SAC portrait: Professor Enrique Iglesia

Professor Enrique Iglesia holds the Theodore Vermeulen Chair in Chemical Engineering at the University of California at Berkeley and also a position as Faculty Senior Scientist at the Lawrence Berkeley National Laboratory. He is the former (and founding) Director of the Berkeley Catalysis Center.

Berkeley
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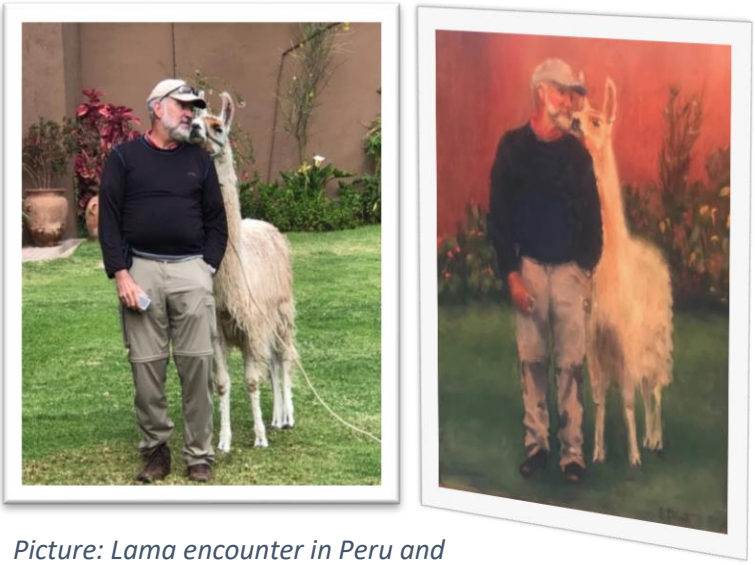
A diverse background

Enrique Iglesia's path to Berkeley was neither straightforward nor predictable. His family is originally from Spain. His parents and grandparents left Europe during difficult times in the early 20th century to seek refuge in Cuba, where he was born. They emigrated to the U.S., once again a refugee family, in 1969. Between his native Spanish and his poor English language skills, mathematics and chemistry provided the language-neutral bridge that ultimately led him to a lifelong career in chemical engineering. Influential mentors in secondary school ignored his language barrier and noted a talent and an intensity that made them encourage him to apply for top universities in the U.S. Princeton offered him a chance and he received his chemical engineering degree as the top-ranked graduating senior in the College of Engineering. Summer internships at Exxon gave him a taste of industrially relevant problems and they also exposed him to the "magic" of catalysis. He was torn between a career in industry and the opportunity to sharpen his skills through graduate studies. Coached by his Princeton mentors, he decided to enter the Ph.D. program in chemical engineering at Stanford University. There, Professor Michel Boudart became not only his mentor but his lifelong teacher and friend. A few weeks ago, Professor Iglesia received the Michel Boudart Award for the Advancement of Catalysis. This is the most prestigious award given by the North American Catalysis Society and the European Federation of Catalysis Societies, and a recognition that he describes as "*the most meaningful in my career*".

The practical challenges then won over academic ambitions and he accepted a position at the Corporate Research Lab of Exxon after graduating from Stanford. From 1982 to 1993, he rose through the managerial ranks without losing sight of research and contributed to the development of some of the enabling concepts for technology developments in natural gas conversion and in catalysis for the upgrading of hydrocarbons to fuels and petrochemicals. His rapid climb through the ranks at Exxon

Enrique Iglesia emphasizes that fundamental understanding is key: "*Industry often proceeds with the illusion of solving the problems without understanding them and one needs to understand the problem in order to solve it".* Academia has a strong advantage on understanding and that is ***time***.



Picture: Lama encounter in Peru and corresponding artwork

did not completely fulfill his inquisitive traits; he found himself missing *"the molecules and the equations that seemed so much more logical than the humans*" that he was leading. After seeking the advice of his mentor, he made the decision to leave the *"comfort of industry for the uncertainties and economic challenges of academia"*. This brought him back to California where he and his wife had started their married life together, and where he cherished the cool and dry weather and the hills and open spaces for hiking and climbing. This time he found the University of California at Berkeley, the prime historic sports rival of his graduate alma mater, to fit best with his diverse background and his love of teaching and mentoring. He started a group that has become known for its alumni, who have gone on to join some of the top chemical engineering and chemistry departments worldwide. This is a legacy that continues from his graduate advisor and one about which Professor Iglesia is particularly proud.

Today, he stands as one of the most recognized academics in the field of catalysis and chemical engineering, and as one who eminently bridges the fundamentals with the practice of catalysis. He has been described upon induction into the American Academy of Arts and Sciences as a role model for the inseparable nature of teaching, research and scholarship. His research accomplishments have been recognized with numerous honors and awards, including election to several national academies and several honorary professorships and doctoral degrees, as well as awards for more relevant practical contributions, such as the ENI Prize, the Tanabe Prize, and the Award for Excellence in Natural Gas Conversion. But given that Professor Iglesia left industry for academia to teach and mentor, he is, not surprisingly, most proud of his many teaching and mentoring awards and of the cadre of students that continue his tradition of excellence in industry and in academia. He has selflessly served the catalysis community as Editor-in-Chief of Journal of Catalysis, as President of the North American Catalysis Society, and as Vice President and President-Elect of the International Association of Catalysis Societies. His publications have been cited more than 30,000 times and his patents have provided some of the enabling features for several technologies in current practice.

***Typical recurring phrases, often posed as challenges and admonitions to Enrique's research group**:*
"thinking Is harder than doing, but more productive"
"the impact of our work is known after 20 years, the rest is glamour, hype, h-index, and salesmanship"
"if it does not have a number, it is not data"
"if it seems truly novel and useful, which law of thermodynamics does it violate? "

Life beyond research:

Enrique tells us of his activities outside science: *"Terry and I were high school sweethearts and have been married for 40 years. We have three children, some of them close to middle age by now (gulp!), but still children to us. We also have four grandchildren between the ages of 18 and 30 months. In contrast with the typical U.S. family, every one of them lives within 20 km of our home. They keep us quite busy and serve as excellent signposts to remind us where we are needed most."*

Picture: Hiking in India with Johannes Lercher

I keep my sanity, and some semblance of physical stamina and shape, by running the quiet hills near our home and by occasionally stretching my spirit of adventure and my aging muscles and joints with exotic and age-inappropriate treks. Recent ones took us to Ladakh in Northern India with my close friend Professor Johannes Lercher (Technical University of Munich) and to the Sacred Valley and Lares in Peru with Terry; there, I bonded with a friendly llama and a painting was made to record the moment for posterity".

Enrique on iCSI and the future of catalysis research:

"It is at the junction between knowledge and its useful practice where concepts driven by ideas and usage driven by market needs and, more recently, sustainability meet, to address the problems that humans face. This boundary often resists, but with good intentions and spectacular successes, all efforts to manage it. The iCSI Centre addresses these challenges with a thoughtful structure that brings together talent and experience in diverse disciplines, a group of engaged industry stakeholders, and a set of problems and techniques at the state-of-the-art in our catalysis discipline. In doing so, it seeks to develop the technologies of the future in areas of interest to the stakeholders. Irrespective of its ultimate success, the work and the people will go on to develop solutions that we do not yet envision as part of the on-going work. It will develop as its most important accomplishment the human talent, competencies, and skills that will go on to train others in industry or academia. This is the multiplicative effect of academic research when its emphasis is to teach and the technological contributions merely the side benefits of a well-crafted academic mission. Society's benefits are both immediate and long-term, even if the current strategies seek to address problems with much shorter horizons. My journey has placed me at the two sides of joint industry-academia efforts and ***I find the structure and the objectives of iCSI to be balanced and enlightened and the execution of this mission to be on target and well-planned****."*

Tips to young scientists *garnered from those with whom I have shared my scientific journey in industry and academia:*

- *Your work will seldom "save the world" or make you famous, but when it creates "recyclable knowledge" it will build upon that of many others, and together it will solve problems that are different and more important than those you initially sought to solve.*
- *To see our ideas come to practice, we often must let others own them and take credit for them.*
- *The value of our work is that part of it will still matter and be read and used after a few decades of scrutiny.*
- *Be skeptical of that which seems too novel or too useful until you check and check again.*
- *Confusion forces you to change your hypotheses and your assumptions and channels your path; this is how science works.*
- "*Lectures must be spontaneous, but spontaneity must be carefully rehearsed*" a paraphrase of a quote attributed to Professor Joel Hildebrand.
- *Talent and tools are seldom enough, without the time to think and the persistence to outlast and to appreciate those precious moments of complete confusion along the journey; they show the way.*

"The iCSI Centre has a well-balanced portfolio of projects and the tools required to address the fundamental questions that such projects ask. Their competence in materials synthesis and characterization complement those in spectroscopy and in reaction studies. I have very much enjoyed the interactions and the intellectual intensity of the iCSI Annual Seminars and I am certain that the Centre will become an excellent model for academic-industry collaborations, as well as a place that will be remembered for having grown the talent that will populate catalysis research for decades to come.

I view the future of catalysis research as one with a greater focus on the rules of reactivity and selectivity at the level of bond-making and bond-breaking and on the intrinsic relations between the energetic descriptors of materials and the ability of their surfaces to stabilize transition states for specific reaction channels. This will require that the right level of theory and the structural models most faithful to the reality of relevant catalytic solids be brought much closer to the experimental work. ***We are entering an era in which the synchrony of experiment and theory will become an unavoidable and powerful feature of each project****; I encourage my own group to grow along that path and I give the same advice to the iCSI research team."*

Picture: Lecturing at the iCSI Annual Seminar.