

Introduction and commentaries for the special issue: “Arnold L. Demain—A life lived”

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Arnold L. Demain passed away on April 3, 2020, just shy of his 93rd birthday, from complications due to COVID-19 infection. He led an exemplary life as a scientist and humanitarian. In 2017, the *Journal of Industrial Microbiology and Biotechnology* (JIMB) published a special issue entitled “Arnold Demain—Industrial microbiologist extraordinaire” to coincide with his 90th birthday (Baltz et al., 2017). It is with great sadness that we honor Arny this final time.

Arny's impact on industrial microbiology and biotechnology, and on the many scientists whom he has mentored and influenced over many decades, have been documented in commentaries by Joan Bennett, Satoshi Ōmura, and Erick Vandamme (Bennett, 2017; Ōmura, 2017, 2021; Vandamme, 2020, 2021). Many of “Arny's army and friends” have contributed articles to the previous and/or current special issues. As guest editors, we would like to pass on a few personal recollections that further exemplify Arny's character as an extraordinary colleague and human being.

Joan Bennett—Remembering Arny. All members of Arny's army and friends struggle when we try to express what made Arnold Demain so special. How do you memorialize a man who combined hard science with a soft heart, and who never forgot that his path into the National Academy of Sciences was lined with fermented vegetables?

Arny's professional credentials were impeccable, with more than 500 publications, 17 books, 22 patents, 38 editorial boards, dozens of important national and international committees, and hundreds of invited lectures and symposia. In his lifetime, Arny received 68 honors and awards and 10 separate international symposia were held in his honor. For those who want to learn more about his illustrious career in applied microbiology, his autobiographical essay at the beginning of the 2004 volume of *Annual Review of Microbiology* gives details of his laboratory work: “Pickles, pectin, and penicillin” (Demain, 2004). This essay stands out for the care with which he acknowledged students, collaborators, and co-workers. One of Arny's most admirable attributes was the way he unfailingly shared credit for his accomplishments.

When Arny entered microbiology, long before the modern biotechnology industry transformed biology, many people still drew a firm line between pure and applied science. For example, the British scientists who won the Nobel Prize for their work on penicillin were proud of the fact that they did not apply for patents. They expressed contempt for those whose discoveries were turned into profitable outcomes. Applied microbiologists often were disparaged as dirty and “money grubbing.” A condescending scientific snobbism surrounded those who were “above” profit. Arny would have none of this. He recognized how much applied microbiology affected our everyday lives and championed the fact that the benefits of many antibiotics, commercial enzymes, and other mainstays of modern living were rooted in ancient arts of fermentation. Moreover, he was unusual in how attuned he was to the fact that the advancement of knowledge is intimately entwined with the people who come up with the ideas that generate progress, whether it be in the commercial production of secondary metabolites or in the organization of a special topics conference. He built disciplinary subgroups and knew how to cultivate the social side of scientific symposia. In the idiom of science, he was a catalyst. He also knew how to make science fun.

I was never a member of Arny's army, but I shared Arny's love of secondary metabolites. I first knew him as someone who had written highly informed reviews and could move easily between basic experimental studies and commercial production facilities. Like Arny, my research was basic but in an applied field, and thus I sought him out as a mentor. He taught me the value of attending meetings, not just for the lectures but also for the personal contacts. Scientific conferences serve up varying proportions of intellectual excitement, practical transactions, and nerdy recreation. Arny was in his element at meetings. He was a master at introducing people to one another. He understood that fine food, sufficient alcohol, and soft rock music provided a perfect communal backdrop for serious dialogue.

Over more than 30 years, Arny and I overlapped at meetings of the American Society for Microbiology (ASM) and the Society for

Industrial Microbiology (SIM, now SIMB). Back in the day, both societies had annual presidential banquets that started with a cocktail hour, included a formal, sit-down dinner, and were followed by several hours of social dancing. There were fewer women in microbiology at the time—and almost no solo dancing—so when the music started, more men looked for dancing partners than there were women to go around. I benefited from the skewed sex ratio. I loved to dance. So did Army. He became one of my favorite dancing partners. A big benefit of dancing with Army was how many microbiologists I got to meet when we returned to the table for a libation.

Let me share just one story that illustrates Army's role as a scientific catalyst. At an ASM presidential banquet in the 1980s, I did some fancy dancing with Army. He had a way of making his partners look good. Perhaps that is why Bruce Ames came up and asked me to join him on the dance floor. I had never met Dr. Ames before, although I knew of his mutagenesis test. I soon learned that Dr. Ames could lead an elegant tango. While we were dancing, Dr. Ames asked what I worked with and I told him, "aflatoxin." Dr. Ames then shared that when he had first tried aflatoxin in his famous *Salmonella* mutagenesis test, nothing had happened. He said that the inactivity of aflatoxin was when he realized that he would have to improve his test. So, he added some rat liver enzymes to the Petri plate, at which point aflatoxin became highly mutagenic. It was an aflatoxin story "straight from the horse's mouth" that I could use in my own lectures. Dr. Ames and I danced together several numbers, something that might not have happened without Army, and I still remember the way I felt that I had entered the microbiological big leagues.

Later, after Dr. Ames brought me back to my table, someone at the table asked, "Did you pass the Ames test?" I guess I'll never know, but only a few years later I was elected president of ASM.

This is only one of many stories I could tell about the way Army helped smooth my career. But others have stories to tell. Thus, I will stop here—except for sharing the appallingly bad poem I wrote for Army when Drew University established a student research fellowship under his name to celebrate his 91st birthday.

Some doggerel for Army on his 91st birthday

Let me tell and explain
The story of Dr. Demain
His friends call him Army
We form a small army
To proclaim his name and his fame.

Army grew up on the east coast
Of New York smarts he can boast
He got into fermentation
Before there was automation
His academic gifts were beyond reproach.

While a student at Michigan State
A hot chick named Jody sealed his fate
He entered into matrimony
Their long union gave testimony
That he did not make a mistake.

For years he worked at Merck
Long hours he did not shirk
For metabolites secondary
His papers were legendary
Antibiotic screening brought in big perks.

An industrial lab he did oversee
Until he got a call from MIT
Where if you bring in the money

Your lab will be sunny
Army soon mastered the funding key.

He knew where to intercede
High standards were his lab creed
He published many papers
Avoided scandalous capers
Success was soon guaranteed.

When along came recombinant DNA
Army saw it as an alternative way
To make microbes yield product
By building a fresh construct
Or a newfangled phage display.

I met him at a Gordon Conference
Army had no pompousness.
His data were impeccable
He was socially approachable
His support built up my confidence.

Soon I joined the meeting circuit.
Army taught me how to work it.

To break up meeting workdays
We'd lead social breakaways
And load into cars
Head for discos and bars.
I loved being his protégé.

Army was great on the dance floor
In conversation never a bore
He was kind to his friends
Never put means before ends
For his students opened professional doors.

Army's career makes a good case
For research of elegant grace
To share relevant data
Forgive rivals and haters
In science it is not commonplace

So let me end with a cliché
Fine science is never passé.
He's the debonair heir
Of research beyond compare
Army: Happy 91st birthday!

Sergio Sánchez—Some Stories. After retirement from MIT in 2001, Army joined the Charles A. Dana Research Institute for Scientists Emeriti at Drew University in Madison, New Jersey. This institute provided him with an office and a laboratory to train undergraduate science students to do modern-day research. In addition, he wrote original articles from collaborations and reviews on the frontier of industrial microbiology and biotechnology. I was lucky to be considered among his collaborators in several academic adventures. In addition, his occupations as a member of editorial boards and principal speaker in many meetings kept him busy most of the time. In an old mail, he wrote me: "Thank you so much for the birthday greetings. Only 83 with many more to come—I hope! Things have been fine in NJ. Jody and I are in Wash DC for a meeting." He loved his work and had no reason or interest to stop it. We, who were the beneficiaries of this man's scholarship, teaching, and, above all, his deep friendship, owe the success of our careers to Arnold Lester Demain. He taught us how to work hard, be professional, ethical, and especially, to enjoy our chosen careers.

Prof. Demain was an inspiring teacher and a role model for future academic researchers. He arrived early to work and left late.



Fig. 1 Army's army—meeting III at Ghent University, Ghent, Belgium, July 8–9, 1999.



Fig. 2 Army presenting his closing lecture at Ghent University.

Because of his example and inspiration, many of his students, co-workers, and colleagues near and far were able to achieve international fame for their research.

Prof. Demain's imprint has been left on "Army's army," the more than 120 undergraduate and graduate students, postdoctoral associates, and visiting scientists who have trained under his mentorship and who are now outstanding scientists, educators, and administrators. And, although some of them are already retired, they still hold special feelings and make tributes to his memory like this special issue of the *JIMB* in his honor.

One of the things that I learned from Prof. Demain was his fondness for the lab and, through extensive research discussions, to appreciate the richness of scientific life. He arrived early in the morning and dragged himself late in the night. Prof. Demain also stimulated his students to read extensively and publish a useful review on a topic we were working on unless a recent and comprehensive review was already available in the literature.

In addition to our many research discussions in the lab, I also remember those beautiful parties at MIT where everyone could leave their work behind and simply have fun; probably, this character was inherited from Prof. Phaff during Army's doctoral training. I will never forget all those scientific meetings and all the fun we had at the dinners with our colleagues and the new people that Army used to introduce to every one of his students. Prof. Demain has greatly inspired me, and the fondness for the lab that he generated within me as his student still lives on 46 years later. I learned that formula, and I try to acknowledge that with my students. I feel that any heights I have reached in science are due to his teaching example and friendship. Dear Army, whenever I think I need a lift or some motivation, I shall look up at the heavens above and think of you. You are a great scientist, human being, and friend, and you will continue to encourage me for as long as I live.

Erick Vandamme—Army's Cordial and Empathic Attitude. Upon arrival at MIT from Ghent, Belgium, in early 1974 (with my wife Mireille and now oldest daughter Heidi), Army picked us up at Boston Logan airport, and the very first thing he told us was to call him Army; we felt uncomfortable addressing this famous MIT professor as Army, and it took a while before we could make this mind switch. Heidi went to kindergarten in Malden, where we lived, and her paintings/drawings decorated Army's office door for many decades onwards. In Europe, undergraduate students, Ph.D. candidates, and postdocs had to address their "distant" boss of the lab/department always as "professor" and we were called by our last name for the term of our stay and beyond.

While doing experiments in Army's lab (with often nightly sampling of long-running fermentations) at MIT, he regularly scheduled a meeting in his small office where the two of us critically discussed the data and graphs obtained over the passing month; he distilled from our interaction suggestions for further experimentation but he was also interested in whether my wife and I were able to gradually integrate into his group and the MIT way of life. We were very welcome to join in for MIT seminars, usually presented by other famous MIT professors or by international visitors, some of whom I met later on in other international settings.

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Spiro -
In addition to
testing pyrophosphate,
you should test
polyphosphate.

Army

Fig. 3 Army's note ca. 1979. Army's handwritten note left on Spiros Agathos's desk after discussing the potential link between *in vivo* enzyme instability and energy metabolism in antibiotic-producing microorganisms.



Fig. 4 Army's lab 1978. Pictured, row 1 from left (L) to right (R): Jacqueline M. Piret (USA), Avishay ("Avi") Stark (Israel), Wei-Shou Hu (Taiwan); row 2 from L to R: Yasuro Kawabata (Japan), Ashwin Mahdia (India), Agnès Lemarchand (née Poirier, France), Yosuke Sawada (Japan), unknown student; row 3 from L to R: Army Demain, Emmanuel Denenu (Nigeria), Molly Crowley (USA), Nadine A. Solomon (née Hunt, USA); row 4 from L to R: Clifford Behmer (USA), Spiros N. Agathos (Greece), and James ("Jim") Townsend (USA).

This MIT–Army connection remained a main link to broaden my international network for decades to come.

My team and I organized the third edition of Army's army at Ghent University, Ghent, Belgium, on July 8–9, 1999; it was internationally a very rewarding—and even cozy—event with MIT friends and their families present from all continents (Fig. 1). Army presented a touching closing lecture tightening the bond between all of us even more (Fig. 2).



Fig. 5 Shanghai Army's army 2005. A subset from the 1970s. Standing from left to right: Spiros N. Agathos, Avi Stark, Jacqueline M. Piret, Stephen W. Drew, Randy Greasham, Song Hae Bok, Nadine A. Solomon, and Prakash Masurekar. Sitting: Army Demain.

This cordial attitude, personal human touch, and empathy with his students and their families, made our stay and many visits later on (at MIT or worldwide) an unforgettable life-time experience.

Spiros N. Agathos—An Exceptional Mentor. I was already a Ph.D. student at MIT in early 1977, having been admitted in the Department of Food Science and Engineering section a year and a half earlier. I walked into Army's office at MIT's Building 56 to ask for something unheard of: that he become my new Ph.D. advisor on a topic of his choosing, as I was getting disenchanted with my assigned topic despite publishing a peer-reviewed paper with my then doctoral advisor, who was about to leave MIT shortly thereafter. Amazingly, Army took a chance on me, a biologically clueless chemical engineer at the time. And the rest is history. A history of becoming part of "Army's army," a wondrously vibrant intellectual community led by a gifted and benevolent mentor who would teach by example what it is to be a scientist. A trajectory that included the pursuit of exciting and adventurous science; the enjoyment of asking the right questions but also dealing constructively with the frustration of "mumbled" answers from preliminary experiments; the hard work that eventually pays off; the resilience required during "dry" periods; and, last but not least, the friendly and collaborative atmosphere that he inspired both in and out of the lab. With Army as a mentor, I had the privilege of gaining a second extended family in addition to my own, one spanning across borders and continents and becoming enriched with ever-more dozens of distinct personalities and talents.

A couple of valuable lessons Army taught me during my doctoral studies had to do both with science and with people. The science had to be of an irreproachable quality that would be validated by repetition and proven through its causal link with a plausible hypothesis even in uncharted waters such as, in my case, the *in vivo* instability of biosynthetic enzymes in secondary metabolism. The people who would challenge a graduate student or postdoc at the weekly BEAM (Biochemical Engineering and Applied Microbiology) seminar, even in an intimidating place like MIT crawling with hugely eminent scientists but also crowded with bulky egos, did not matter as long as a lowly graduate student like me had done a good job of explaining his findings: "Spiro, don't answer the 'questioner'—just answer the question!" And, coming back to science, Army would often get carried away by the excitement of a finding to suggest another experiment or a fresh



Fig. 6 MIT Army's army 2007. A 3-day symposium, the 6th edition in the "Army's army and friends" series took place in Cambridge, MA, in August 2007 to pay tribute to Army's 80th birthday.

dimension after the first glimmer of a new insight and, after some hours, he would surprise me with a handwritten note (Fig. 3). Well before Internet and online access, Army would also insist on every member of his lab following the relevant literature religiously and being up to date on the latest papers through the lab's subscription to *Current Contents*—a weekly reproduction of the title pages from dozens of peer-reviewed scientific journals, with information on papers that had been published some weeks previously. Fig. 4 shows Army's lab members in 1978. What characterized Army almost to the same extent as his scientific acumen was his uncanny ability to bring people together: in addition to connecting with colleagues from complementary or even seemingly remote fields at different career stages and locations, he would make sure his students, especially the more introverted ones like me, would meet and exchange with others from his extensive networks, not to mention the scientists and engineers from academia and industry attending scientific meetings, especially during breaks and socials. In a sense, Army was a "connector" and brought to his scientific message the "stickiness" of influence well before these terms became popular in the early 2000s (Gladwell, 2000). A "connector" is someone "with an extraordinary knack of making friends and acquaintances." According to Malcolm Gladwell "connectors" are a special set of people so adept at cultivating connections, and they are the reason why the rest of us are connected as well.

The vibrant science and special camaraderie of "Army's army and friends" (AA&F) have been felt most vividly in the several AA&F meetings organized in different countries/continents (Figs. 1, 5 and 6). And some of us had multiple chances to celebrate Army's attainment of the highest accolades in science, as in the case of his Doctor Honoris Causa at Ghent University in March 1999 (Fig. 7).

In my own career as an academic scientist, educator, and university administrator, Army had a huge influence throughout my trajectory and was there unfailingly not only as a mentor but as a loyal friend who would not only support me but also warn me of potential dangers lurking at the crossroads one invariably faces a few times in one's professional life.

My most recent exchanges with Army were in late April 2019 when I wished him on his 92nd birthday and shortly thereafter he congratulated me on SIMB's 2019 Waksman award, which I dedicated to Army as the model mentor "par excellence."

Going back full circle to that first fateful meeting of mine in Army's office in 1977, something extraordinary happened: I met someone who would become a second father figure to me.



Fig. 7 The Belgian contingent—Army Demain's Doctorate Honoris Causa at Ghent University with Erick Vandamme—as his promotor—and Spiros Agathos, March 19, 1999.

Hiroiyuki Osada—My Memory of Army. Prof. Demain (Army) was a great leader in applied microbiology and had many followers and friends all over the world. He was also a great mentor for Japanese applied microbiology and visited Japan many times to deepen his friendship through "Army's army and friends."

In 1988, I met Army for the first time when the International Symposium on Biology of Actinomycetes (ISBA88) was held in Tokyo. At that time, I was introduced to him by Prof. Beppu, who was my mentor at the University of Tokyo. Although it was just a short greeting, I thought he was very kind and after that I was able to talk with him when I met him at conferences, such as the special conference series on Biotechnology of Microbial Products (BMP) held by SIM (currently SIMB).

In 1968, he became an editorial board member of the *Journal of Antibiotics*. He contributed to the publication for 30 years until he became an emeritus in 1998. In fact, he was awarded the Order of the Rising Sun, Gold Rays with Neck Ribbon, by His Imperial Majesty of Japan for his long years of effort in training Japanese researchers and his contribution to applied microbiology in our country.

In 2011, he was invited to the International Union of Microbiological Societies (IUMS2011) conference held in Sapporo. The attached photo was taken at the meeting of the members of the



Fig. 8 Army with editorial board members of the *Journal of Antibiotics* at the International Union of Microbiological Societies (IUMS2011) in Sapporo, Japan. Front row: Hisayo Ito, Julian E. Davies, Arnold L. Demain, Satoshi Ōmura, and Gerard D. Wright; middle row: Yoshikazu Takahashi; rear row: Kazuro Shiomi, Hiroshi Tomoda, Hiroyuki Osada, Haruo Tanaka, Minoru Yoshida, and Kunimoto Hotta.



Fig. 9 Microbial breeding workshop in Spoleto, Italy, 1984. Several members of GIM-IC participated in the workshop as lecturers. These included Maria Alacevic and Giuseppe Sermonti, row 2, positions 2 and 4 from the left; James Shapiro and Army Demain, row 3, positions 1 and 4; Eric Cundliffe and Richard Baltz, row 4, positions 2 and 4; Juan Martin and Rolf Hütter, row 5, positions 1 and 2. Other lecturers included Charles Thompson, row 1, position 6; Tobias Kieser, row 2, position 9. Other lecturers not identified included C. Bruni, E. Di Mauro, B. Hall, T. Nilsson-Tillgren, and P. Niederberger.

Journal of Antibiotics editorial board (Fig. 8). It was the last time I met him.

I was saddened by the news of Army's passing last year and I express our sincerest gratitude to him for the seeds he sowed, which have blossomed and produced many fruits in Japan.

Zixin Deng—Army, Key Pioneer Figure and Unforgettable Friend and Mentor for Chinese Biotech Trainees. As the current president of the International Committee on Genetics of Industrial Microorganisms (GIM-IC), I am always thrilled by the initial establishment

of GIM in Prague in the Czech Republic (Czechoslovakia then) in 1970. That was a time even I was so young, and our country in China was experiencing the 10-year horrific Cultural Revolution. Recalling the history of the time, microbial genetics had started to play important roles that stemmed from milestone scientific achievements in DNA structure, DNA polymerase and ligase function, understanding the lac operon, discovery of restriction enzymes, and so forth, using microorganisms as research tools. These advancements were responsible for several Nobel



Fig. 10 The 10th International Symposium on Biology of Actinomycetes (ISBA-10), Beijing, 1997. The International Advisory Committee and local Program Committee members. From left to right: row 1—Jianping Wu, Wensi Xu, Michael Goodfellow, Wolfgang Piepersburg, Keith Chater, Ruisheng Jiao, Arnold Demain, Satoshi Omura, Teruhiko Beppu, and Kunimoto Hotta; row 2—Richard Baltz, Zhihen Liu, Boaquan Zhu, Xiufen Zhao, Yongle Chen, Yiquang Wang, not identified, Huarong Tan, Guangsheng Chen, and Yuanrong Chen; row 3—Guoping Zhao, Dakang Song, Zixin Deng, Zhiping Zhang, and Rongguang Shao.

Prizes, and paved the way for the development of recombinant DNA technology. Meanwhile, the microbial fermentation industry was leading the international biological economy as more and more microorganisms served as indispensable sources for new drugs such as antibiotics and antitumor agents, healthy foods and nutrients, chemicals, and later biofuels. As microbial genetics further expanded from fundamental to applied science, new concepts developed, giving rise to the many, often multi- or transdisciplinary branching fields of today. While we were very pleased to see the dramatic development of Chinese microbe-based biotechnologies gradually in recent years, we could never forget Army, as one of the key GIM-IC founding members, and a true world pioneer in these fields. Army is an unforgettable friend and mentor who trained dozens of Chinese scientists after the opening up of China to the outside world from the late 1970s. Although I benefited directly from training by David Hopwood's laboratory at John Innes Institute, UK, fantastic experiences and opportunities came so often with rather intimate connections with Army, at many regional and international conferences, especially like GIM and ISBA. With such connections, very close collaborative relationships were efficiently established with some of his group members, especially many excellent trainees such as Profs. Yuanrong Cheng, Lixin Zhang, Jianwei Zhu, and others, when they were abroad, and later back in China. I should really attribute my later career development process, at least in a great part, to the efficient, long-term, and fruitful connections with Army, and his army and friends. Army is great, and he is still alive in our minds!

Richard Baltz—The Pool Game. I first became aware of Army Demain while working on the cephalosporin C fermentation as an associate scientist at Eli Lilly and Company around 1967. Army had published papers on incorporation of α -amino adipic acid, cysteine, and valine into the cephalosporin C molecule while working at Merck. I first heard him speak in 1976 at the first ASM-sponsored meeting on Genetics and Molecular Biology of Industrial Microorganisms (GMBIM) in Orlando, Florida, a

meeting conceived by Army. When I published a manuscript on protoplast fusion, my first paper during my second stint at Lilly, the first reprint request that I received was from Army. This pattern continued as I published papers on various aspects of antibiotics and actinomycetes. Army was on top of the field. I got to know Army in the 1980s, as we both served on the GIM-IC, and attended meetings on industrial microbiology. As members of GIM-IC, we were both speakers at the Microbial Breeding Workshop in Spoleto, Italy, in 1984. Fig. 9 shows some of the early members of GIM-IC, along with other speakers and attendees of the workshop. Army and I also served as the representatives from the USA on the International Advisory Committee for the 10th ISBA, held in Beijing, China, in 1997 (Fig. 10). Note the young Zixin Deng in the back row. Prof. Deng and I cochaired a session on new technologies. We have come a long way since then.

I helped Army put together the first ASM-sponsored book *Manual of Industrial Microbiology and Biotechnology* in 1986, and later served with Army and Julian Davies as coeditors of the second edition in 2010. We became good friends over the past four decades.

In 2012, I was a speaker at a symposium at Rutgers University celebrating the 60th anniversary of Selman Waksman's Nobel Prize for the discovery of streptomycin. The evening before the start of the main symposium, there was a dinner featuring Army Demain as the speaker. Joan Bennett was slated to introduce him, but she thought that the dinner was to be held the following evening, and was not in attendance. Doug Eveleigh, who had organized the symposium, was frantically looking for someone to introduce Army. He came to the table where David Hopwood, Jason Sello, and I were seated, and said that one of us *must* introduce Army. David and Jason insisted that I introduce Army, so I picked up a small paper napkin and wrote down about five bullet points in the minute that I had to prepare the introduction. It went well, and Army gave a great talk, as usual. As we walked through the

lunch line the following day, Arny thanked me for the kind introduction, then told me that I had forgotten one thing—"the pool game!" Flashback four years. Arny and I were attending an ECI Conference in 2008 on "Natural product discovery and production" in Whistler, BC, Canada. It was summer, and there was not much to do in the evenings except to go to the hotel bar, order Canadian beer, and talk science. Arny and I were sitting at a table, probably discussing the book on "industrial microbiology and biotechnology" that we were planning or editing. There was a pool table in the bar, dominated by young locals who thought they were very good at pool. I asked Arny if he played pool. He said that he had played "some" as a youngster growing up in Brooklyn. I interpreted that as an understatement. I asked him if we should challenge the young players—all you had to do was to put a quarter on the pool table to get in the queue to play the winners. When our turn came up, Arny and I made short work of our first opponents. Then Arny carried us to victory! We won two more matches before losing the table. Arny, a man of many talents, said that it was the most fun that he had in a long time! When I think of Arny, I will always remember "the pool game."

Ramon Gonzalez—Arny's Impact. Every industrial microbiologist around the world has been impacted by Arny's career. While Arny was not my mentor, I greatly benefited from his leadership and contributions to the field of industrial microbiology. As a young chemical engineer graduating from the Central University "Marta Abreu" of Las Villas in Cuba, the island's biotech boom in the late 1980s (Cuba's Biotech Boom, 2009) was the reason I decided to pursue a career in industrial microbiology and biotechnology. As it turns out, Arny and a small group of US scientists contributed to the development of the biotechnology industry in Cuba (Demain, 2009). Thank you, Arny!

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