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Festschrift for Larry Sulak
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Only in fiction, as Mark Twain recounted in Tom Sawyer, can a living person attend his own funeral. But a festschrift, when it is presented as a two day conference, is almost as good. I am pleased to take part in this symposium to speak about Larry Sulaks contributions to, or rather, the Sulak Effect on Boston University.

Franz Kafkas unhappy metamorphosis of a man into a cockroach was prosaic compared to the extraordinarily auspicious metamorphosis that occurred in all the sciences and engineering at Boston University following the arrival of Larry Sulak.

A review of scientific facilities in 1971 when I came to Boston University was a depressing undertaking. The laboratories lacked much of the equipment necessary for serious research or even adequate undergraduate teaching. The chemistry department, for example, had no spectrometer, and its laboratories would have looked familiar, though not fancy, to Willard Gibbs or Louis Pasteur. In 1971, we received fewer than $10 million in federal funds, almost all from the NIH to our medical school. Federal funding for science and engineering was negligible. Even by 1975, federal funding for research in physics, biology, chemistry and engineering was only $1.2 million and growing very slowly.

Physics had promise of excellence, as long as we stuck to theory and the history and philosophy of science: John Stachel, Robert Cohen and Abner Shimony were outstanding, and I thought Boston University could surely afford to keep them in books, chalk and blackboards. But I had little help to offer George Zimmerman, even though he was doing interesting experimental work in novel materials. Limited by Boston Universitys annual operating budget of only $72 million (it is about $1.6 billion today), I could not foresee any substantial investment in experimental science. But Zimmerman tirelessly and courageously strengthened the department step by step on what was a near starvation budget. I hoped at best to advance slowly in all the sciences and engineering while moving rapidly in the less expensive areas of law, management, the social sciences, the arts and the humanities.

Ten years later, however, things were to change dramatically and unexpectedly, as often happens in human affairs when an individual appears with the talent and leadership to make change happen.

In 1983, hosted by So-Young Pi, Harvards Shelly Glashow took his sabbatical at Boston University. It was a development of historic importance, for in the following summer of 1984, Glashow, now fully apprised of the strengths and weaknesses of our programs, met with Larry Sulak and several other

Michigan colleagues who were on sabbatical at Harvard. Larry was developing with the late Vernon Hughes a fast-scintillating calorimeter for a new G-2 experiment and teaching Harvard students Electronics for Scientists (presumably a more dignified course than Physics for Poets). That same summer, Shelly and Joan Glashow invited me to dinner to meet Larry and Beth Sulak. In the course of the evening, perhaps tired of the isolation and dreary winters in Michigan, Beth Sulak rose and asked, Couldnt someone please find a job for my husband in this town?

That set off a chain reaction. Shelly, the Nobel matchmaker, informed me that Larry and his team from Michigan–any one of whom might win a Nobel Prize–were moveable. If we were able to recruit the entire team, Shelly believed they could develop our department into a major center of physics research.

The prospects were alluring. But were they feasible? That is, could we find the funds necessary to support Larry and his team? Larry was obviously interested in moving, for he used spare time from his sabbatical year to develop a five-year plan, tutored by my friend and neighbor Herb Holloman. Then he and Shelly proposed a meeting to present it.

Far from competent in physics and knowing that a move of this sort would require a major commitment from the Board of Trustees, I asked our chairman Arthur Metcalf, himself a physicist and mathematician, to attend the meeting with me. Larry laid out an ambitious plan that he said would in five years raise funding from $1 million to $5 million annually, increase physics majors from 35 to 120 and graduate students from 55 to 100.

All he wanted immediately was 15 new positions, $2 million in seed money for the new faculty and 60,000 square feet of new space. The plan also called for additional facilities by 1988, along with another $2 million to equip them. Altogether he planned a research computation facility, an electronic design facility and a scientific instrument facility. The last was a term of art for a huge factory, equipped with the latest machinery, including CNC machines from Japan, to manufacture all the equipment necessary for a variety of scientific experiments. This facility I could see would be of use not only to physics but to all departments in science and engineering. Larry had done his homework, for he presented his plan with the names of the faculty and staff needed to carry them out.

Metcalf asked searching questions about the scientific issues, and I asked questions about sources of revenue to offset the massive upfront costs, which required an initial infusion of $5 million and tens of millions more for facilities.

Arthur Metcalf and I left our meeting with Sulak eager to discuss his plan and assess the millions in cost against the vision of outstanding departments in all the sciences and engineering. A window of opportunity had opened that had not been foreseen in any of our long range dreams.

I told Arthur that if the scientific program made sense, this was something we ought to do. It is one hell of a gamble, I said, but by frontloading this scheme, I believe we can attract outstanding faculty who in turn will attract outstanding students, and create a major source of tuition and grant revenue to offset the costs. Boston University can now aspire to become a major center for science and engineering that will match our aspirations for the humanities, the arts and non- scientific disciplines.

Metcalf said there was no question about the feasibility of the scientific proposals. These young men, he continued, are all outstanding and there is no recommendation more convincing than Glashows

endorsement. The risk, he added, is financial. Can you pull it off and still balance the budget, he asked. I replied that being President of Boston University was from the start an exhilarating career on the brink of disaster, so we might as well risk it. Metcalf added, If you recommend it, I will support you and urge the Board of Trustees to approve. I am not one, he added, to step on any mans dream.

I noted that we had already asked the Congress to earmark funds to assist us in acquiring facilities and equipment necessary to attract first-rate faculty in science, and in 1985 we received $19 million to build a science and engineering center. The federal funds were supplemented by a major gift from Arthur Metcalf and matched several times by University funds. Thus we could offer Larry his 60,000 square feet in the new Metcalf Center for Science and Engineering, but only by delaying commitments to Biology, which were fulfilled only three years later with the construction of another building.

So the die was cast, and with the superb assistance of our provost Jon Westling we began serious negotiations with Larry by accepting his five year plan. Larry would not commit. But despite his personal indecision, he began recruiting his team: Ahlen, De Rujula, Rebbi, Stone and Whitaker. Before accepting our offer himself, he, with Jon Westlings assistance, developed a high-energy proposal for the Department of Energy, for which Westling wrote a brief, persuasive introduction committing Boston Universitys full support of the proposal. On August 1, 1985, Jon and Larry even went to Washington to present it. All the while, Larry remained at Michigan, still a free agent–tempted but reluctant to jump.

I decided it was time to give Larry a deadline: sign on by December 6, or our commitment to your five year plan will lapse. His acceptance was immediate. Actually, he could hardly have declined, for much of his plan had already been implemented and colleagues had joined Boston University on the basis of his promises.

Two years later, we requested and received $8.5 million in earmarked funds for the biology and physics research center Sulak demanded by 1988. It would also house the scientific instrument facility. Momentum was beginning to develop, and Larrys success in advancing physics dramatically with the appointment of outstanding young physicists whetted the envy and ambitions of the astronomers, biologists, chemists, computer scientists, mathematicians and engineers. All were now thinking big and clamoring for more facilities and additional faculty.

By the close of 1988, external funds raised through peer review in physics had reached $4.5 million and the five year goal to double the number of graduate students had already been reached. Our factory, the Scientific Instrument Facility, was fully engaged completing our projects and contracting projects for Draper Labs, JPL, Caltech, NASA and others. These developments in the sciences helped us persuade the Fraunhofer Institute in Germany to establish a demonstration center for manufacturing engineering here at Boston University by providing $10 million in advanced machinery. And the web was further enlarged by the proposal to develop a photonics center, which led to a grant of $29 million in earmarked funds and additional operating grants.

The synergism that followed the catalytic developments in physics transformed all departments in the sciences and engineering and mathematics.

Let us now carry forward to 2004, the final year of Larrys chairmanship of physics. Consider what had been achieved. The ranking of the physics department, according to the National Academy of Science in its latest report, rose from 74 in 1986 to 35. By objective measures of productivity–the number

of publications, the total number of citations, the impact of those citations (measured as citations per paper), the total external funding and national awards–the department easily ranked among the top 25 of all schools.

Among independent university departments, we ranked in the top ten over the period of 1997-2002 in the number of refereed papers published, ahead of Brown, Carnegie Mellon, Chicago, Columbia, Johns Hopkins and Penn. We were sixth in the number of citations and fourth in the number of citations per paper, ahead of Berkeley, Caltech, Chicago, Columbia, Cornell, Harvard, MIT, Princeton, Stanford and Yale. We even ranked ninth in research funding. These gains had been achieved, moreover, with only 35 faculty members, compared to the national average of 50. Twelve percent were women, double the average of the National Research Councils top 40. Twenty-six new professors joined the physics department over the last 17 years, and in 2004, we could boast the appointment of Sheldon Glashow, who won the Nobel Prize in physics in 1979.

Our faculty has won 35 awards and 95 national physics prizes or fellowships in the last decade. All 13 junior faculty were awarded either NSF career awards or other national awards including seven DOE awards for junior investigators, ten Sloans, four Cottrells, three Guggenheims, two Ulams and many others. The Presidents Citizen of the Year Award for the initiation of the Human Genome Project went to Charles De Lisi in Engineering, who accepted the deanship of Engineering after assessing the renaissance of science at Boston University that followed Sulaks initial initiatives.

The research results are equally impressive. They include the first measurement of the ground state of a nanoscale mechanical oscillator–to visualize it, think of a tuning fork the size of a few atoms; a 2K experiment, which discovered neutrino mass, the first observation of physics beyond the standard model and the highest cited particle physics experiment of all time; a G-2 experiment, a second test for physics beyond the standard model for which a spokesman and two technical team leaders came from Boston University, and which used the ultra fast electronic and mechanical components for the worlds largest superconducting magnet built at Boston Universitys machine shop. The G-2 experiment is the highest cited particle physics experiment for 2001 and 2002. These are only among the finest examples of results by our physics faculty.

In 2004, we had 115 graduate students and 120 undergraduate majors, plus 30 postdoctoral and research professors. One hundred thirty-five PhDs and 165 MAs were awarded in the last decade, and several pre-doctoral students won prizes including the Nottingham Prize, the NSF Graduate Fellowships and the Wigner Prize.

At a time when technical support has dwindled at most research universities, ours has increased as we have shared outstanding scientific facilities and equipment with all departments of science. Our Scientific Instrument Facility may be the best of any university in the country. There we constructed the first and only telescope for the South Pole, and constructed most of the components for the G-2 storage ring at Brookhaven, the worlds largest and most accurate superconducting magnet. The Electronic Design Facility designs and produces state-of-the-art chips and circuit boards for the major forefront projects at Fermilab, Brookhaven and CERN. Our Center for Computational Services provides supercomputer power for all the universities in the Boston area, including our own. This NSF center is a source of unparalleled level of supercomputing for faculty members and students.

The results for the University as a whole can best be seen by comparing award totals. From 1984,

when Larry Sulak came here on a sabbatical, to when he left on sabbatical in 2004, the results were as follows:

- In FY1984, peer-reviewed research awards for physics totaled $1.06 million. In FY2004, they totaled $10.7 million, an eleven fold increase–in constant dollars a five-and-a-half fold increase.
- In the natural sciences, including physics, peer-reviewed grants totaled $5.8 million in 1984 and $49.8 million in 2004.
- In engineering, peer-reviewed grants totaled $1.3 million in 1984, and $30.4 million in 2004.
- Peer-reviewed research grants in science and engineering totaled $7 million in 1984, and $80.2 million in 2004.

This eleven fold increase or, adjusted for inflation, this six-and-a-half fold increase in science and engineering research is as objective a measure as one can ask in assessing the quality of science at Boston University. It also measures the value of Congressional earmarking. By helping to provide superb facilities and equipment for scientific research, the earmarked grants enabled us to finance Sulaks goals along with the ambitions of his colleagues in the other sciences. The quality of our superb faculty is confirmed by the dramatic increase in peer- reviewed grants. Peer-reviewed grants to the faculty of Boston University now almost equal annually all the grants provided by Congressional earmarking. Earmarking achieved the Congressional purpose: it helped establish a new center of first-rate research in the sciences as now measured by peer review awards.

These results reflect the presence here of outstanding faculty in all fields of science and engineering who would never have come or ever been as successful in competing for peer-review awards had it not been for the foresight, determination and irrepressible enthusiasm of Larry Sulak. He painted a glorious scientific future for Boston University that no responsible administration could refuse to support. And his example stimulated his scientific colleagues in all fields to follow his lead. I am proud of what Boston University has been able to accomplish, thanks to trusting this daring young man. Our accomplishments not only in physics but also in biology, chemistry, computer science, mathematics, engineering and in bioengineering are all ripple effects of the brilliant leap forward in physics under Larry Sulaks leadership.

One final word: behind every great man is a surprised mother-in-law. Alberta Annon Carten, like Larry, is from West Virginia and is here with us tonight. Larrys mother is here too.

There is also behind every great man a strong woman, and that strong woman, Beth Sulak, accounted not only for a large part of Larrys success but also of mine when she rose from the table at that dinner party in 1984 and asked, Couldnt someone please find a job for my husband in this town?