving Ernest's life.

Ernest's parents were part of a prosperous, well cultured family; they were community leaders in Cologne, Germany [7]. The anti-Semitic atrocities of the 1930's caused the Eliel family to flee from Germany. In 1938, Ernest was sent by his parents to Scotland where he was awarded a stipend for university study. His parents emigrated to what was then officially named Palestine. One brother went to Holland, the other to England. On May 12, 1940, two days after Germany invaded Belgium and Holland, Ernest was classified by the British 'as an enemy alien' and taken to an internment camp. In July 1940, Ernest was put on a ship and, as he described the ordeal, was "told that its destination was a military secret. Thus I left Europe for good [2]."

Ernest was deported to an internment camp in Canada (Figure 3). Ten months later, he was again deported, this time to Cuba via Trinidad and Venezuela. He lived for five years in Cuba until July 1946, learning Spanish, matriculating illegally into the University of Havana, working in the pharmaceutical laboratories of one of the eventual founders of Syntex (Figure 4), and writing his undergraduate thesis in Spanish to the Universidad de la Habana in June 1946. The thesis is entitled "El Aldehido Homoverátrico, Intermediario para la Síntesis de Homoveratrilamina y Ácido Homoverátrico." It was dedicated "A mis Padres" (Figure 5).

With the end of the war, the emergence of the United States as the premier place to do science, and no country to call home, Ernest immigrated to the United States. He arrived at the University of Illinois with \$100 and bold ambitions. His



**Fig. 2.** The announcement of Ernest's Priestley medal in the May 15, 1995 issue of *Chemical & Engineering News*. Photograph courtesy of Peter Cutts Photography.



Fig. 3. Ernest in Canada, 1941.



Fig. 4. Ernest (center) in a pharmaceutical laboratory in Havana, Summer 1945.

far more than survival-story is told in his autobiography [1] which could well have been titled *From Cologne to Chapel Hill via Scotland, Canada, and Cuba*.

I posit that Ernest's European birth and heritage, his escape to Scotland, Canada and ultimately to Cuba coupled with his own personal and professional successes gave him

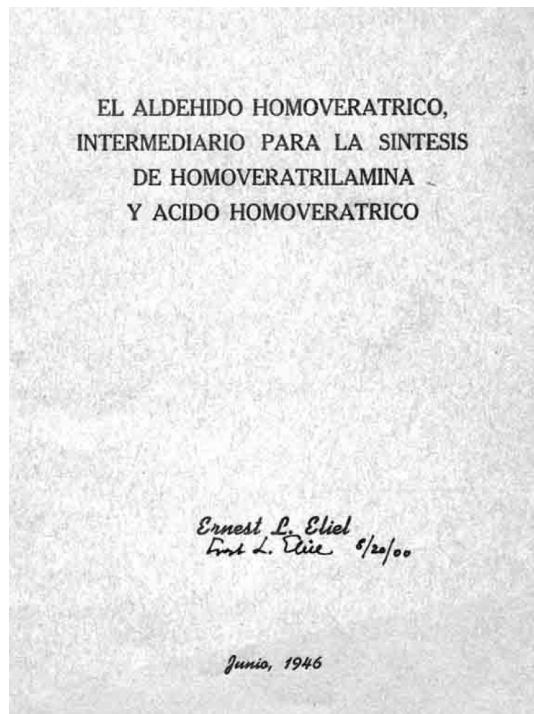


Fig. 5. Ernest's undergraduate thesis cover, "Junio, 1946".

the empathy and energy to devote so much of his life to others less fortunate than himself. But especially pertinent and poignant to this article and this special issue of *The Journal of the Mexican Chemical Society*, Latin America saved Ernest's life. As Ernest said and is recorded in his notes of a speech entitled "A Western European Experience from Years Past" given when he was president of the ACS as a symposium on immigration,

"The 1940's – a time when many refugees wanted to flee that part of Europe which was under Hitler's dictatorship – saw the lowest number of immigrants to the United States ever. Quota restrictions trapped many of these potential refugees in Europe where they were eventually cruelly murdered. Fortunately I escaped that fate, but it is true that the quota number of which I registered at the US Consulate in Germany in 1937 was not called up for processing until 1940, nearly three years later [8]."

Ernest also said,

"Cuba gave me asylum at a time when no other country did [9]."

The purpose of this paper is to reveal Ernest's concern for and activities on behalf of chemists around the world. Specific focus will be placed on Latin American, more specifically on his activities on behalf of Mexican chemists and ACS-Mexican and Mexico-US scientific relationships. This paper will be illustrative and not comprehensive being limited to information found within Ernest's archives at the CHF.

## Eliel's Students from México

Ernest had a number of students from Latin America. For example, Juaristi, now president of the Mexican Chemical Society, was, as mentioned above, his graduate student from 1972 – 1977 (see Figures 6-8) [10]. As Eliel recalled in what was his last chemistry publication in 2005,

“I first met Eusebio in a course on conformational analysis in Guadalajara in 1970... Eusebio has told me that the subject matter and my presentation appealed to him so much that he decided to do his Ph.D. research with me. He was accepted for graduate study at the University of Notre Dame in 1972, but since I had then just moved to the University of North Carolina in Chapel Hill, he resolved to follow me there. Or, rather, he preceded me by a couple of months and, through the generosity of the then chemistry chair Richard Hiskey, was able to use the time constructively to take a course in English, which helped him greatly in his teaching and later in the writing of his dissertation” [11].

Dr. Barbara Gordillo, a former graduate student in Juaristi’s group, was a postdoctoral student with Ernest from 1988 – 1990 [10]. Demonstrating his interest in and aspirations for chemistry in México, Eliel further commented on Juaristi’s impact on Mexican science,

“I find it particularly gratifying that of his 27 former graduate student collaborators now in academe, two-thirds (18) are located outside of México City, thus counteracting the concentration of talent in the mega-universities of the capital. Surely there must be many promising students outside of México City... Eusebio



**Fig. 6.** Guadalajara, December 1970. According to Eusebio Juaristi, “I met Ernest in a short course on conformational analysis he taught (together with Prof. Xorge A. Dominguez - left in the picture) and Prof. Pedro Lehmann (not seen in the picture). At this exact conversation, Prof. Dominguez is recommending me as a potential graduate student in Ernest’s group [12].” (Left to Right) Dominguez, Eliel, and Juaristi. Photograph courtesy of Eusebio Juaristi.



**Fig. 7.** Guanajuato, May 1980. According to Eusebio Juaristi, “a new version of the stereochemistry course was organized by me in the city of Guanajuato. I joined the ‘three musketeers’ as a fourth instructor [12].” (Left to Right) Juaristi, Eliel, Pedro Lehmann, and Xorge A. Dominguez. Photograph courtesy of Eusebio Juaristi.



**Fig. 8.** Ernest with four former students, during an afternoon swimming adventure at the 1980 Gordon Conference on Stereochemistry. (Left to Right) Fritz Vierhapper, Kenso Soai, Bill Bailey, Ernest, and Eusebio Juaristi. Photo courtesy of K. Soai.

has clearly done his share in supplying the provincial universities with highly trained and talented young faculty who – once given the needed financial support – will contribute to improving the level of chemical science taught in those universities all over México” [11].

## Participation in the ACS Joint Board [of Directors]-Council Committee on International Activities (IAC) and the ACS Latin American Task Force

Ernest served for many years on the ACS Joint Board [of Directors]-Council Committee on International Activities (IAC) whose responsibilities were

"for studying and recommending appropriate SOCIETY participation and cooperation in international undertakings pertaining to chemical education, professional activities, and scientific matters of interest to chemists and chemical engineers, and coordinating its efforts with those of other organizations, especially the National Academy of Sciences—National Research Council [13]."

and

"ACS has a long-standing interest in international affairs. The Committee on International Activities (IAC) was established in 1962 in recognition of the need for ACS to cooperate with scientists internationally and to highlight the application of chemistry to the worldwide needs of humanity... The committee is charged with studying and recommending appropriate Society participation and cooperation in international undertakings pertaining to chemical education, professional activities and scientific matters... [14]."

Eliel served as the chair of the International Outreach/Developing Countries Subcommittee. He reported on a poll of the foreign participants who visited US laboratories and were supported by the ACS International Initiatives program.

"Committee members concluded that the program has helped improve the quality of science in the countries involved, established good ACS relations with overseas chemical societies and contributed toward producing a positive image of the United States in Latin America and central Europe... The International Initiatives task group [was called upon] to develop a consensus on what further objectives the program should address and to write specific guidelines for choosing participants whose scientific activities will move the program towards those objectives... Dr Eliel agreed to develop objectives and internal guidelines for the program.

"Dr. Eliel added that a meeting was held at the recent conference of the Federación Latinoamericana de Química (FLAQ) to discuss ways of extending ACS efforts in Latin America. A participant suggested ACS invite the Latin American chemical societies to send student affiliates to meet with contemporaries from the United States. [ACS staff] indicated that the ACS Student Affiliates Program would be amenable to participate in this activity... [15]."

For several years, Ernest served as Chair of the ACS Latin American task force. The April 3, 2001 meeting covered a wide range of topics. Representative of these are:

"Dr. Eliel indicated the need for ACS to enter more interactions with LA [Latin America]; FLAC represents and aggregates countries in LA and FLAC does build cohesion among LA countries in the area of chemistry... ACS acts best as a catalyst; ACS can't be [a] driver..."

"ACS to help with presence of eminent chemists in technical sessions at FLAC 2002 and national chemical society

meetings. Help with advertising FLAC 2002 with ACS membership... focus on young people in LA to promote [the] study of chemistry. FLAC to improve this situation in publishing journal – Noticias Panamericanos. Can ACS help to promote and circulate journal? FLAC moving to distribute NP electronically... Dr. Juaristi discussed lack of interest of young people in chemistry. Mexican Academy of Science fighting for space in newspapers to promote science... ACS advanced in this direction – public outreach on worth and promotion in chemistry. Idea – can ACS share its articles, artwork and translate into Spanish for chemistry columns... Dr. Eliel indicated there was lots of progress in this area over [the] ten years. Materials can be made available. Need to negotiate with ACS office that does this. Dr. Juaristi said México exploring possibility of access to SCI Finder at discounted rate... [16]"

In the latter months of 2004, the IAC Latin American task force, of which Ernest was a member, reported that its purpose was to

"further develop the conceptual approach and prioritize interactions [of the ACS] with developing countries in Latin America... [They were] exploring with the Mexican Chemical Society opportunities to foster scientific exchange on an industrial aspect of chemistry that is relevant to the US-México border. The Office of International Activities is working with ACS regional meeting staff to determine how US-México science issues could become a permanent reoccurring program feature at appropriate Regional Meetings. The Committee is co-sponsoring a US-México chemical education symposium in San Diego... [They were also] engaging ACS technical divisions in LAC activities... [17]."

The April 8, 2002 meeting (Eliel chair) provided a large discussion of many points. For example,

"ACS is not a formal member of FLAC which impacts the level of its involvement... In fall 2001 there was discussion regarding nominal ACS co-sponsorship of the FLAC 2002 meeting... The primary role request of ACS from FLAC was to contribute by bringing world class chemists to the FLAC 2002 meeting. A 'Famous Chemist' panel is an example of the kind of help which would contribute to the program... there are financial implications... and time availability issues.

"With Latin America there should be a focus on partnership and collaboration in developing ideas and launching programs that end up being relevant and sustaining. A key question is what is most important furthering excellent pure science or how to best serve economic development Task force members also discussed the benefits of concentration on getting US students into other countries for scientific work. Members and guests were asked to think about new ideas and communicate them to the LATF chair [Eliel] [18]."

The August 20, 2002 meeting (Eliel chair) also provide a large discussion of many issues, including,

"Dr. Eliel provided a report on the IAC meeting and its discussion on major ideas. He highlighted the environmental / green chemistry workshops in Latin America, based on the models for the ACS INTERNATIONAL ACTIVITES OFFICE NSF-funded workshops in Central Europe... Dr. Eliel discussed the ACS Distributed Analytical Facilities (DAF) for Latin American chemists to have access to facilities for more advanced analyses. The program is envisaged to be a stepping stone to US / Latin American research collaborations and as a feed to the ACS International Initiatives program... Dr. Juaristi added that México's CONACyT [the National Council of Science and Technology [19] [20], essentially, the "NSF of México] is considering adopting the Brazilian sectorial funds model for its own S&T research programs... Dr. Eliel discussed his symposium on New and Exciting Research in Chemical Sciences with participation from R. Breslow, M. Molina, F. Stoddart, and J. Meinwald. ACS is not a formal member of FLAQ and therefore has centered its participation on [sic] program... Dr. Eliel will ask M[adeleine] Jacobs of C&E News about putting an announcement about the FLAQ 2002 in the next edition of the magazine... Dr. Miller reported on a telephone conference in July 2002 among Dr. Eliel, and the directors of marketing and academic program marketing with CAS... CAS is interested in providing services to Latin American clients through consortia arrangements (headed by a single legally constituted entity to which a single invoice be sent in a given country.) [21]"

At the 25<sup>th</sup> Latin American Chemistry Congress (Congreso FLAQ 2002) held in September 2002 in Cancún, México, Eliel's symposium on "New and Exciting Research in the Chemical Sciences" was held. The president of the Mexican Chemical Society, Dr. Jaime Noriega, commented on the conference in this way.

"This was an opportunity for the Latin American chemistry community and the American chemistry community to become aware that there is an enormous possibility for professional growth in the Americas. Many of the conditions are already in place, [and] the markets are developing in that direction. This is the time to organize ourselves in such a manner as to exploit these markets, to push professional growth, and to reaffirm the conditions and capabilities that each of our countries has in order to become more and more competitive, and to do good work for our countries and for our people. Also, we need to become closer in our goals – scientific goals and education goals [22]."

## Statesmanship, Philosophies, and the "Bull Dog"

Ernest influenced the ACS in many ways. His various leadership roles provided the basis for being influential; his commitment, energy and philosophies led to his being both elected and chosen to those various positions. He was also a "bull dog", a label given to Ernest by a colleague but one that he was more than amused by [2]. His self-referral to that nick-

name suggests to me that he felt it was both appropriate and valid as well as somewhat amusing.

Ernest began his 1992 ACS President's Annual Report by saying,

"One of the presidential initiatives in 1992 was the strengthening of the international activities of the Society, in view of the fact that not just academic but industrial chemistry is becoming more and more transnational. An international activities retreat, held in May, results in several recommendations, one of which – an increase in personnel in this area – is being implemented in 1993. Another recommendation, namely to promote study abroad by chemistry majors is being follow up by a special task force and by the Committee on Professional Training [23]."

On December 19, 2001, Ernest [24] wrote to John Malin (Figure 9) with a copy to Bill Carroll, stating that the draft ACS International Agenda, 2002-2003

"is a bit deficient in not stating that the chemists and chemical engineers whose interests we serve as well as 'other organizations' are all over the world. I would propose to add 'worldwide'... [24]" in one of the two locations shown in italics below:

### *International Activities at ACS*

"The fifteen-member Joint Board-Council Committee on International Activities (IAC) is responsible for the direction and



**Fig. 9.** John Malin, then Assistant Director of International Activities, at his ACS office, displaying a medal from the Arab Union of Chemists given to ACS "after we organized the first Middle East conference, at Malta. Ernest was on the organizing committee for the event, which was chaired by Zafra Lerman." Photo taken January, 2004. Photograph courtesy of John Malin.

oversight of the Society's international program. The Committee is charged with studying and recommending appropriate Society participation and cooperation in international undertakings pertinent to chemical education, professional activities and scientific matters of interest to chemists and chemical engineers *worldwide*, and coordinating its efforts with those other organizations *worldwide* [25]."

## Developing and Running His Own Outreach International Programs

In addition to Ernest's many years of committee membership, he was also been personally, actively involved in enhancing opportunities and education in Latin America. An early example comes from lectures and courses he gave in México. For example, Ernest gave a short course on conformational analysis in the city of Guadalajara in December of 1970 with both Pedro Lehmann, son of the founder of Syntex, and Xorge A. Domínguez [12]. During that course, Dominguez introduced Ernest to the young Eusebio Juaristi who was seeking to study as a graduate student with Ernest (Fig. 6). Ten years later, in 1980, Ernest gave a series of lectures on stereochemistry in Guanajuato, again with Lehmann and now with the young professor, Dr. Juaristi [26] (Fig. 7).

Another example of Ernest's outreach efforts is described in his request to reprint an article he published in *The Journal of Chemical Education (JCE)* on heterotopicity written to Dr. J. J. Lagowski, then Editor of *JCE*,

I am to give in May 1980 "a short course on asymmetric synthesis (in Spanish) in Guanajuato, México, jointly with Professors Eusebio Juaristi and Pedro Lehmann of the National Polytechnic Institute of México City and Xorge Domínguez of the Polytechnic Institute of Monterrey. This course is sponsored by the Mexican Ministry of Education.

"Dr. Juaristi, who is in charge of the course, plans to prepare a rather extensive booklet in conjunction with it. In this context he has asked me whether he may translate the above article into Spanish and use it in the booklet... Would you, on behalf of the *Journal of Chemical Education*, be willing to give us permission... [27]"

Lagowski immediately granted permission [28].

## Outreach

Ernest served as Chair of the ACS Latin American Task Force in 2003. He knew that communication and publicity were critical to achieve the ACS international activities goals.

On January 15, 2003, Ernest announced,

"It gives me great pleasure to draw your attention to the first number of the Boletín Electrónico Latinoamericano of the ACS... an electronic publication... The purpose of the Boletín is to

bring you news from the ACS about projects and publications... for example notices of meetings in various Latinamerican [sic] countries... [29]."

In 2004, Boletín Electrónico Latinoamericano and the ACS Bulletin Afrique were consolidated and extended into the ACS International E-newsletter. The first issue reported on the Regional View an Outlook for Latin American Chemical Markets in 2004 and the Mexican Microscale Chemistry Center in the Department of Chemical Engineering and Sciences of the Universidad Iberoamericana in Mexico City.

## Promoting Science through ACS-Facilitated Collaborations

The ACS has participated in a series of student exchange programs between Latin America and the US. Several of these were documented within the Eliel archives.

On October 22, 1993, Ernest [30] wrote to Dr. Antonio Peña Díaz, Presidente de la Academia de la Investigación Científica, describing the early stages of the "Young Latin American Investigators" project,

"For some years the American Chemical Society (ACS), of which I am immediate past president, has endeavored to strengthen ties with the Mexican chemical community. Part of the collaboration has been through the North American Congresses; I am on the executive committee for the 5<sup>th</sup> Congress to take place in 1997. We also have a project, funded by ACS, for short-term visits of Mexican chemists and chemical engineers to make contacts with colleagues in the USA in the hope of arranging collaborative research. The extent of our collaborations has been largely limited by the availability of funds.

"Recently we learned from the International Division of our National Science Foundation (NSF) that they would be willing to make a grant to ACS for the purpose of bringing chemists and chemical engineers from several Latin American countries to laboratories in this country for periods of two to two-and-one-half months in the summer..."

"It is particularly important that the participants for this project be chosen from all over México and not just from a few large institutions in the capital.

"My question at this time is whether you consider this a desirable project and, if you do, if the Academia de la Investigación Científica would be willing to work with the American Chemical Society on this project. Collaboration would involve taking the necessary steps with CONACYT to make sure that the project is acceptable under the existing arrangements and, eventually, to arrange for applications from Mexican chemists and chemical engineers and to rank these applications if there are more than can be accommodated in any given year..."

"P.S. The Mexican-US Foundation for Science is doing well; we have just approved the first 12 grants [30]."

A final report to the NSF for the period January 1, 1997-December 31, 1999 was written by Ernest and John Malin, co-principle investigators, entitled "Latin American Regional Cooperation: Short-Term Visits to US Institutions by Young Latin American Investigators [31]." This report described that

"During the reporting period January 1997 through December 1999 the Office of International Activities of the American Chemical Society administrated a grant of \$67,000 from the National Science Foundation to expand ACS's program to develop cooperation of US researchers with early career scientists in Latin America. The funds, together with contributions for travel expenses from agencies in Argentina, Brazil, Chile, Costa Rica and México, made possible fifteen visits of some two months duration to the United States by Latin American scientists at the start of their careers..."

"... program to develop cooperation of US researchers with early career scientists in Latin America... [involved] fifteen visits of some two months duration to the United States by Latin American scientists at the start of their careers... The American Chemical Society Office of International Activities worked with a counterpart organization in each of the five countries to select the participants... [including] the Mexican Academy of Sciences... final section was made by the principle investigators Prof. Ernest L. Eliel and Dr. John M. Malin in consultation with experts form the US chemical community..."

"The American Chemical Society Office of International Activities worked with a counterpart organization in each of the five countries to select the participants... Final selection was made by the principle investigators Prof. Ernest L. Eliel and Dr. John M. Malin in consultation with experts from the US chemical community... The ultimate distribution of the fifteen fellowships was: Argentina (3), Brazil (1), Chile (5), Costa Rica (3) and México (3).

"Participants were selected on the basis of 1) the scientific quality of the proposal, 2) the applicant's scientific ability as evidence by early productivity, 3) the ability for the host researcher to assist in carrying out the proposed project, 4) evidence that the applicant had relatively little previous opportunity to do research in the United States, and 5) the likelihood that the visit would develop into a future collaboration..."

"This project has furthered relations between US scientists and important segments of the Latin American scientific community in the following ways. Especially, the program has fostered one-to-one collaborative research partnerships between US and Latin American laboratories which are the basis of continuing interactions. Also, American Chemical Society has strengthened relations with sister societies and research organizations in Argentina, Brazil, Chile, Costa Rica and México. Finally, ACS has developed a new relationship with each of the visiting scientists, which we intend to pursue by maintaining contact with them as their careers develop.

[The participants from México were] "Dr. Abel Moreno Cárcamo, 30, Institute of Chemistry, National Autonomous University of México (UNAM), at the University of California, Irvine with Dr. Alexander McPherson..."

"Dr. Hugo Alejandro Jiménez-Vazquez, 34, Escuela nacional de Ciencias Biológicas, Instituto Politecnico Nacional, México at Yale University with Dr. Martin Saunders..."

"Dr. Jose Antonio Medina, 34, Universidad de Guadalajara, Guadalajara, México at the University of Washington with Dr. Daniel T. Schwartz... [31]."

A review of the files on this NSF-funded project [32] provided the reviewers' comments on the original proposal. One set of comments is particularly revealing,

"Unfortunately, only six candidates per year will benefit from the proposed research visits, which in part (travel expenses) will be financed by the Latin American partners. This program deserves a broader scope and more funding!"

"It is anticipated that every successful visit will catalyse a chain reaction of productive research cooperations and future exchanges. For this reason some careful thoughts should be expended on how the Latin American candidates choose their US hosts. I would recommend that younger colleagues with personal experiences in Latin America be given preference. It seems advisable to screen US universities for such qualified colleagues and provide a listing to the various Latin American partner organizations [33]."

Ernest was active as a member of the México-U.S. Foundation for Science, sometimes referred to as the U.S.-México Foundation for Science (USMFS) or FUMEC, which stands for Fundación México-Estados Unidos para la Ciencia. FUMEC

"was established in 1992 as a non-profit organization to promote cooperation in science and technology for the solution of problems of interest to both the United States and México. The USMFS is located in México City and organizes workshops, conferences, studies, and exchanges of scientists and engineers in order to define the scope and content of science projects and activities to address problems shared by both countries that are amenable to science and technological solutions [34]."

According to the abstract of a talk given by Ernest at the 221<sup>st</sup> ACS National Meeting in San Diego, CA in 2001 entitled "What is the U.S.-México Foundation for Science and what does it do?" FUMEC's

"14-member Board consists of representatives of the three Academies (Science, Engineering and Medicine), CONACyT (the Mexican vis-a-vis of NSF) and the chair of the presidential Science Council plus two business representatives in México, and corresponding representative individuals in the U.S. Its budget is derived mainly from income of an endowment contributed by the two governments [35]."

In 1997, as a member of the FUMEC governing board, Dr. Eliel received a \$195,200 NSF award to support various of its activities. Ernest was committed to bringing about closer ties

in science and technology between the United States and Latin America. An initial commitment of \$2 million was required from each country. The United States contribution included funds provided by the National Science Foundation and the Environmental Protection Agency as well as from the private sector. Initial funds were used to support two rounds of collaborative research, underwrite summer grants for young Mexican faculty to spend time with senior U.S. investigators, and provide fellowships for graduate students to complete their thesis work at U.S. laboratories. In addition, the Foundation has supported the travel of outstanding scientists and engineers to México for lectures and scientific interactions. The Foundation intended to use these funds to support visits by distinguished U.S. experts to México, summer visits by young Mexican faculty to the U.S., academic year fellowships for Mexican graduate students to U.S. universities, and a workshop to deal with environmental issues on the U.S.-México border. This program continues to this day, with support from FUMEC and the Academia Mexicana de Ciencias (though apparently not from the ACS) [10]. Since 2002, the program has been coordinated by Eusebio Juaristi [10].

During this period, Mauricio Fortes was president of the Mexican Academy of Sciences, and later, served for eight years in the Board of Governors of FUMEC and was President of the Board. He followed Ernest's term as president and thus Ernest and Mauricio had a great opportunity to interact with ideas for scientific collaboration and suggestions of new programs. Fortes recalls,

"FUMEC was formed after the intense promotion of the late Congressman for California, George Brown. He wanted to create a practical mechanism for a high-level scientific collaboration between US and Mexican researchers for which he dedicated some years in useful lobbying in the US House of Representatives. His proposal was based on the US-Israel Foundation for Science which had been instrumental in creating a very effective exchange of scientists between those two countries. Congressman Brown was a person with a great vision for this sort of endeavors. He not only convinced the Federal Government in each country to provide funds for the Foundation's Endowment but also had suggested that the National Academies of Sciences and of Medicine in each country should be charged in appointing the Board members. This was a very fortunate decision because the bylaws were designed under academic and scholarly principles.

"Ernest Eliel was appointed by the US NAS and immediately became an invaluable colleague that helped shape the goals and practices of this Foundation. Since the ACS and the Mexican Physical Societies were already working on bi-lateral programs and the funding agencies in each country (NSF and CONACyT) also had some collaborative programs, FUMEC needed original ideas and creative thinking to initiate its own programs. Ernest excelled in his suggestions and soon, the Foundation was operating collaborative research programs under very strict selection and review processes. In addition, I proposed to create new initiatives together with the Mexican Academy of Sciences. The

latter organization would help us in setting peer-review standards and in promoting the new initiatives across the country. At least two of these initiatives are still operating: The exchange of distinguished professors, and short visits of Mexican doctoral students at US research facilities and universities [36]."

In 1994, Ernest [37] wrote to Rosalinda Contreras of the Centro de Investigación y de Estudios Avanzados addressing several issues that she addressed to him in her "fax of February 24." Ernest wrote,

"I fear the chances of successfully arranging an exchange of chemistry graduate students at a nation level is very slim. It would require 1) a willingness of U.S. chemistry faculty to have people in their labs for a year without their staying to do a thesis. 2) a willingness of U.S. graduate students to spend a year in México. 3) Funds. Problem 2) is particularly severe; a recent study done by ACS (albeit at the undergraduate level) indicated that the number of U.S. chemistry students going abroad in the course of their studies is minuscule.

"I believe that the problem 1) can best be addressed by arrangements between individual faculty members with similar interests in the two countries to host each others' graduate students for short periods... Problem 2) could best be addressed by not tying the exchange to chemistry. Many graduate students of Spanish or of Latin American Studies ([The University of North Carolina at Chapel Hill has] such a program) might be eager to go to México in exchange for a chemistry student who comes here. If problems 1) and 2) can be solved, I think we can address problem 3). Even if tuition is waived (as it should be in a bilateral exchange) it takes about \$8,000-10,000 per year for a student to live here. However, I would be willing to try to address this problem [37]."

In 1997, Eliel received a \$10,000 U.S.-México award to support the participation of 20 early-career invitees to the Fifth Chemical Congress of North America which took place in Cancun, Quintana Roo, México, November 11-15 of that year [38]. The activity was under the joint sponsorship of the ACS, the Canadian Society for Chemistry, and the Sociedad Química de México (SQM). One goal of the meeting was to enhance the dissemination and exchange of chemical knowledge by scientists of the countries of North America. A one-day workshop will be held to generate plans for improving chemistry cooperation in the Americas. Total attendance at the conference was 2,645 from 46 countries. Special workshops included "Hemispheric Collaboration in Science" and "Internet in the Americas" and a symposium entitled "Science Policy and Scientific Cooperation in the Americas". The meeting led to collaborative initiatives in some cases and enhanced scientific understanding among the countries involved [38].

Juaristi remembers that Ernest played a determining role "in overcoming opposition within ACS and the Canadians to hold the 5<sup>th</sup> Chemical Congress of North America (5<sup>th</sup> Congreso de Química de América del Norte). The argument was that ACS already had too many meetings, including

PaciChem. Thanks to Ernest's support, the 5-CCNA took place in Cancun in November 1997. Unfortunately, there has been no 6-CCNA" but there is hope that a 6<sup>th</sup> and many other such Chemical Congresses will occur in the future. According to Brad Miller, Director, ACS Office of International Affairs,

"We are working to resurrect Canada, US and México cooperation on the occasion of the 2011 International Year of Chemistry and have a region planning team in place. Ernest would have been very supportive of that [38]."

In 2000, Ernest and Malin reported that

the ACS "Office of International Activities is now completing its own study of the Latin America chemical enterprise in the five largest economies of the region, *Chemically Related Activity in Industry, Higher Education, Government, learned Societies and Trade/Professional Associations and Research Institutes in Argentina, Brazil, Chile, México and Venezuela* [with a goal of] searching for specific areas in which the academic communities of the region might work with national and multinational industry... we suggest the following areas of future opportunity for industrial-academic cooperation in Latin America: analytical chemistry, bioprospecting and natural products chemistry, catalysis, environmental chemistry, molecular genetics, and natural and synthetic polymers [39, 40]."

On October 13, 2001, Juaristi, AMC-ACS-FUMEC Program Director, wrote to Malin, then ACS administrator of International Activities, stating,

"As you are already aware, one of the main objectives of the Academia Mexicana de Ciencias is to promote research through various actions such as international exchanges and collaboration... We will be most grateful if the American Chemical Society can support two fellowships (for \$5,500 USD each) for the continuation of the program in 2002. In this regard, the Fundación México-Estados Unidos para la Ciencia (FUMEC) has already committed two additional matching fellowships, also for the year 2002. As in previous years the Academia will take care of the promotion of the program and the evaluation of the candidates [41]."

Juaristi's letter was received with great enthusiasm by John Malin of the American Chemical Society,

"Great news! The attached letter from Eusebio Juaristi of the Academia Mexicana de Ciencias indicates that the Foundation México-Estados Unidos will contribute \$11,000 to ACS in continuing support of U.S.-México exchanges of scientific personnel. This program participated in the World Reach Fund in 2000-2001, and I would like to submit this new contribution for matching under the program [42]."

This program clearly continued. On April 21, 2005, Juaristi wrote to Bradley D. Miller, then ACS International Activities Manager,

"The Academia Mexicana de Ciencias is pleased to recommend two proposals from a total of six applications to receive a fellowship from the American Chemical Society and the México-US Science Foundation, under the program Short-Term visits to US Chemistry Institutions by Young Latin American Investigators [43]."

In his Comment published in *Chemical & Engineering News (C&EN)*, Bill Carroll [44], then Chair of the IAC, reported the then new ACS program "Global Instrument Partners." Ernest had been approached to help "some researchers [in South America who] have difficulties accessing advanced instrumental methods [44]." Through Ernest's advocacy and active work — applicants were asked to sign up by contacting Ernest — an electronic bulletin board was created to connect "North American researchers who have advanced capability and who would like to collaborate with researchers in need of that capability in Latin America [44]."

The minutes of the November 18, 2004 telephone conference including Ernest reported in detail on

"USA-México interactions... to foster scientific exchange on an industrial aspect of chemistry that is relevant to the US-México border... to determine how US-México science issues could become a permanent reoccurring program feature at appropriate [ACS] Regional Meetings. The Committee is co-sponsoring a US-México chemical education symposium in San Diego [45]."

## Promoting Science through ACS-Facilitated "Distributed Analytical Facilities for Latin America" and other resources

As Chair of the ACS Latin America Task Force, on July 27, 2002, Ernest wrote to members of that committee,

"I have been looking into the possibility of making available sophisticated analytical facilities in the US to researchers in the chemical sciences in Latin America... I have found about half a dozen US chemical scientists who would be interested, in principle, to participate. We still have to establish ground rules in consultation with them: What instruments do they have available? How many analyses would they be willing to perform per month (or per year)? What would the charge be?... What happens if payment for the service is required and the Latin American originator has not money (or no dollars)? Should ACS set up a modest fund to cover such eventualities [46]?"

He then continued,

"Several US partners mentioned that the scheme works best if the Latin American investigator can come to their laboratory, at least early on, to see what is actually going on in the analysis. We might think of using the International Initiatives in this context [46]."

Ernest's hand in providing resources to Latin American chemical societies and chemists stretches back many years. One example comes from a ACS memo from John Malin, then staff head of ACS's International Activities programs, which stated,

"Presently there is a request from Dr. Eliel, whop would like us to distribute one copy of the 1991 edition [of the ACS *Directory of Graduate Research*] to each of the fifteen 'Second World' chemical societies currently being assisted by the Society's International Initiatives program... we will mail copies to Argentina, Brazil (2 societies), Chile, México... Also, at Dr. Eliel's request, I will write to each of those national societies asking them to identify several of their major universities whose chemistry departments would benefit by receiving a copy [47]."

## Providing First Hand Information to the ACS, and Stimulating Enhanced Opportunities for Latin America by the ACS

Ernest was always interested in enhancing the education and opportunities of non-American chemists. On October 3, 2000, Ernest learned from Bob Massie, then Director of Chemical Abstracts Service (CAS) that SciFinder Scholar had been sold to two universities in México, both outside México City [48]. He responded to CAS, demonstrating clear knowledge of and interest in assisting chemical research in México:

"I assume [that] attempts have been made to sell [SciFinder Scholar] to the institutions in México City — if they have not succeeded so far, it might be fruitful to try to interest them in a consortium. The two important chemistry departments are in the National University (UNAM) and the National Polytechnic Institute (IPN), but the Metropolitan University might also be a player. Interestingly, both UNAM and IPN have research as well as teaching departments; the one at IPN (that I know quite well) is called 'CINVESTAV' [48]."

In 2004, Ernest "reported his assessment [to the IAC], based on his participation in the October 2004 International Conference on Chemistry and Chemical Engineering in Havana, that general conditions in Cuba are worsening [45]."

## Eliel's Fluency in Spanish: On His Effectiveness in Communications and Interactions

Ernest earned his undergraduate degree at the University of Havana, Cuba, a safe haven for this German-born Jew from the Nazi's and his native Germany during World War II. During his undergraduate years in Havana and his research experiences there in the laboratory (Fig. 4) of another refugee George Rosencranz, later one of the founders of Syntex in México, Ernest became fluent in Spanish. Within Ernest's files are a

number of communications dealing with ACS International Activities written by Ernest in Spanish.

When it comes to translations of scientific text, it is often critical to have the assistance of not merely a translator but someone who is a scientist as well. On more than several occasions, Ernest provided critical assistance to me in translating German to English. I found one interesting example in his archives that Ernest served in this capacity for the ACS, using his knowledge of Spanish. I am certain there are other such instances.

On August 12, 1999, Ned Heindel, former ACS President and Chair of the ACS Division of History of Chemistry and longtime member of the ACS Landmarks Committee, sent to Ernest "the plaque texts which go for [sic] the bronze foundry for casting next week... [49]" Two plaque drafts were sent, one in English, one in Spanish. Ernest corrected "de la" to "del" and circled two pairs to text: "una especie Mexicana de dioscorea" and "Méxicán yam"; and "fármacos de esteroídes" and "steroidal pharmaceuticals [50]."

In his ACS past president's report, Ernest noted that

"A Spanish translation of ChemCom was arranged for [23]." Ernest ended a 1994 letter to Rosalinda Contreras by saying, "Please forgive me for writing in English, but it is easier for me. Of course, you should feel free to write to me in Spanish [51]."

## Providing Frank Appraisals and To-the-point Advice

On July 17, 1996, Eliel [52] wrote to Dr. Adolfo Martínez Palomo, then Director General of the Centro de Investigación y Estudios Avanzados (CINVESTAV),

"As you already know, I continue to be concerned about the relatively poor shape of chemistry in México. Chemistry there is in worse shape than it was 25 years ago.

"I am told that chemistry study in México is unattractive because there are no jobs. Even those who are enthusiastic about the subject and might be willing to accept lower pay in order to do something they really like (isn't that true for all us academics!) are deterred.

"Is there a way to break this circle? I think there is... CINVESTAV now has about 60 postgraduates [sic] students in chemistry... Many of these students come, I am told, from the 'provinces.' Would it not be a good idea to get them to go back to the provincial universities who, I am told, are very short of Ph.D.'s and even M.S.'s among their own chemistry professorate? Perhaps the ultimate effect would be a continuing growth in both the number and quality of chemists in México —both as graduate students at CINVESTAV and UNAM and as teachers at the provincial universities— something that would be very desirable... [52]."

## Honoring Ernest Eliel

Surely one of the sweetest joys in the scientific profession is being honored by one's own peers. Ernest received many

awards and honors, including membership in the U.S. National Academies of Science and receipt of the Priestley Medal of the American Chemical Society (1996) [53], the George C. Pimental Award in Chemical Education of the American Chemical Society (1995) [54], and the Chirality Medal of the Società Chimica Italiana (1996) [55]. I know of several symposia held in Ernest's honor (prior to his passing), as I spoke at two of them (and was just invited to participate in another)! In 1991, a symposium in Ernest's honor was organized by Juaristi and Robert O. Hutchins, another of Ernest's students, was held in México. As Ernest wrote in his Thank You messages to the participants,

"It was a wonderful affair, enhanced by the enthusiasm of the Mexican students and the generosity of the Mexican Academy of Scientific Research [56]."

Ernest was informed on July 15, 1991 that he was to be made a corresponding member of the Academia de Investigación Científica, an invitation he immediately accepted. On July 17, 1991, he responded that

"I shall be happy to present a lecture on October 17 in the afternoon on the topic "Síntesis Asimétrica y la Regla de Cram [57]."

In his thank you message to Dr. Hugo Aréchiga U., President of the Academia de Investigación, Ernest wrote

"If I can be of any assistance to the Academy in my position as 1992 president of the American Chemical Society or through my membership of the US National Academy of Sciences, please let me know [58]."

And to Professor Rosalinda Contreras, he wrote

"I want to thank you again for your very warm words [of introduction] on the occasion of my installation... it is a strange but rather touching experience to hear one's own words read back in another language – I enjoyed it!... I have found that the citations that go with awards constitute the most pleasant memories and this one is my first in a language other than English [59]!"

In 1999, Ernest was made an Honorary Member of the Chilean Chemical Society. He received this award from Professor Guillermo Contreras, then President of the Society. The ceremony was held in Valdivia in late November of that year.

At the 2002 FLAQ meeting (October 17-23) hosted by the Cuban Chemical Society, Ernest was presented with an honorary degree from his alma mater, The University of Havana (Figure 10). As related by Brad Miller,

"He was presented with the diploma as well as a copy of his transcripts while a first degree chemistry student at La Habana. With the American and Cuban flags standing side by side, the ceremony began with the playing of both the Cuban and U. S. national anthems. As reported by meeting attendees, the playing



**Fig 10.** Ernest in Havana, 2002. Photograph courtesy of Brad Miller.

of the national anthems was a symbol of the spirit of cooperation and collaboration felt by both the U.S. and Cuban participants who attended the ceremony [38]."

## The Legacy

Ernest's contributions and commitments formed the basis for activities during and subsequent to his own lifetime. In his life, Ernest touched the personal and professional lives of a wide number of people, both directly and indirectly. His science, his books, his dedication to his profession and to others less fortunate than himself point to a man worthy of an international Priestley medal. There simply is no way to quantify the legacy of Ernest Eliel.

With an understanding that any listing is a minimal representation, a listing that omits the consequences of Ernest's influence on the lives of many individuals, I provide the following.

The *Boletín Latinoamericano* has now been transformed into the ACS International E-Newsletter. With a readership of over 3000, the Newsletter, first conceived by Ernest for Latin America, now touches all regions of the globe.

In the domain of chemistry education in 2006, ACS worked with the Mexican Chemical Society for the delivery of two workshops on inquiry/activity based chemistry education. Content was presented to 50 chemistry faculty members of the Autonomous University of México as part of their pre-winter in-service and again at the annual meeting of the SQM in México City in September. According to Brad Miller,

"Education was always an important part to Ernest's view on fostering sustainable collaboration. The workshops represent an actual application of this aspect of his vision [38]."

Mauricio Fortes, Ernest's colleague on the Board of FUMEC recalls,

"On a personal note, I recall that the Board meetings were held each year over the spring, in México, and over the autumn in the US. The spring happened together with the Easter recess since it was a very convenient time to take away from our duties. On several occasions the Jewish Passover holidays coincided with the meeting. Although Ernest and I were not religious, we tried to make up for our missing the traditional Passover dinner with the family by exchanging personal memories of our student years. After learning about the very difficult period Ernest endured during his early youth in Germany, and later in Canada, I could not avoid the association between his forced exodus in the twentieth century and that of the Jews in biblical times.

"The México-US Foundation for Science flourished from the very beginning in large part due to Ernest's unique qualities. His turbulent upbringing in Europe, Canada and Cuba added a truly humanistic component to his scientific career that transformed him into a scholar with a multidimensional perspective. He had a perfect understanding of the nuances of other cultures and always showed empathy towards the Mexican academic community and, especially, to its graduate students. These qualities made Ernest not only an international scholar but an inspiring leader in the buildup of the new enterprises which we were fortunate enough to share with him [36]."

Culminating an interest expressed by Ernest extending over many years, the Mexican Chemical Society and the ACS have launched a new initiative to include Mexican research institutions in the 2009 print and web editions of the ACS *Directory of Graduate Research*. The inclusion of México in this popular and valuable resource adds substantially to increasing México/ U.S./Canada scientific exchanges. With more scientist-to-scientist interaction comes enhanced oppor-

tunities to build trust, to share knowledge, and to learn about the local factors which shape the study, application and frontiers of chemistry in all participating countries.

## Final Words

On August 25, 1993, Ernest presented his "Past President Report to [the ACS] Council." I believe that his words illustrate his own appreciation of and dedication to science and scientists in Latin America and around the world. He said,

"This is my last appearance before you as part of the presidential succession [of President Elect, President, and Immediate Past President of the American Chemical Society]. I shall therefore forego the usual litany of what I have been doing since the last Council meeting; you can read that in my written report if you wish. Instead, I should like to summarize for you some of the things I think important for the Society with emphasis on those I have tried to tackle as President, indicating also the success or lack thereof that I've had..."

"Perhaps the one items I can take credit for as past president is our expansion in the area of international activities. Science has always been an international endeavor; what is more recent, perhaps, is the totally transnational aspect of the chemical industry... It is important for us to cultivate good relationship with sister chemical societies and individual chemists in other countries, not only in the industrial but also in the developing world. I believe both the Board of Directors and the Executive Director have now taken the necessary steps to position the Society where it can do what it must do on the international chemical scene [60]."

## Acknowledgments

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**Fig. 11.** Ernest and Eva at an ACS meeting in 1996. Photo courtesy of Jeffrey I. Seeman.

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