64. Undergraduate Life from a Faculty Perspective

Carlos Stroud

Many alumni of the Institute have remarked on the profound effect their education had on their lives. There is one exclusive group who one might expect were most profoundly affected by their time spent in The Institute of Optics. The group includes at least seven: James Forsyth, Steve Jacobs, Wayne Knox, Alex Gaeta, Dan Gauthier, Mark Biermann, and Mark Beck. Each began his higher education as an undergraduate optics major, continued all the way through the doctorate at Rochester, and then went on to hold a faculty position. Reflecting on this list, it occurred to me that there must be something about our undergraduate program that inspired this group to continue their optics education and emulate their mentors in an academic career, so I asked some of them to recount the formative experiences that they had.

Mark Beck received his B.S. in optics from the University of Rochester in 1985, and his Ph.D. in 1992. He is now associate professor of physics at Whitman College in Walla Walla, Washington. He writes:

I vividly remember my first Optics course—Geometrical Optics with Duncan Moore. Working on that ray tracing program using punch cards and the old IBM mainframe was quite a challenge. I even remember one of our exam questions that asked about the eye of an anablebs fish. It lives on the surface and its eye sits half in the water and half out, yet both halves are in focus! I actually saw some of these fish in an aquarium a couple years ago and instantly recognized them.

One thing I really appreciated as an undergraduate was the opportunity to work on a research project. I wasn’t alone in this, a number of my friends had research jobs, either at the Institute or at the Laboratory for Laser Energetics. Working on this project hooked me on research, and strongly influenced my decision to pursue a Ph.D. It influences me to this day, as I teach at an all-undergraduate institution and nearly all of my current research involves undergraduate students. I’m glad to be able to provide them with an opportunity similar to the one I had.

Mark L. Biermann is associate professor of physics at the U.S. Naval Academy. He began his studies in the Institute in 1980 and completed his Ph.D. in 1991.

I was an undergraduate in The Institute of Optics from 1980 to 1984. I have many memories of that time, from our first freshman Optics course with Dr. Chris Dainty, to our senior Optics Laboratory with Dr. Parker Givens. However, one of my most vivid memories is associated with the Geometrical Optics I course, Optics 241, with Dr. Duncan Moore. Anyone who took this course during this time period will immediately know the single component of Optics 241 that I am about to refer to. This assignment was a touchstone for Optics majors for years and was clearly seen as a key rite of passage. The assignment was, of course, the computer ray tracing and aberration analysis project. The “computer program,” as it was generally referred to, was an important part of Optics 241 for years. Our class was in a unique position, however. In taking the course in the fall of 1981, we were the last class to do the program almost exclusively on punch cards. The use of terminals...
to talk to the IBM mainframe had just been introduced, but terminals were tough to come by and the safest approach in the fall of 1981 was to rely on the tried and true punch cards. The use of punch cards, while inconvenient, actually helped to forge a clear sense of community among the Optics majors of the class of ’84. During the week or two leading up to the due date for the program, I could always count on finding a dozen or more fellow 241 students in the computer work room where the punch-card reader was located. Anytime of the day or night, there was a strong Optics presence to be found. Working in that small space in Taylor Hall, we all felt great when somebody’s “a-ray” made it through correctly, and shared the disappointment of the wrong value for the Petzval field curvature. The experience helped us to see ourselves not just as college students, but more importantly, as Optics students. While the “computer program” was not always fun, it certainly helped to give us a strong sense of what it meant to be an Optics major in The Institute of Optics.

Alexander Gaeta is associate professor of applied and engineering physics at Cornell University. He received his B.S. in 1983, M.S. in 1984, and Ph.D. in 1991.

When I started as an undergraduate in the fall of 1979, I had intended to major in Physics and Astronomy. An upperclassman told me that there was this cool major called Optics which involved lasers and the sort. I took Optics 100 that Spring taught by Conger Gabel, and within a week I knew that optics was what I wanted to study. The optics classes were the ones I enjoyed the most and although my tennis pursuits interfered with my academic performance, I still remember well the material I learned in all these courses. Inspired by Duncan Moore’s lectures, I offer “Shorts” in all the classes I now teach.

Curiously it was fate that intervened my senior year and led me to my career in nonlinear optics. I was considering applying to the Master’s program and was told by a straight-talking faculty member that I would have to work in a faculty member’s lab if I was to have any chance of being admitted. My undergraduate advisor, Prof. Chris Dainty, wrote down a list, in alphabetical order, of faculty who he thought would be looking for undergraduates to work in their labs. Bob Boyd’s name was at the top of the list and I went to see him, having no idea what nonlinear optics was. The rest, as they say, is history. I’ll always be immensely grateful for the opportunity to work in his lab as an undergraduate. His encouragement and the experience of seeing and working with his graduate students inspired me to focus my efforts on more intellectual endeavors which culminated in receiving my Ph.D. under his supervision.

Daniel J. Gauthier is the Anne T. and Robert M. Bass Associate Professor of Physics and associate professor of biomedical engineering at Duke University. He received his B.S. in Optics in 1982, his M.S. in 1983, and his Ph.D. in 1989.

The Class of 1982 was part of a growing movement in optics, both in the Institute and around the country. Our class was substantially larger than previous years (just under thirty) and was an indicator of much larger classes to come. Yet, the class size was small enough so that we received a lot of attention from faculty while it was large enough to take on new activities. We started the first Student Chapter of the Optics Society of America for the expressed goal of learning more about careers in optics, networking, and having good parties (which Dean Thompson was more than willing to support). The chapter was very active in bringing in speakers from local industry and taking tours of their facilities, and hosting evening pizza parties and an occasional faculty/student social get together (usually surrounding a keg . . . ). On the job front, we were most impressed by the number of companies willing to wine and dine us as soon as we declared the Optics major; little did we know of the boom and bust cycles of the optics industry!

One fond memory of life as an undergraduate in the Institute were the laboratories associated with most classes. While time consuming, it was great to get our hands on the real thing, even when the rail for the “Fourier Transform Processor” was a bit wobbly, for example. While independent study projects weren’t emphasized, many of us found a job working on some small project, such as playing around with a small CO_2 laser (which we never were able to get working). All in all, we had a great time together and managed to get in quite a bit of fun in between classes and homework!
Stephen Jacobs is senior scientist at the Laboratory for Laser Energetics and professor of optics and chemical engineering at the University of Rochester. His connection with the Institute is the longest of the group, dating back more than halfway to the founding of the department.

Thank you for the opportunity to share some thoughts on what it was like for me to be an undergraduate in Optics at The Institute during the 1960s. I entered the U of R as a freshman in 1966 and graduated with a B.S. in 1970. I must have enjoyed the experience, because I never left.

Our first introductory optics class was taken in the beginning of the sophomore year. I remember that this was the first contact I had with an Optics professor. We met on the fourth floor of B&L in a small room. Of the approximately six of us students, I recall Cynthia Barnes, Jay Eastman, Mark Westcott, and Jim Buran. It was kind of like magic when W. Lewis Hyde showed up for lecture. He was the director of the Institute and what a gentleman! Always dressed in a coat and tie, he had these special felt markers to use on the overhead projector. There was this continuous roll of transparency that he wrote on during class. He seldom made mistakes or crossed anything out. His printing was neat and easily read. The book was Jenkins and White. It was much drier than his lectures, which were always well organized. I credit him with conveying to me the elegance of optics.

Two of the classes I took during the junior year were also held in this small lecture room on the fourth floor of B&L. They were taught by Peter John Sands, an assistant professor from Australia who was learning everything he could about advanced lens design during his time at The Institute. Prof. Sands taught us atomic and molecular spectroscopy, and for the second semester he offered the six of us a course on polarized light. This turned out to be my favorite course, and he was a great teacher. He used Shurcliff’s book that had just come out in 1966. I still remember his fondness for the pop quiz, and my marginal performance on these surprise tests. We argued about giving them. I lost. I credit him with conveying to me the excitement in optical engineering.

In the late 1960s the undergraduates received a lot of attention, because our numbers were so few. That put us in a great position to do well in our Senior year, when we took the same classes as the graduate students. I’ll never forget Senior lab in Gavett Hall. [No one forgets Senior lab!] Cynthia Barnes was my lab partner, and she often had to leave somewhat early to attend a graduate course in lens design. She was always irritated with me, since the labs seemed to drag on until after her departure. This made her writing a difficult endeavor. Sorry Cynthia.

Congratulations to The Institute on seventy-five years of excellence. It has been my good fortune to have shared thirty-eight of them.

James Zavislan, currently associate professor of optics at the University of Rochester, received his B.S. in Optics in 1981 and his Ph.D. in 1988. He worked in industry for several years and recently returned to the Institute as an associate professor.

I arrived as an undergraduate at the University of Rochester and the Institute of Optics in 1978 from Colorado. At the time the twenty-four-beam Omega Laser system was being
completed at the Laboratory for Laser Energetics. I was interested in working in optics so I applied for a job at the laser lab as soon as I arrived. My first job was copying the pencil-on-vellum engineering drawings onto blue prints. It was a tedious job involving spending hours aligning large sheets of paper into a noxious ammonia-spewing duplicator. However, it was a wonderful introduction to a large-scale engineering project. I can honestly say that I saw every part that went into the laser system. I also saw how many revisions were required on seemingly simple parts. The drafting area and duplicator was located in the future target bay for the laser fusion system. It was exciting to think at some point in the future twenty-four laser beams would be replicating the conditions of the Sun inside a laboratory. My affiliation with the laser lab continued throughout my undergraduate years. Because I was previously trained as a machinist, I later worked for several scientists machining mechanical parts for various laser or optical metrology systems. Everyone with whom I worked was helpful in teaching me about their research. I learned about and worked on instrumentation to make ultra-fast laser pulses and high damage threshold optical coatings.

In my junior year I took the optical interference coatings class taught by Professor Jay Eastman, then the director of the LLE. I remember one homework assignment was particularly difficult: Design an anti-reflection coating for $1\omega$, $2\omega$ and $3\omega$. Nobody in the class was able to meet the specifications, although some of us came close. When we remarked to Prof. Eastman how challenging the design was, he told us, “Yes, we need this coating for Omega but we have not come up with a solution yet so we thought we would give the class a try. We don’t know if a design exists.” It was a great lesson that not all problems have solutions.

Taking classes from famous faculty could be intimidating, but I remember many light-hearted moments: Professor Givens wore a honey bee tie tack when he taught about the optics of the honey bee. Professor Kingslake told us that we could call him at home before 10:30 if we had any questions, “I don’t hang out at the bars anymore.” Professor Thompson would give an annual skit on “How not to give a technical presentation,” and commenting that for a successful career one should cultivate a British accent.

I often encourage students to develop fundamental understanding and intuition about the behavior of light in different environments and systems; I tell them to “be the photon.” As an undergraduate at The Institute for Optics and the Laboratory for Laser Energetics, I was surrounded by photons in myriad of circumstances. The combination of theoretical and applied understanding I learned at the Institute and LLE helped develop a deep appreciation for breadth and depth of optical engineering and optical sciences. I am deeply thankful for the education and the experience.

The experiences of two others among this group, Wayne Knox and James Forsyth, are recounted in separate essays in this volume.