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White House Releases R&D Priorities for FY 2025

The White House Office of Science and Technology Policy (OSTP) and Office of Management and Budget (OMB) have released their annual research and development (R&D) priorities memorandum that provides guidance to federal agencies as they develop their budget requests for fiscal year (FY) 2025.

The memo builds on the White House’s research priorities from last year and highlights the following issues:

Advancing “trustworthy” artificial intelligence (AI) technology to accelerate progress, noting that “the choices we make in the coming years about advancing and using AI will have important consequences for civil rights and civil liberties, safety and security, jobs and the economy, and democratic values.”

Addressing the climate crisis “by harnessing the power of nature, reimagining and updating our infrastructure, strengthening and protecting the health of communities, lowering energy costs for families, protecting biodiversity, and creating good-paying jobs here in the United States.”

Leading on issues of global security, including advancing critical and emerging technology areas (microelectronics, biotechnology, advanced materials, etc.) and mitigating emerging and evolving national security risks, such as those associated with biosafety, biosecurity, and nuclear weapons.

Achieving better health outcomes for Americans, including by robustly funding the Cancer Moonshot initiative; bolstering our capacity to mitigate current and emerging health threats, including addressing antimicrobial resistance and identifying and eliminating infectious disease outbreaks before they become pandemics; and advancing environmental justice.

Reducing barriers and inequities by supporting regional innovation and workforce development in STEM “with an emphasis on emerging research institutions and historically underserved communities,” and by broadening public participation in regulatory and civic processes and in R&D.

Improving “our richly complex research system,” including by bolstering support for both basic and applied research; assisting emerging research institutions to compete effectively for federal funding; providing support to both the industrial and academic sectors in addressing research security challenges; and building the infrastructure and capacity for providing free, immediate, and equitable public access to federally funded research results. Notably, the Administration urges agencies to experiment with different funding processes and try “new approaches such as streamlining processes to minimize administrative burdens, engaging new R&D performers, exploring new R&D methods, and forging new partnerships.”

Strengthening applied, technological, and industrial R&D to bolster global and economic competitiveness.
This article is a reflection of the loss that occurred with Bob Schwartz’s death on Friday, August 11, 2023. Bob succumbed to Lewy Body Dementia with Parkinson’s Disease. He is survived by his widow, Ellen, and his twin brother, Arthur (Wendy). Bob had a large family including his children and grandchildren: Jeffrey (Jared); Scott (Sky); Adam/Lisa (Tyler, Danielle); Shawn/Rick (Oliver, Evan); Peyton/Jenette (Bridgette). In addition, he had multiple nephews, nieces, and cousins. He was predeceased by his parents, sister Janet, and brother-in-law Joe. He left behind his cat collection including Merlin, Snickers, Thor, Gicci, and Bentley.
representing only a part of the pets he doted upon over the years.

Bob was born in Brooklyn, New York, on April 13, 1941. He earned his Bachelor of Science in biology from Brooklyn College followed by a Master of Science in microbiology from Long Island University. He earned his Doctor of Philosophy in microbial genetics from the Waksman Institute of Microbiology at Rutgers University. During his career, Bob worked in New Jersey, Florida, West Virginia, and California. He finally settled in Waukegan, Illinois, where he joined Abbott Laboratories in 1987. At Abbott he was the Senior Development Scientist in Fermentation Development until his retirement in 2007. Bob’s interest in fermentation resulted in his membership in SIM/B which started in 1974. His activities included:

» Board of Directors
  » Director (1983-1986)
  » President (1991-1992)
» Journal of Industrial Microbiology
  » Editorial Board Member (1985-1996)
  » Senior Editor (1996-2010)
  » Editor-in-Chief (2010-2015)

» Awards/Honors
  » Charles Porter Award (1989)
  » SIMB Fellow (1994)
  » David Perlman Award (2015, first recipient)

» Annual Meeting
  » Program Chair
  » Annual Meeting 5K Run/Walk organizer (individually plus with Trader’s Proteins, CRC, and FTF)

» RAFT

As an indication of the importance of SIMB in his life, Bob proposed to Ellen during the opening reception of the 1992 SIMB Annual Meeting!

This article also stands as a reflection of the wonderful life he had. A large family to love! Lots of hobbies and interests! Bob could be found:

» Traveling in the United States and Canada
» Traveling in Europe and Asia
» Dining out
» Tasting wine
» Attending baseball games
» Enjoying amusement parks, especially rollercoasters
» Walking trails through Waukegan
» Participating in and instructing jiu-jitsu
» Participating in and instructing Tai Chi
» Participating in and instructing Qi Gong

Bob will be missed and will be remembered.
Emeritus Professor Dr. ir. Erick J. Vandamme*

Department of Biotechnology, Faculty of Bioscience Engineering, Ghent University, Ghent, Belgium

* Dedicated to Mireille, my lifelong partner, for her moral support, continual help and devotion over all those years
From the Farm to Fermentation, Industrial Microbiology and Biotechnology

1. My gradual introduction into the rural and real bioscience engineering world

I was born on August 4, 1943, and raised on a + 50 acres farm in a small rural village, Vinkem, Belgium, with about 430 inhabitants. The village is situated about 15 km from the Belgian North Sea coastline and about 6 km from the border with France. People were fluent only in a Flemish dialect typical for that region in Flanders. Flemish is the name given to the official Dutch spoken in Flanders in the northern half part of Belgium and is very similar to the Dutch language spoken in the Netherlands, while French is spoken in the Belgian southern half part. However, in Flanders at that time, French was the common language of the notabilities and upper-class people. Villagers in Flanders were mainly running farms and/or were involved in agricultural-related activities (as farmers, farhands, horse-drivers, blacksmiths, millers, and woodcutters) and had a number of beer pubs unproportionally high. There was a church, kindergarten, two lower schools for boys or girls, a few small shops and a bakery, and that is about it! My birth in 1943 in the bedroom above the cellar in our farmhouse, with no medical doctor around, happened when WWII was raging. (Figure 1). Belgium was occupied by Nazi-Germany from 1940 till 1944 with lots of damage to buildings and infrastructure, in addition to 88,000 casualties (1% of the...
Belgian population then). Food, fuel and clothing were rationed by German authorities and information and press were under German control. Only farms were self-sufficient as to water, food and feed supply. This included farm-made fermented products such as leavened bread loaves, butter, buttermilk, cheeses, pickled fruits and vegetables, that were weekly prepared unknowingly as a craft. Farmers also provided food and feed, including silage, to nearby villagers and their animals to better survive wartimes. In the rural region where I grew up, relatively little war-damage occurred, since bombing/fighting by German and Allied forces was focused on important cities (Antwerp, Ghent, Liège) and on parts of the Belgian coastline such as Ostend harbour. Our family on the farm was somewhat shielded from the war atrocities. Electricity, radio, telephone, and newspapers, gradually infiltrated in the countryside from 1935 onwards. After kindergarten from 1950 on I went by bicycle to primary school through the farmlands. As a youngster, I helped my parents with daily chores and became interested in seeding, planting and harvesting food crops (wheat, barley, oat, potato) and industrial crops (flax, sugar beet). I became also interested in raising farm animals such as cows, pigs and chickens as a source of milk, butter, meat, eggs and in working and caring the land over the seasons. Belgian horses provided the power to work the fields and to pull carts and coaches carrying people. Only since the mid-1940s, automobiles, farm machinery, and small tractors gradually took over man and horsepower in the countryside. Also, we had a strict but excellent schoolteacher in the 6th and 7th grade. He persuaded my parents to let me continue my studies in secondary school, while most of my friends stayed on the farm or took a hands-on job in the village or the region. The only secondary school close by where Languages (Dutch, French, Latin), Mathematics and Sciences were combined as a specialty study program was a well-known boarding school in Ostend, about 40 km from my home. It became my new home on 1 September 1956 for 6 years. During alternating weekends and holidays, I returned home by bus and helped on the farm, where every support was needed. This became a physical escape from my mental efforts in Ostend. Even till then my village remained my world! After finishing secondary school in Ostend in June 1962 with high grades, I left my birthplace and I moved to the nearest university about 100 km away, Ghent University (UGhent), to study quite logically at the Faculty of Agricultural & Applied Biological Sciences (since 2004 renamed Faculty of Bioscience Engineering). I lived for 5 years in a student room rented from a Ghent family and returned mostly weekly home by train and local bus. I was the first in our family to go to a university and to obtain a university degree. During summer holiday periods, I continued helping my parents and elder brother on the farm till about 1964. By that time, I had become especially fascinated by the biochemical and microbiological oriented courses and laboratory procedures at UGhent. From then onwards I was intrigued by the potential offered by those powerful, useful but unseen microbes up till today! There I obtained after a total of five years of study firstly after 2 years my Ba. Sc. degree in July 1964 with courses in mathematics, statistics, physics, inorganic and organic chemistry, mineralogy, geology, biochemistry, enzymology, botany,
zoology, and microbiology. Then three years later I obtained my M. Sc. degree in July 1967 in Chemistry and Agro-Industries Engineering, focussing on organic chemistry and biochemistry, molecular biology, industrial microbiology, bio-engineering technology and fermentation science. In the summer of 1965 after my first year of M. Sc. studies, I had selected the lab of my biochemistry Professor Walter Fiers (1931-2019) for my thesis research, where basic bacteriophage research was going on. (Figure 2). He was soon in the early 1970s to become a famous molecular biologist “avant la lettre”, as he had spent a postdoctoral period in the early 1960s with Har Gobind Khorana (1922-2011), then active at the University of Wisconsin, Madison, USA, and later as Nobel Laureate Professor at the Massachusetts Institute of Technology (MIT), USA. He told his students all about his postdoctoral stays and travels in the USA and we were fascinated! In the Fiers lab I had to grow E. coli in 20 -liter lab fermentor vessels and then add RNA phage MS2 mutants to infect the cultures, collect cells at different growth stages to then lyse the E. coli phage infected cells, and search the lysates and supernatants for viral RNA polymerase activity (Gillis et al., 1967; Vandamme et al., 1972; Vandamme and Mortelmans, 2019). This was the research subject of my M. Sc. thesis. With this first lab experience dealing not just with Petri dishes and shake flasks, but also with lab fermentor vessels, bacteriophages, 14C-labeled nucleotides and enzyme-based tests, I became increasingly interested in biochemistry, molecular biology, microbiology and in fermentation related scientific papers in journals available in our UGhent libraries. I had to leave the Fiers’ lab for one year of obligatory military service from 1 August 1967 till 31 July 1968 with the 6th Engineer troops stationed in Kassel, then West-Germany, close to the Iron Curtain. Also, in early 1968 my life changed when I met the girl of my dreams Mireille Dezeure. She was also born in Vinkem, but we had never met each other till early 1968, since she was studying at a boarding school in Ypres, while I was stationed in Ghent or in the army. I did know her father since he had come to our farm over several years with his threshing and combine-harvesting machines in winter and summer times. At the end of 1969, we married and moved to Ghent in an apartment close to my Faculty, where I continued my Ghent university studies. While at the army camp, I had received by surprise an invitation to become as of 1 August 1968 research assistant in the Laboratory of General and Applied Microbiology headed by Professor Jules Voets, my former professor of several basic and applied microbiology courses at my faculty. My first task was to teach the lab techniques and procedures in basic microscopy and general microbiology to large groups of Bachelor students. While there I could start up my subsequent PhD research over the period 1968-1972. It involved screening and characterization of novel bacterial and fungal penicillin V acylases to produce the penicillin nucleus 6-aminopenicillanic acid (6-APA) (Vandamme and Voets, 1972, 1974; Vandamme, 1976b). 6-APA was then already a much-needed nucleus to produce semi-synthetic penicillin derivates and the hunt was still open to find and characterize improved microbial penicillin acylases for industrial use. In that time period I noticed in the literature especially the name of Professor A. L. Demain from MIT and his range of research topics and very informative review papers. I was also interested in the types of microbial metabolites he and his team were studying. My PhD thesis and public defense was successfully presented, and I received my PhD degree on 26 January 1972. From then on, I was determined to specialize further abroad and in consent with Mireille, we screened several well-known research groups at top universities in different countries in Europe and also in the USA and I started applying for funding at the Belgian Ministry of Education. With our first-born daughter Heidi then being around, we boldly undertook then three postdoctoral periods between 1973 and 1976: from then onwards the world became our village! After these postdoctoral stays abroad - see below -, time had come to return back to Ghent and to present and defend my D. Sc-thesis (Habilitation-Degree) on 16 September 1976 (Vandamme, 1976a). This allowed me together with my postdoctoral stays to apply for a lectureship at UGhent. My D. Sc. thesis was based on the contributions that I had made through my research between 1973 and 1976 when I had held 3 postdoctoral positions at the following university locations: at Oxford University (UK) (May till September 1973), MIT (USA) (1974 and 1975), and Queen Elisabeth College, London (UK) (April till September 1976). I received my D. Sc. degree on 11 October 1976 after a public lecture in the Ghent University main Aula. The periods in between my postdoctoral stays abroad, I could return to Ghent University where I lectured and instructed microbiology practicals in the lab of Professor J. Voets (1923-1977). He died suddenly in December 1977. Two
postdoctoral colleagues and I had to take up his lecturing duties (general, food, environmental and industrial microbiology) for several years to come.

2. Gradual connection and first involvement with SIMB

My connection with SIM (Society for Industrial Microbiology) which was in 2011 renamed SIMB (Society for Industrial Microbiology and Biotechnology) started a bit hidden after my British Council sponsored successful first postdoctoral stay in 1973 at the Sir William Dunn School of Pathology (SWDSP), Oxford University, UK, with Professor Sir Edward P. Abraham (1913-1999), where I did basic research on the molecular mode of action of peptide antibiotics (Kenig et al., 1976; Vandamme, 1976a). I did select this famous school, since it was there that in the years 1939-1941 the foundations were made for penicillin to be developed from a lab curiosity into an industrially important and medically essential antibiotic. Edward Abraham was then a young researcher in the historic Florey and Chain team and was now a highly renowned respected professor at Oxford University. I was admitted to joining his group in 1973, also since my previous PhD research on penicillin acylases fitted into their ongoing research projects (Vandamme and Voets, 1972, 1974; Vandamme, 1976b). There I also met with Norman G. Heatley (1911-2004), the keen and inventive laboratory assistant in the original Oxford team (Vandamme, 2016a, 2021). That experience opened up my international contacts with many famous scientists coming there on visit including a few from the USA, like the famous fermentation microbiology scientist David Perlman (1920-1980) (University of Wisconsin, Madison, WI) and biochemist Jack L. Strominger (1925-present), Harvard University, MA). I knew their names and research fields from the literature, and I had a unique chance to meet and talk to them. I expressed my desire to spend a longer postdoctoral period in the USA. They were positively inclined but insisted on providing my own funds. This stimulated me and Mireille upon return to Ghent to hunt at the Belgian government offices for sponsorship for a longer postdoctoral stay in the USA. I was successful in obtaining a NATO fellowship and wrote first to Professor Arnold L. Demain (1927-2020) at MIT with this excellent news, since by then I had read most of his research and review papers in the field of industrial microbiology and fermentation (Demain, 2004). A supporting letter from my UGhent Professor Walter Fiers and my recent research stay at Sir Abraham’s laboratory in Oxford also helped a lot to successfully apply for a postdoctoral stay with Professor Demain at MIT. “Arny” Demain’s swift positive reply came soon and off we were by plane to Boston, our very first long-haul flight out of Europe to join his Laboratory of Fermentation Microbiology, a stay that lasted from early 1974 till late 1975. Of course, soon after arrival I contacted Professor G. Khorana in person in his laboratory that was close to Arny’s laboratory to bring over very best wishes from my former UGhent M. Sc. promoter Professor Walter Fiers. By then he and his UGhent team had determined in 1972 the first complete nucleotide sequence of a gene, coding for the bacteriophage MS2 coat protein (Min Jou et al., 1972). I could not believe myself, talking to a Nobel Prize winner about my UGhent professor, being his former postdoc! While at MIT, Arny’s group (also nicknamed Arny’s Army) attended several local and regional conferences in New York, namely New York City, Albany and Ithaca, but the main event was the Society for Industrial Microbiology (SIM) Annual Meeting in August 1975 at the University of Rhode Island, Kingston, Rhode Island, where I presented a lecture (Demain et al., 1976; Vandamme and Demain, 1976a, 1976b) and became a member of SIM which I am still today. I also successfully obtained the “MIT certificate in Fermentation Technology” (Summer Course, 28 July-1 August 1975). At MIT I had plenty of opportunities to meet and discuss with several renown visitors and with MIT professors, including Nobel Prize laurate Salvador Luria, lecturing biochemistry and bacterial genetics courses. Also at that 1975 SIM meeting, I met in person renown Professor S. John Pirt (1923-2000) from Queen Elisabeth College (now King’s College), London, UK, where I discussed and agreed with him on a postdoctoral stay in 1976, to do research on a quite unusual and challenging topic: microbial growth kinetics and defined mixed culture fermentations (actinomycete and fungus) (Pirt et al., 1981). Me and Mireille had busy, unforgettable, and fascinating stays in Oxford, at MIT, and in London, worked hard, enjoyed different cultures, made friends but had no money to spend. Mireille was active as a volunteer home health aide in Malden, the village we lived in while at MIT, and as a schoolteacher aide during our stay in London, so as to alleviate our tight budget a bit. Our oldest daughter Heidi was by then fluent in English, while we were fluent in “broken English spoken very well”. During these three postdoctoral positions away
from our homeland, we made lifelong friendships with our co-researchers and their families. They were mainly postdocs and their family coming from all over the world and they were not that fluent in the correct English language. Back in Ghent, we moved from a rented row house into our own detached house with surrounding garden in 1978 where we still live today as devoted and happy life-partners! (Figure 3). By then two more twin girls were born, that kept us very busy for quite a while. Mireille took most of the duties of raising our three children, so that I could focus on my research and lecturing, for which I am so grateful to her. Since then we gradually did travel first all over Europe and later on the globe mainly to international conferences – from Finland down to Spain (and even further south to South Africa) and from the Americas to the Far-East, focusing on Japan, South Korea, Singapore, Australia, and New Zealand, occasionally combining this with visits to our former UK and MIT friends and with tourism. After my postdoctoral stays abroad and return to Ghent University, I kept in close contact initially in writing with my three postdoctoral professors. The UK was close by and relatively cheap to visit regularly. We quite frequently traveled to Oxford or London, often combining a scientific visit to my former UK professors with local tourism. A trip to the USA was very expensive for us! However, soon we and Arny met on a bi- to tri-annual basis mainly within Europe, where Arny was frequently in demand as invited MIT professor/lecturer at biotechnology conferences. From 1993 onwards, I started publishing our UGhent research data in The Journal of Industrial Microbiology (JIM) and later the Journal of Industrial Microbiology and Biotechnology (JIMB) and in SIMB News, the official journal and newsmagazine respectively of the Society (Vandamme, 1993; Dewulf et al., 1996). Later on, when I had my tenured professorship at Ghent University in 1986, I wanted to honor and reward my three postdoctoral professors for their guidance and hospitality. I invited them to visit my laboratory at Ghent University on several occasions. I proposed to Professor E.P. Abraham as G. Sarton-Chair holder (History of Science) at our university for the academic year 1989-1990. George Sarton (1884-1956) was a UGhent alumnus chemist who emigrated to the USA in 1914 and became a famous Harvard University professor, where he established the research field of the History of Science. In 1985 the UGhent established the yearly G. Sarton Chair and G. Sarton Medal Awards for scientists who contributed significantly to the field of History of Science. Professor Sir E.P. Abraham presented on 16 November 1989 in our main Aula a fascinating firsthand lecture on “Reflections on the Development of the Penicillins and Cephalosporins” (Abraham, 1990; Vandamme, 1990). In between, me and Mireille had visited him and his wife also at their mansion in Oxford. In March 1999, I invited Professor Arnold L. Demain and his wife Jody to Ghent University, where he received the prestigious Doctor Honoris Causa degree again in our main Aula. We did meet with Arny and his wife on several occasions in Europe and later again in the USA. We also visited Professor S. John Pirt and his wife Margaret almost yearly in London after my stay with him in 1976. He joined me several times at UK and European microbiology/biotechnology meetings and he was also frequently present at the Journal of Chemical Technology and Biotechnology (JCTB) editorial board (of which I was a member) meetings at the SCI (Society Chemical Industry) headquarters, in London. Me and my UK fermentation microbiology friends, Robert Poole and Peter Hambleton, were planning to honor Professor S. John Pirt with a
celebration at SCI, but his sudden death in 2000 prevented this to be realized (Poole, 2000).

3. Further links with SIMB and MIT along my UGhent career

During my following Ghent University career, my group focused gradually on industrial microbiology related research topics, involving screening, biochemistry, new genetics, fermentation optimization and downstream processing. They included over the years peptide antibacterial compounds (bacilysin, nisin and pediocin bacteriocins), antifungal polyenes, defined mixed culture continuous fermentations, industrial enzymes (tannase, sucrose phosphorylase, inulinase, proteopectinases, and others), biopolymers (alternan, Gluconobacter dextran, bacterial cellulose), rec E. coli fermentation optimization, bioflavours, biosurfactants (sophorolipids), osmolytes (ectoine), acetic acid bacteria as fermentation workhorse, specialty sugars (D-ribose, mannitol, glucose-1-phosphate, cyclodextrins) and rare sugars (L-fucose) by fermentation and biocatalysis. Several of these research projects were sponsored by the Belgian Science Foundation and the Agency for Innovation by Science and Technology, and by Belgian or European/USA companies, having a research center in Belgium or Western Europe. A few relevant research and review papers are referenced at the end of this article (Vandamme and Voets, 1974; Vandamme and Derycke, 1983; Sakai et al., 1993; Vandamme, 1993; De Vuyst and Vandamme, 1994; De Wulf et al., 1996; De Wulf and Vandamme, 1997; De Baets and Vandamme, 1999; De Baets et al., 2002, 2002, 2004; Vandamme and Soetaert, 2004; Naessens et al., 2005; De Mey et al., 2007, 2010; De Muynck et al., 2007; Van Bogaert et al., 2007, 2008; De Groeve et al., 2009; Soetaert and Vandamme, 2009, 2010; Vandamme, 2011a, 2016a; Vandamme and Revuelta, 2016; Demain et al., 2017). Also, several patents were filed and granted. The first occasions to meet again with my postdoctoral professors were at initially European international microbiology or fermentation conferences. Gradually I was able to procure funds to attend the SIMB annual meeting first in 1987 in Baltimore, ML, USA, and several others then followed. As such the SIMB annual meetings have been instrumental and a wonderful platform for me to meet again with Arny and to meet many of his Arny’s Army and Friends (AA&F) and SIMB members on a regular basis. I also had invited Arny to Ghent in 1993 as a plenary speaker at our 7th three-day Forum Applied Biotechnology (FAB) conferences, a series of which I was a co-founder. The first FAB was organized in 1987 and attracted about 250 people, mainly Europeans. We invited also renown scientists from the USA (including SIMB members) and from the Far-East.
These conferences are still going strong, being renamed since 2005 as Renewable Resources and Biorefineries (RRB), alternating yearly between Ghent and a few times in Bruges and another European city: so far twice in York, UK; Rotterdam, The Netherlands; Dusseldorf, Germany; twice in Toulouse, France; Valladolid, Spain; Wroclaw, Poland; Aveiro, Portugal. Our RRB conferences have always attracted several USA scientists, and especially members of SIM(B), to lecture, to organize sessions and/or present posters. Our RRB conferences cover quite similar topics as the SIMB conference series named Symposium on Biomaterials, Fuels and Chemicals (SBFC) and mutual interaction is growing. I organized with my group the 3rd AA&F meeting in Ghent University, July 8-9, in 1999. It was a unique occasion to meet with Arny and former MIT colleagues and their families from all over the world. As the years passed on, I did meet with many SIMB-members/friends, including Arny and many AA& friends (AA&F) at Western and Eastern European conferences and also in the USA at SIM(B) annual meetings. One of the later AA&F reunions (6th) was held at MIT immediately after the 2007 SIM annual meeting in Denver, CO (Vandamme, 2007a, 2007b). This reunion at MIT was really a memorable event coming back to the roots with many AA&F members and partners present. (Figure 4). I also noticed that Arny had drifted away from fermented pickles - his original research topic - and had become fascinated by beers from all over the world, but he admitted…nothing tastes like a good Belgian beer!! (Figure 5).

Over the years I became increasingly involved in the actions of the Board of SIMB and of its journals JIMB and SIMB News. I became Editorial Board member of JIMB in 1988 and acted as Senior Editor since 2004 and through today. I became a Quarter Century Club member in 2000 and I was elected as Fellow of SIM in 2005 and recipient of the Waksman Outstanding Educator Award in 2007. I was also invited to present the banquet lecture at RAFT-IV in 2001 in Long Beach, CA, (Vandamme, 2002) and also at the SIM Annual Meeting in Denver, CO, in 2007 (Vandamme, 2007b). Additional honors that I have received include my election as a Fellow of the American Academy of Microbiology (AAM) in October 1999. I have been invited worldwide as visiting professor to several universities to lecture for a two to four week period on industrial microbiology and biotechnology places like the Weizmann Institute of Science in 1980, Rehovot, Israel; in 1984 and 1990 to New Delhi and Hyderabad Universities in India; then at several universities in South Africa (Bloemfontein, Cape Town, Stellenbosch) in 1992 and 1995; all over in Australia in 1991and 1996; in South Korea in 1999 and 2011; in Poland (Poznan, Krakow, Lodz, Czestochova) regularly since the 1990; in Ireland (UCD-Dublin, Cork) in 2002 and yearly till 2010; at Huazhong Agricultural University in Wuhan, China, in 2013, 2015, 2017 and 2019. I am also since the late 1970s a member and was on the Board of the Belgian Society of Microbiology (BSM), and was active in the European Federation European Microbiological Societies (FEMS), European Federation of Biotechnology (EFB) and European Society of Applied Biocatalysis (ESAB). I participated in several similar international initiatives in Japan, South Korea, Malaysia and China. Since 2001, I am also a founding member and on the Board of the International Society of Rare Sugars (ISRS), that organizes a biannual conference in Takamatsu, Shikoku, Japan. I lectured at all of them until the coronavirus pandemic struck in early 2020. At Ghent University, in the period 1998-2004, I was the Director of Studies (now named Vice-Dean of Education) at my faculty and since 2004, I was a member of the Ghent University Board of Governors till my obligatory retirement at age 65.

4. Links with SIMB, JIMB and SIMB News after my UGhent retirement in 2008

After I had to retire in 2008 from my university, I did arrange my home office in one of the children’s former bedrooms. I still could attend additional SIMB annual meetings (thanks to support from SIMB headquarters and from Springer, Germany, and from Oxford University Press, UK, the publishers of JIMB). From January 2020 onwards, the coronavirus pandemic blocked all my international travel plans up till today (Vandamme, 2020). Arny, my life-long go-between to connect SIMB with my endeavors did not attend these meetings, except the SIMB meeting in Toronto and the New Orleans in 2016, where he was honored for his 90th birthday with a special tribute to Arny lecture session that I helped to organize (Vandamme, 2016b). However, at the later SIMB meetings being a continuous link to Arny, I could mingle with AA&F people, many of whom are SIMB members, and talk over many a beer on Arny’s impact and spirit in his physical absence. Sadly, Arny passed away on April 3, 2020. Many of us will miss him as an inspiring, productive and empathic scientist and humanitarian. I felt honored to co-write...
As fervent SIMB members, what Quarter Century Club members really are, we feel pushing and advocating the conventional and novel biotechnologies towards the attention of other scientists and bioengineers and to inform the food, feed, chemical, fermentation, pharma, environmental, and other relevant and new upcoming biotech starters and industries of its untapped potential. We also urge young students to enter this fascinating study and research field. SIMB’s scientific offspring contributes a lot to many of the new -omics- and related developments in industrially useful microorganisms, from metagenomics of uncultured species over proteomic analysis to directed evolution of industrial biocatalysts, metabolomics, biomathematics, and biosystem analysis, domains where also my successors at Ghent University are excellently performing (De Mey et al., 2007a, 2010; De Muynck et al., 2007; Van Bogaert et al., 2007, 2008; De Groeve et al., 2009; Soetaert and Vandamme, 2009, 2010; Vandamme, 2010; Vandamme and Revuelta, 2016; Demain et al., 2017; Bennett, 2017; De Paepe et al., 2017; Francoeur et al., 2017; Jezierska and Vandamme, 2017). Special issues of JIMB with me serving as guest co-editor have recently been published as well, to commemorate the worldwide impact of Arny Demain and his Army in the field of industrial microbiology and biotechnology and to emphasize the crucial role of SIMB on the field (Baltz et al., 2017, 2020, 2021; Vandamme, 2020a, 2021a). Over the years, I have edited several standard books on topics such as: Biotechnology of Industrial Antibiotics (Vandamme, 1984) and Biotechnology of Vitamins, Pigments and Growth Factors (Vandamme, 1989). Also I co-edited the books Bacteriocins of Lactic Acid Bacteria and Microbiology, Genetics and Applications (De Vuyst and Vandamme, 1994); volumes 5 and 6 of the Biopolymers series (Polysaccharides of Prokaryotes/ Eukaryotes) (Vandamme et al. 2002, 2004; De Baets et al., 2002, 2004) and their Chinese editions, Biofuels (Soetaert and Vandamme, 2009), Industrial Biotechnology: Sustainable Growth and Economic Success (Soetaert and Vandamme, 2010) and Industrial Biotechnology of Vitamins, Biopigments and Antioxidants (Vandamme and Revuelta, 2016). I received three Doctor Honoris Causa awards: in 2008 from Technical University of Lodz (Poland) and in 2009 from Hubei University of Technology and from South Central University of Nationalities, Wuhan, China. From 2011 till 2014, I acted as one of the four Directors of SIMB. Also, next to publishing many papers in JIMB, several members of my Ghent group attended actively SIMB Annual meetings. A few came to MIT for postdoctoral research. Many of my former M. Sc. and PhD students and collaborators have now responsible positions in
the Belgian or European biotech, pharma, food, feed, environmental sanitation industries and in governmental institutions and several have professorships at Belgian universities in Ghent, Antwerp, Brussels, and others, or universities in other European countries (UK, Italy, The Netherlands, and others).

In 2015 the SIMB Outreach Committee (with Susanne Kleff as Chair) was installed to activate collaboration with other national/international applied and industrial microbiology societies. As I was the only non-USA member on board, I tried to convince so far in vain the larger European societies such as FEMS and EFB to negotiate about potential cooperation. This was a difficult mission since few of these European societies had intentions to officially negotiate with SIMB. They hardly had official go-betweens and had themselves to compete with the many national (applied) microbiological societies that flourished well all over Europe and the Far East. In the end, we succeeded only with our Ghent based series of conferences on Renewable Resources and Biorefineries (RRB) in having a mutual exchange of sessions/speakers with SIMB's SBFC. In 2018 one of SIMB's Directors, Thomas Klasson, was present as an observer and lectured at RRB-14 held in Ghent (Belgium). Also, SIMB's representative Jonathan Mielenz attended several times. In 2019, this International Outreach exchange was realized in having SIMB Outreach representative Michael Resch as speaker at our 15th edition of RRB in 2019 in Toulouse, France. The coronavirus pandemic prevented this to realize in 2020, though in 2021 (17th RRB edition in Aveiro, Portugal) and in 2022 (18th RRB edition in Bruges, Belgium), SIMB member speakers, Nigel Mouncey, gave online presentations. Similar exchanges with SIMB, SBFC, and RAFT speakers could be envisaged with future RRB editions like the 19th planned in 2023, 31 May-2 June, Riga, Latvia and the 20th edition in 2024, 5-7 June, Brussels, Belgium.

As an ongoing hobby, I have published over the years quite a range of history of industrial microbiology-oriented articles, many of which were published in SIMB News and in the Belgian Society for Microbiology (BSM) Newsletter (De Baets and Vandamme, 1999; Demain et al., 2017; Vandamme and Frimout, 2009; Vandamme, 2002, 2007a, 2007b, 2011, 2014, 2015, 2016a, 2016b, 2017, 2018, 2019, 2021, and recently a few with Ostend, Belgium-born Kristien Mortelmans (President of SIMB in 2000) from SRI International, California as co-author (Vandamme and Mortelmans, 2019, 2020). Recently, postponed two years due to coronavirus-restrictions, on February 24, 2022, I was awarded the prestigious George Sarton Medal of Ghent University for my range of publications and contributions related to the history of microbiology-related sciences and technologies (Vandamme, 2021, 2022).

5. Epilogue

My personal life story illustrates the importance and impact that SIMB has had indirectly and directly on my career as a young M. Sc. student, as PhD and D. Sc. researcher and as a Ghent University Professor, also as an invited lecturer worldwide on all continents. It also reflects my dedication to promote and advocate the significance of industrial microbiology and biotechnology to the younger student/researcher generation, to the biotech industry and to policy makers as a green technology to contribute to green chemicals and to climate repair on our globe! My contacts with SIMB and its ongoing support over the years and its range of activities have been essential and instrumental to reach these goals. In retrospect, a life path is a crossroad with many diversions to choose from. Initially my parents, schoolteachers and later on local and foreign university professors had a crucial impact on the road I finally followed. In hindsight given my agro-bio-tech experience as a youngster tending the fields and crops and raising farm animals, it is no surprise that I have chosen a career path with similar biotech and engineering techniques as a training and profession, be it with much smaller organisms! Also, I am equally very grateful to and proud of all members over the years of my research group and successors at Ghent University in helping me to build up what is now the renown Centre for Industrial Biotechnology and Synthetic Biology at the Faculty of Bioscience Engineering at Ghent University. But my main drive all along was Mireille, my physical, spiritual and mental supporter and soul mate in all my endeavors over so many years.

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Acknowledgements:

My sincere thanks go to the SIMB Board of Directors, the Headquarters staff, especially Christine Lowe and Jennifer Johnson, to the SIMB News Editorial Board members Melanie Mormile, Elisabeth Elder and Kristien Mortelmans, and the JIMB Editors in Chief Allen Laskin, George E. Pierce, Joseph J. Cooney, Robert Schwartz and Ramon Gonzalez and the editors of JIMB, with whom I had the pleasure to collaborate since the 1990s first from a distance and later on in person, for the constructive and pleasant cooperation, friendship, opportunities and scientific, financial and moral support.

6. References:


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7. Legends to Figures

Figure 1. The farmhouse, picture taken in 1966 in Vinkem, where I was born in 1943 and where I grew up.

Figure 2. Studying relevant literature in my room when I was a Research Assistant in UGhent in 1969.

Figure 3. Mireille and me at a Party in Ghent in 2011.

Figure 4. Arny and me at the AA&F meeting at MIT in 2007.

Figure 5. Enjoying my daily beer at the 2018 SIMB Annual Meeting in Denver, Colorado.
Introducing SIMB’s NEW Special Conference

When: November 3–6, 2024
Where: Wyndham San Diego Bayside, San Diego, California
Chairs: Elisha Wood-Charlson (Chair), Nigel Mouncey (Co-Chair)

About:
A new microbiome conference aimed at Connecting Microbiome Communities (CMiC)—the microbes and those that study them! Looking to integrate insights across ecosystems (human, environment, laboratory) and sectors (academia, government, industry), CMiC is a place to explore common challenges, create shared solutions, and establish new collaborations.

CMiC aims to create a welcoming environment that encourages open, honest dialogue and fosters intriguing new ideas for collaboration across systems.

You can look forward to SIMB’s renowned in-person meeting experience with traditional sessions intermixed with non-traditional sessions such as panels, flash talks, or community-led discussions.

Topics under consideration for CMiC’s program include:
- Biodiversity and Ecology
- Bioinformatics and Machine Learning
- Engineering Microbiomes for Human and Ecosystem Health
- Microbiomes and the Bioeconomy
- Microbiome Policy, Advocacy, and Regulation

Learn more at: simbhq.org/cmic
It was a pleasure to host the 2023 SBFC in Portland, Oregon, from April 30th to May 3rd, 2023. The symposium had a fantastic attendance of 306 attendees from government, industry, and academia representing 18 different countries.

We opened the symposium with an inspiring talk from our Keynote Speaker, Dr. John McGeehan from the World Plastics Association, who discussed how we as scientists can work together globally to accelerate technologies to address plastic pollution by recycling, upcycling, and redesign.

This year’s program contained 3 topical tracks, each with 4 sessions. The ‘Biofuels, Bioproducts, and Synthetic Biology’ track included topics highlighting work in the Agile Biofoundry, AI/ML strategies for bioproduction, metabolic engineering to target biofuels and products, and upgrading bioderived carbon precursors to hard to electrify fuels such as Sustainable Aviation Fuels. The ‘Alternative Feedstocks and Biosynthetic Materials’ track featured research on organic waste valorization, plastic upcycling, C1 feedstocks, and the production of novel biomaterials and alternative foods. Lastly, the ‘Engineering and
Deconstruction of Biomass’ track included topics on engineering of biomass and recalcitrant polymers, biomass and lignin deconstruction, biomass active enzyme discovery, mechanisms, and engineering, as well as integration and scale up for lignocellulosic biomass conversion.

The symposium also included 2 sessions of student talks and Rapid Fire presentations each day before the 2 poster sessions, highlighting our next generation of researchers. We additionally hosted a special session on ‘Biofuels and Negative Emissions’ where invited industry speakers discussed their perspectives and contributions on combining carbon capture and storage with biofuel production in an engaging and interactive panel discussion. All of the sessions included in this year’s SBFC represented researchers across academia, government, and industry in current and emerging research areas towards the development of a viable bioeconomy and more sustainable future.

At the end of the Symposium, awards were presented including the 2023 Charles D. Scott Award to Badal C. Saha from the National Center for Agricultural Utilization Research, USDA-ARS, the 2023 Raphael Katzen Award to Sean Simpson from Lanzatech, along with awards for outstanding posters and presentation from students. It was exciting to see the excellent engagement of all attendees through the entirety of the meeting.

Overall, it was a great honor and privilege to serve as the Program Chair of the 2023 SBFC, and I am especially thankful to have worked with such an engaged and dedicated team: Kevin Solomon (Co-Chair), Davinia Salvachúa (Past Chair), and Tina Hockaday, Jennifer Johnson, Haley Cox, James Earle, and Suzi Citrenbaum (SIMB). In addition, I want to say a big thank you to the Topic Area Chairs and Session Conveners who were instrumental in inviting a great group of speakers and ensuring sessions ran smoothly, and to our sponsors BioP2P Network, INFORS HT, and KATZEN International. We are especially grateful to KATZEN for sponsoring an excellent reception following the scientific sessions that served to unite attendees and fostered many networking opportunities. I am very much looking forward to the 46th SBFC a stone’s throw away from Washington, DC in Alexandria, Virginia from April 28 – May 1, 2024, where the Program Chair will be Kevin Solomon and his Co-Chair will be Ben Woolston. If you would like to be part of the organization or provide any input for the upcoming 2024 SBFC, please contact Kevin Solomon (kvs@udel.edu).

I hope to see everyone again next year in Alexandria!
Thank you to all who came to the 73rd SIMB Annual Meeting and Exposition from July 30–August 2, 2023 at the Hyatt Regency Minneapolis in Minneapolis, Minnesota! Recap will be published in the next issue of SIMB News.

In the meantime, please save the date for the 74th SIMB Annual Meeting and Exposition from August 4–7, 2024 at the Sheraton Boston Hotel in Boston, Massachusetts.

The 2024 SIMB Annual Meeting will be chaired by John H. Evans, Ph.D., Vice President, Yeast Innovation AB Mauri. If you’d like to get involved with the program, you can reach him at commsSIMB2024@gmail.com.
RAFT® 15 (2023 Recent Advances in Fermentation Technology)

Naples Grande Beach Resort and Hotel
Naples, Florida
Oct. 29–Nov. 1, 2023
www.simbhq.org/raft

Registration and Housing
Regular Registration Deadline: October 10, 2023
Housing Deadline: October 6, 2023 (Rate $209+ taxes)

Pre-Meeting Workshop
Saturday, October 28, 2023
Advanced Fermentation Concepts
Organized by Tim Cooper, Danimer Scientific; Chris Stowers, DSM

Program Chairs
Kat Allikian South Pacific Sera (Chair)
Daniel Dong, DSM-Firmenich (Co-Chair)
Keynote Speaker

Christopher J. Guske, PhD
D2 Biotech Consulting, LLC

Program Topics and Sessions:

SESSION:
Next generation strain design: Looking beyond the lab

Microbes that produce bioactive natural products and biologics have proven to be of high commercial and societal value as antimicrobial agents, crop protectants, immunomodulators, and fermented food and beverage producers, as well as antitumor, antiparasitic, and antiviral agents. Producing commercial titers of a compound or biologic can take years of development work to overcome limitations found in native strains. Side products, instability, genetic tractability, toxicity, and other issues are barriers to strain improvement. Advances in DNA and RNA sequencing and new genome mining and editing tools have provided valuable insights and capabilities for strain engineering. Nevertheless, over-producing valuable compounds is often limited by unknown genotypes and a lack of insights into metabolism and other unknown “dark matter” in microbes. In this session, some valuable lessons and new approaches to developing over-producing strains for commercial applications will be highlighted.

CONVENERS:
Matthew Bochman – Indiana University, USA
David Mead – Terra Bioforge, USA

SESSION:
PAT for process insight, improvement, and automation

Today, nearly 20 years after the FDA’s formal publication of a guidance document on process analytical technology (PAT), practitioners of biomanufacturing enjoy a powerful toolset for understanding and validating the relationship between process and product quality. Ann M. Thayer, reporting on the subject for Chemical and Engineering News in 2005, connected PAT to the wisdom of the Ancient Greeks in her title, “Know Thy Process”. With Industry 4.0 ambitions for “self-driving” automation, the original “Know Thyself” may now be more apropos: the process will know itself, correct itself, and call for help only when deviating beyond its design space. Many rewards await the successful implementor of PAT: process prediction, control, and understanding, increased yield, saved batches, and real-time release–quality assured by the process data alone. These rewards also extend beyond pharma into the industrial realm, where narrow margins often demand essentially perfect execution at massive scale with minimal staffing. In the most exciting applications, PAT offers a deviating process a path back into spec, yet the devil is in the details. As the instruments grow more complicated, so too grow the possibilities for failure or ambiguity. The presentations in this session explore recent advances in new sensor technologies, modern PAT tools for complexity reduction and process robustness, and PAT case studies that highlight the rewards realized and the technical hurdles overcome.

CONVENERS:
Tim Davies – Corteva AgriScience, USA
Gian Oddone – Biolucid LLC, USA

SESSION:
Scaling: Up and down and back again
(Sponsored by Kuhner Shaker inc.)

This session is an opportunity to share experiences – both positive and negative – found in the process of scaling up fermentations, down-scaling to address new concerns...
and then using those findings to scale up again. In today’s bioeconomy, companies are leveraging a diverse set of microbial chassis as hosts to produce a variety of products. Each microbial host may present its own unique set of scale up and scale down challenges. Whether scaling up a new production strain or simply an improved process, what unique set of challenges were identified and how were those addressed?

CONVENERS:
Mary Bosserman – Valent BioSciences, USA
Stefan de Kok – Geno, USA

SESSION: Sustainability in fermentation

Production of chemicals, pharmaceuticals, and other materials by fermentation is often significantly more sustainable than standard synthetic chemistry based manufacture. Nonetheless fermentation systems often require energy input, energy fossil based material and competitive feedstock that reduce their environmental and societal positive impact. This session will focus on showcasing recent advances in fermentation systems, alternative feedstocks, gas fermentation, process changes, and other novel technologies to improve the sustainability of fermentation systems and reduce the greenhouse gas emissions associated with bioproduction.

CONVENERS:
Craig Behnke – Lumen Bioscience, USA
Jimmy Roussel – Luxembourg Institute of Science and technology, Luxembourg
Ehsan Mahdinia – Mettler Toldeo, USA

SESSION: The interplay between upstream and downstream processing

Commercial fermentation success depends upon the ability to capture product with customer-desired attributes. Classical or unique challenges such as dilute product streams, large and diverse types of contaminants or specific project needs are significant barriers that oftentimes decide project success rate. Deliberate research strategies around the interplay between upstream and downstream processing can decrease risk and bring our products to market faster. This session will include presentations covering how scientists and engineers tie together upstream research initiatives with downstream solutions to create new or advanced, end to end approaches in fermentation.

CONVENERS:
Brad Cox – Corteva AgriScience, USA
Michael Japs – Geno, USA

SESSION: Process modeling for fermentation understanding and control

With the growing amount of biotech products reaching the market and the increasing data types and quantity that can be collected and generated, there is a demand and opportunity to reduce the amount of learning loops with digital process development. Equally, there is a growing need to consider process control in the process development workflow. Thus, this session will focus on novel modeling approaches for effectively understanding and controlling industrially-relevant fermentation processes. The session can include mechanistic, data-driven and hybrid modeling approaches, as well as of the fluid dynamics of the bioreactor, among others. Consideration of model robustness is welcomed and is important when a model is used in commercial manufacturing to aid in decision making, or ultimately to automatically control bioreactor operation. Discussion will emphasize the actual applicability of modeling approaches in industry and be connected with case studies. Challenges and practical aspects that need to be considered for successful fermentation process modeling will also be considered.

CONVENERS:
Gisela Nadal Rey – Novozymes, Denmark
Keith Smith – Applied Materials, United Kingdom
ROUNDTABLE DISCUSSION:
Net zero: How does the fermentation industry get there?

Spurred by the increasingly alarming IPCC reports on global warming, more and more companies are committing to science-based targets for greenhouse gas emission reduction, often with important milestones in 2030 and 2040, and aiming for net-zero emissions by 2050. Net-zero commitments need to consider the entire value chain; for a fermentative production process not only scope 1 (own CO2 emissions) and scope 2 (CO2 emissions caused by purchased energy) emissions should be accounted for. For many products, scope 3 emissions are most significant. These are caused by production and transportation of fermentation feedstock and nutrients, as well as distribution and end-of-life use of the final products. Taking this perspective, electrification, energy reduction and switching to renewable electricity sources in the bioprocess itself are clearly insufficient to reach net-zero by 2050. Switching to alternative feedstocks with net-zero potential, CO2 capture and utilization, byproduct valorization (in other value chains), net-zero logistics and decreased consumption are all in scope. This session will aim to paint the bigger picture of future net-zero fermentation processes, and will discuss some of the identified challenges and opportunities in detail.

CONVENER:
Wouter van Winden – DSM-Firmenich

MODERATOR:
Marty Muenzmaier – Cargill, USA

POSTERS
Poster presentations are an integral part of the RAFT* technical program as they showcase cutting-edge developments, extend the technical scope of the program, and provide opportunities for in-depth one-on-one discussions. This year’s RAFT* poster session will highlight new research and industrial applications in next-gen strain design, strain optimization, Process Analytical Techniques (including automation), process modeling, scaling (up & down), fermentation sustainability, and integrating upstream and downstream processing.

CONVENERS:
Nancy Dowe – National Renewable Energy Laboratory, USA
Ed Talideh – Lallemand Bio-Ingredients, Canada

Exhibit Hall!
The Exhibit Hall has sold out, so more tables have been added! Sponsorship and program advertisements, printed and online, are still available.


EXHIBITORS:
*AS OF AUGUST 29, 2023
» Aber Instruments LTD.
» Beckman Coulter Life Scientific
» BiolIntelligence Technologies
» Biolog, Inc.
» BIONET Servicios Tecnicos, S.L.
» BioP2P Network
» BlueSens Corporation
» Bruker Optics
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» Microbial Discovery Group
» Ohly Americas
» On-chip Biotechnologies Co., Ltd
» optek-Danulat, Inc.
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Reminder that RAFT® 16 will be held in 2025, going back to the cycle of every other year.

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Save the date and join us near DC for #SBFC2024!
The introduction mentions the “good viruses” used in making vaccines as well as oncolytic viruses before turning the focus to bacteriophages. Professor Zinaida Yermolyeva, in Stalingrad, is credited with the initial isolation. Bacteriophages outnumber all other living entities on Earth with trillions being isolated from basically every known ecosystem including freshwater, seawater, sewage, soil, and air. They inhabit a broad array of bacterial hosts in these ecosystems as well as being on and in our bodies. Phages can remain dormant for extended periods before activation results in rapid production of new phages; changes in the host cell metabolism; changes in host and phage genetics; host cell demise; and changes in the phage’s environment. Phages have been credited with 10% of carbon turnover for Earth. The contributions of genes from marine phages to their hosts are credited with as much as an eighth of the oxygen in the atmosphere. Jumbo phages could help explain where the first cells on Earth originated. Even with phages having been studied for 30 years, something close to 99% are still unknown. The goals of Ireland’s book are to make more people aware of phages and their importance.

Ireland’s goals were met through his scientific background, journalistic ability, dedication, and willingness to travel the world, while studying history and interacting with physicians, patients/families, and scientists. He covered the long-running importance of the Ganges River and its surprising ability to cure people of a broad variety of diseases despite, or more likely because of, the pollution levels and tremendous population of phages. He reviewed the work of many early researchers including Frederick Twort, Felix d’Herelle, Albert Calmette, Gunther Stent, and Igor Asheshov covering their often-conflicting interests in bacteria, vaccines, and plaques in bacterial cultures. The phage feud expanded into medicinal applications...
supported by Russia/Soviet Union and Stalin which conflicted with the development of antibiotics. A more positive interaction occurred between George Eliava and the Eliava Institute’s support of d’Herelle’s phage theory. Strong support of phage work came from the annual phage meetings organized by Elizabeth (Betty) Kutter at Evergreen State College in Olympia, Washington. Kutter also played a major role in reactivating phage research in Georgia which had lagged with the demise of the Soviet Union. Kutter’s support of phage use was augmented by Alexander Sulakvelidze who had moved from Georgia to Maryland. Funding from the US National Academy of Science supported his work with Glenn Morris at the Veteran Affairs Medical Center in Baltimore. Sulakvelidze was able to pass his knowledge of medicinal applications of phages to Morris. The role of Georgia in phage research gained exposure when Arthur Gertler, a Canadian jazz bassist, went to Tbilsi, Georgia, for phage therapy on an ankle injury. While the applications have potential, they also have problems with purity of the phage compounds and willingness of practitioners/patients to utilize them. Phage clinics have used natural and engineered phages to treat burns, lung infections associated with cystic fibrosis, joint/bone infections, blood infections, and diabetic foot ulcers. Fundamental research is ongoing to provide therapy for tuberculosis, leprosy, COPD, asthma, Crohn’s disease, and ulcerative colitis. The Center for Innovative Phage Applications and Therapeutics (IPATH) was established by Steffanie Stratheed who saved her husband’s life with phages and is the first center of its kind in the United States. Jess Sacher, a Canadian, and Jan Zheng have established the Phage Directory that connects researchers, practitioners, and patients. Biobanks are collecting and studying medicinally useful phages. With this progress, regulatory approval is still some time in the future. Both natural and engineered phages have potential in development of antibiotics and vaccines, as well as drug delivery, probiotics, pest control, disinfection, and aquaculture/agriculture.

In continuing his review of scientists, Ireland moved to discussing Max Delbrück’s interest in physics which led to group discussions with other physicists, biochemists and biologists. Based on his broad interests, Delbrück wrote a paper on how each gene might be encoded by a chemical and that the properties of the atoms/molecules might be related to the gene’s function. This publication resulted in Delbrück interacting with Carl Zimmer, Erwin Schrödinger, Niels Bohr, and Salvador Luria. Delbrück moved to the California Institute of Technology with the support of the Rockefeller Foundation. Once at Caltech, his interests changed to genetics which led to connections with Emory Ellis and his work on the relationships between phages and cancer. The Delbrück/Ellis interactions focused on
one-step growth experiments. The Delbrück/Luria interactions focused on gene composition. Ultimately Alfred Hershey introduced microbiology and microscopy into the group’s work. The combined interactions resulted in the formation of the Phage Group which included Niels K. Jerne and Ernst Peter Fischer. The Phage Group negotiated the Phage Treaty in which phage scientists agreed to work on only 7 phages grown in nutrient broth at 37°C using Escherichia coli to provide reliable, consistent experiments. These restrictions have resulted in limitations on the work accomplished to date.

Other scientists involved in phage research include Mya Breitbart, a marine biologist at the University of South Florida. She works on phage dominance in marine systems with increased energy and oxygen production using less light. Gary Trubl, at NASA, studies phages in extreme environments and clean room procedures. Forest Rohwer works on molecular techniques to isolate phages without growing them. Jeremy Barr studies how phages that act like the innate and adaptive immune systems in protecting humans. Francisco Mojica studies Haloferax mediterranei, an archaeon that lives in extremely salty water containing vast populations of phages. He matches CRISPR sequences with segments of phage DNA. In different areas, Rodolphe Barrangou’s undertakes studies of starter cultures used in yoghurt production that are driven by the need to have consistent products and to defend the products against phages. Jennifer Doudna and Emmanuelle Charpentier showed that Mojica’s sequences and Barrangou’s protection against phages were a powerful genetic tool. Martin Jinek worked on Cas-9 which can be programmed to target specific sequences of DNA. Doudna and Jinek got a Nobel prize for their CRISPR work. Sylvain Moineau has also worked with CRISPR to control phages in the food industry.

Isolation of natural phages is ongoing and involves student-led and citizen-led efforts. Development of engineered phages is also continuing and has progressed to using a cell-free system called Phactory, developed by Jean-Paul Pirnay. Rob McBride at Felix is developing an AI/robot-aided kit for designing and manufacturing phages. Carl and Greg Merril build on phages isolated form the natural environment rather than building each one independently. Ongoing work is combining phages and antibiotics to control diseases.

Ireland’s book would be of interest to undergraduate and graduate students, as well as faculty, with interests in phages, bacteria, and genetics. His writing style effectively explains the concepts and draws the reader deeper into the discussion.
### Upcoming SIMB Meetings

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<td><strong>OCT. 29–NOV. 1, 2023</strong></td>
<td>RAFT*15 – Recent Advances in Fermentation Technology</td>
<td>Naples Grande Hotel • Naples, FL</td>
<td><a href="http://www.simbhq.org/raft">www.simbhq.org/raft</a></td>
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<td><strong>APR. 28–MAY 1, 2024</strong></td>
<td>46th Symposium on Biomaterials, Fuels and Chemicals</td>
<td>Westin Alexandria Old Town • Alexandria, VA</td>
<td><a href="http://www.simbhq.org/sbfc">www.simbhq.org/sbfc</a></td>
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<td><strong>AUG. 4–7, 2024</strong></td>
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<td>Sheraton Boston Hotel • Boston, MA</td>
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<td><strong>NOV. 3–6, 2024</strong></td>
<td>Connecting Microbiome Communities</td>
<td>Wyndham San Diego Bayside • San Diego, CA</td>
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### Upcoming Industry Meetings

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<td><strong>MAR. 19–21, 2024</strong></td>
<td>Cambridge Healthtech Institute’s 7th Annual Bioprocessing Summit Europe</td>
<td>Intercontinental Barcelona, Spain</td>
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Considering a Career Outside of Academia?

by Leo H. Liu

The perspectives contained in this article is purely based on my own and dinner conversations with friends (shout out to my dear brother Derrick Liu and my mentor Dr. Jim Bowie for those thoughtful discussions about career paths). The data presented herein is not meant to be any sociology survey. You know, this is the kind of “survey” based on one’s personal experiences.

Are you pondering over your career choices? Do you have anxiety not knowing what you should do after getting that sweet, sweet doctorate degree? Making wise career choices after completing a PhD program can seem daunting. Let me share two matrices that really helped me.

**Figure 1. Skill Set vs. Value Alignment.** The upper right quadrant is the most desired outcome. PhD training would hone many skills; not all those skills need to be perfectly aligned, if enough of them help you land in the upper right quadrant.
Consider two axes that make up a chart with four quadrants (Figure 1). The x-axis describes how much those jobs the society-at-large values their services. While we tend to think all occupations deserve the same dignity, which certainly is true, not all job titles command the same salary.

Before considering your lifestyle or passions, we must first consider the skill and value alignment of these driving forces. After all, career planning is a very realist topic and deserves a realist outlook. You should try to align yourself to the upper right corner whenever you can. If not, then we can explore the upper left or the lower right. Depending on how much you care about the money vs. your hobbies, and you can choose either way, there is no definitive right or wrong answers here.

Once we have established the alignment, then we can consider diving deeper into the different career paths. I would like to think there are ten principal characteristics to consider (see Table 1).

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<th>Characteristics</th>
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<th>Industry</th>
<th>Alternative</th>
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<tr>
<td>Freedom</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
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<tr>
<td>Key Performance Indicator (KPI)</td>
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<td>Pressure of Institution</td>
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<tr>
<td>Job Market</td>
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<td>Large</td>
<td>Medium</td>
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<td>Full Professor, recognition in academic field</td>
<td>Corporate executive</td>
<td>Gov’t leadership</td>
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<tr>
<td>Early Career Security</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Mid-Career Transferability</td>
<td>Easy to transfer out, but hard to transfer in</td>
<td>Easily transferable within the industry</td>
<td>Easy to transfer out, but hard to transfer in</td>
</tr>
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</table>

Table 1. Career Path Characteristics

So, let’s say we all found our dream job or career path that belongs in the upper right quadrant laid out in Figure 1, such as a microbiology professor at university, consultant for the chemical industry, or an inspector for U.S. Environmental Protection Agency (U.S. EPA) for biological hazards spill cleanup. Now we can use Table 1 to further refine our searches. Ask yourself those nine characteristic questions and how much you value each of them. I believe your answer will be revealed soon as you pit yourself against these metrics.
Definitions for terms used in Table 1 are provided in Table 2.

<table>
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<tr>
<th>Characteristics</th>
<th>Definitions</th>
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<tr>
<td>Freedom</td>
<td>Academic freedom or freedom of choosing what to do. For instance, you have more freedom to research in an academic position, but you must work on assigned tasks in industry positions.</td>
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<tr>
<td>KPI pressure</td>
<td>Industry positions usually come with all sorts of performance targets and indexes to hit, while in academia, you are under the dreaded “publish or perish” pressure.</td>
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<tr>
<td>Entry Salary</td>
<td>Easy to understand this one. While there are high salaries to be found in any of those career paths, the salary for an early career entry position in academia, such as post-doc researcher, is much lower than the peers in corporate R&amp;D or sales.</td>
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<tr>
<td>Technical skill</td>
<td>How much does the performance of the job require a direct connection to your PhD training? Are you hired because of the research you have done in the past or the technical know-how you process?</td>
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<tr>
<td>requirements</td>
<td></td>
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<tr>
<td>Transferable skill</td>
<td>Alternatively, to perform well at the job, it is not so much about research or technical knowledge, but the transferable skills, anything from presentation skills or reading the room counts.</td>
</tr>
<tr>
<td>requirements</td>
<td></td>
</tr>
<tr>
<td>Career progression</td>
<td>How fast can you climb up? 2x post-doc rotations + 5-yr assistant professor and maybe a tenure track, or climb that corporate ladder? Nothing is stopping you from running for president, but realistically how fast the career progression is an important metric to consider for us.</td>
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<tr>
<td>Job market</td>
<td>Some job markets are just bigger than others. There are only so many tenure-track professorship positions, but there are a lot more senior scientists in industrial R&amp;D.</td>
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<tr>
<td>Terminal Achievement</td>
<td>What is the biggest job or honor you can get in this career path? Not to say that those are the only achievements; far from it. But just to give you an example to think about.</td>
</tr>
<tr>
<td>Early career security</td>
<td>When we just step out of the door of our grad schools, we need to consider how much risk we can take and how likely we can make it to the “other side.”</td>
</tr>
<tr>
<td>Mid-career transferability</td>
<td>Sometimes, we want to change things up after a while. Or your whole strategy can be based on a successful mid-career switch. Either way, some sectors or jobs are walled gardens, and some are a free-for-all. So, consider carefully how you might be able to make the switch.</td>
</tr>
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</table>

Table 2. definitions of the ten principal characteristics of a given career path
What are the three career paths?

**Academic careers**

Definition: Academic career includes anything from teaching in a community college to research positions in academic institutions. For many students, this might be the most familiar category of which they are aware of.

**Industry careers**

Definition: Corporate research and development (R&D), consulting, and management. Corporate R&D isn’t the only industry job out there. As an Application Scientist myself, sales, product management, and project management are also a good fit for many graduate students. After all, we have had to juggle multiple projects and complex research collaborations while in graduate school. You can also go to consulting. Whether in specialty or management consulting, you can always leverage the discipline you have studied. For instance, a pathology graduate student can apply their acquired skills to a consultant position for the pharmaceutical industry. Lastly, corporate R&D or corporate product management are all good ways to eventually climb to management roles.

**Alternative careers**

Definition: Government, non-profit organizations, and entrepreneurship. From the US Food and Drug Agency to the US EPA to US Department of Agriculture, there are many places in the federal and local governments for a PhD student to shine. The same goes for many large non-government organizations, from the Red Cross to the United Nations. Modern policymaking and enforcement are complex and sometimes require very specialized and advanced knowledge. For example, Los Angeles County recently hired PhD students for water quality chemist positions. Since this county has millions of residences, water quality assurance is no small job. Lastly, entrepreneurship is also a great way to utilize everything you have learned during the PhD training and more. Do you have an awesome discovery or invention and want to commercialize it? Entrepreneurship might be the path for you. But be warned, this path is quite treacherous. As someone who trekked this path before, this is certainly the most unpredictable path. The potential upsides are huge, but only to be matched by equally huge risks.

Overall, pursuing an alternative career outside of academia can provide PhD students with a fulfilling and rewarding career path. By considering the many options available and focusing on their strengths and skills, PhD students can find their ideal career path.
Careers, Coffee, and Conversations at RAFT®

RAFT®15 – Recent Advances in Fermentation Technology will be held October 29 – November 1, 2023. The special conference will be at the Naples Grande Hotel in Naples, Florida. More information on the meeting is online at www.simbhq.org/raft. Information on posted jobs will be available. Interactions between corporate members, sponsors, and exhibitors with attendees can be arranged.

All attendees are welcome to participate. SIMB members representing the Board of Directors as well as various committees have been invited to participate and to provide suggestions. If you are interested, bring your questions and your resume. Members of the Placement Committee will be present 30 minutes prior to the opening session of the Meeting and will be present during the morning and afternoon coffee breaks. For any/all sessions come the Placement Booth which will be close to the Registration Booth. Feel free to contact us if you have any questions.

Corporate members, sponsors, and exhibitors are encouraged to participate. Space will be available for posting job openings. With their permission, resumes of attendees will be available for review.

More information on the meeting is available at www.simbhq.org/raft. Feel free to contact us if you have any questions.

Elisabeth Elder, Placement Committee (elisabeth.elder@gs.w.edu)

Lisa Lee, Placement Committee (l.lee@procelys.lesaffre.com)
## SIMB Committee Chair Email Term expires Members Staff Liaison

<table>
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<tr>
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<th>Chair</th>
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<td>John Evans</td>
<td><a href="mailto:commssimb2024@gmail.com">commssimb2024@gmail.com</a></td>
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<td>Tina Hockaday</td>
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<td>Debbie Chadick</td>
<td><a href="mailto:chadickdebbie@gmail.com">chadickdebbie@gmail.com</a></td>
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<td>Archives and 75th Anniversary</td>
<td>Debbie Chadick</td>
<td><a href="mailto:chadickdebbie@gmail.com">chadickdebbie@gmail.com</a></td>
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<td>Joan Bennett, Kristien Mortelmans, Erick Vandamme</td>
<td>Jennifer Johnson, Haley Cox</td>
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<td>Debbie Yaver</td>
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<td>Tim Davies</td>
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<td>Raj Boopathy, Stephanie Gleason, Thomas Klasson, Sara Shields-Menard, Rajesh Sani, Shawn Nelson</td>
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<td>Steve Van Dien</td>
<td><a href="mailto:svandien@persephonebiome.com">svandien@persephonebiome.com</a></td>
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<td>Yoram Barak, Andreas Schirmer, Priti Pharkya, Jonathan Sheridan, Lisa Lee, Melissa Carpio, Kevin McHugh, George Barringer</td>
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<td>Sheena Becker</td>
<td><a href="mailto:sheena.becker@corteva.com">sheena.becker@corteva.com</a></td>
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<td>Noel Fong</td>
<td><a href="mailto:nfong@nucelis.com">nfong@nucelis.com</a></td>
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<td>Katy Kao</td>
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<td>Dick Baltz</td>
<td><a href="mailto:rbaltz923@gmail.com">rbaltz923@gmail.com</a></td>
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<td>Allen Lee</td>
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<td>Hal Alper</td>
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### Presidential Ad Hoc Committees

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- **Chair**: Nigel Mouncey | njmouncey@gmail.com | 2024 | Noel Fong, Haley Cox, Michael Resch, Md. Azizul Haque, Sora Yu, Jay Huenemann, Allen Lee, Blake Rasor, Eric Eke, Aditya Kunjapur, Guangde Jiang, Bhargava Nemmaru, Lydia Rachbauer | Haley Cox |

#### SIMB Foundation Development
- **Chair**: George Garrity | garrity@msu.edu | 2024 | In Development | Haley Cox |

## Special Conferences

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<tr>
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<tr>
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<td><a href="mailto:kvs@udel.edu">kvs@udel.edu</a></td>
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<td>Co-Chair</td>
<td>Carrie Eckert</td>
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<td>Yi Tang</td>
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