

## Director's letter

"Taking the academic steps one at a time? ... How can that possibly lead to where I want to go fast enough? I have to be ready to apply to med school or grad school." Hey, I don't remember being that impatient when I was in your shoes. Well, maybe it was too long ago and I just don't remember? But no, I think the correct answer is that things are very different today. The way things work now is that there are really lots of steps you're asked to take; distribution requirements, foreign language, freshman seminars, major and honors requirements; but the steps are not all the same size and not all of them have the same effect on your brain. And the funny thing is that you might take a giant step at some point and only later recognize that fact. Sort of like, "Wow, how did I get here from there?"



In this message I want to describe one such seemingly improbable part of the learning process, a special kind of step, the Out of Classroom Experience. The OCE can appear in many forms. It starts when you have a really good idea, possibly stimulated in a formal lecture setting, or maybe in a seminar, and you are motivated to look at a subject very differently and become engaged through one-on-one discussions with experts, or with your peers, or in independent reading and research. There can be a huge leap in understanding that comes from the OCE. Let's look specifically at the research experience: ISP-398 Independent Research. This can be powerful stuff! It can leave a mark on you forever, changing your academic direction and establishing your career. ISP's are strongly encouraged to get involved in research. It's about opening up new kinds of learning pathways where you are more in control, as compared with the specific expectations from a classroom experience of a predetermined curriculum. In the research experience, you make key choices. You make distinct scientific contributions. You declare ownership and grow confident. You represent your achievements to others, peers and professionals, and you have impact on admissions committees and scholarship boards.

The research experience will blend the theoretical structures with practical issues. Let's take an example: Gauss' Law is beautiful. Let's prove it using the divergence theorem and the definition of solid angle! Now over in the laboratory, on the practical side, say I want to remove electromagnetic interference from the coupling circuit of my NMR probe; this is a very practical problem, directly related to Gauss' Law. The motivation from the latter problem gives meaning to the former and vice versa. There is another aspect concerning OCE, and I hope some of our alums can provide feedback here. I suspect that the OCE provides a mechanism for the rigorous, broad ISP training to help you accommodate the practical constraints of the real world, by which I mean life-after-ISP. So the research experience may be the most expeditious way to learn how to apply your formal training effectively.

Speaking of the real world, the ISP house now has new central air conditioning, new carpeting and 'new' furniture too. Steve Daut and Laurence Berland are installing a new server this summer. And the plans for developing an advanced ISP computational science center are finally on the move!

Twenty-two of you graduated this year pushing the envelope with your strength, perseverance, ambitions, and accomplishments; just read all about it in this newsletter. This fall we have 35 new faces with fabulous potential ... look out!

This is my last term as director and so let me take the opportunity of welcoming Chemistry Professor SonBinh Ngyuen, our new director of ISP. To all ISP's everywhere, thank you for being ISP and thank you for your support. Keep climbing those mountains and keep in touch.

Bill Halperin  
 Director, Integrated Science Program and  
 John Evans Professor of Physics



### Special points of interest:

- Current Students' Exciting Summer Plans
- ISP Graduates' Amazing Achievements
- Alumni News

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# ISP Independent Research

**Independent Research is an integral part of the ISP Program.** Each year an average of 30 ISP students participate in ISP 398 Independent Research projects here at Northwestern. ISP's gain valuable hands on exposure to areas including physics, chemistry, biological science,

geological science, computer science, and neurobiology among many others. This work often leads to publication in respected academic journals. Read more below about our current students' and recent graduates' research experiences.

## Awards and Honors

(Note: EC = Entering class)

We had not one, but two Goldwater winners this year! Congratulations to **Wen Liu Hao and Silpa Patel!** (both EC01). For those unfamiliar with the award, "The Barry M. Goldwater Scholarship Program was created," according to the Goldwater website [www.act.org/goldwater](http://www.act.org/goldwater), "To encourage outstanding students to pursue careers in mathematics, the natural sciences, or engineering and to foster excellence in those fields." It is clearly one of the top undergraduate science scholarships in the country. This accomplishment is even more impressive considering both

students were sophomores when they won the awards. There were 200 scholars selected nationwide, and 3 from Northwestern. Wen is majoring in ISP and Chemistry and Silpa is majoring in ISP and Biology. Among our students' many other awards, **Katie Lovejoy (EC99)** won a Fulbright Scholarship. She plans to conduct research in Mainz Germany at the Max Planck Institute (see more below). **Nathan Gouwens (EC99)** won the Churchill Scholarship and a Howard Hughes Medical Institute Predoctoral Fellowship. This was the first time since 1964 that an NU student has won the Churchill

Scholarship and the first time ever an NU student has won the Howard Hughes Fellowship. Way to go Nathan! In addition, three more of our students were inducted into Phi Beta Kappa: **Lucas Koerner, Katie Lovejoy, and Laura Wysocki.** All are from EC99. Seven EC99 and one EC98 students graduated with honors in ISP. We would like to congratulate those who have achieved this remarkable accomplishment: **Lucas Koerner, Jessica Edmonds, Nathan Gouwens, Laura Wysocki, Michael Henninger, Will Salerno, Vishal Verma, and Elyssa Burg.**



ISP EC02 Students Anne Fabricus, Todd Levin, Becky Hostetler, Becky Miller, Amy Rines, and Nathan Brown

# Our Outstanding 2003 Graduates

**Brian Alexander** graduated with a double major in ISP, Biological Science, and Mathematics. Brian worked for several quarters in the BMBCB laboratory of (Biology Molecular Biology Cell Biology) Professor Jon Widom. His mission was to develop an effective strategy and corresponding detailed algorithm for solving a novel and computationally inaccessibly large DNA sequence alignment problem that arises naturally from ongoing experimental work.

**Elyssa Burg** graduated with a double major in ISP (honors) and Biological Science. She was the recipient of the Erwin Macey Scholarship in Life Sciences. Her research in the laboratory of Professor Ravi Allada in the Neurobiology and Physiology (NBP) Department focused on how the disruption of synaptic transmission affects the circadian rhythms of *Drosophila melanogaster*. Elyssa will continue her studies at the University of California San Diego where she will study biomedical science.

**Janet Choi** graduated with a double major in Integrated Science and Biological Science. She will be attending medical school at the University of Illinois this fall. Janet conducted research in the Neurobiology laboratory of Professor Mark Seagraves where she analyzed data obtained from behavioral and neuronal recording studies of rhesus monkeys.

**Jessica Edmonds (EC98)** graduated with a double major in ISP (honors) and Mechanical Engineering. She received many awards and honors such as membership in the Golden Key National Honor Society and the National Society of Collegiate Scholars. Her abstract "New Mariner 6 and 7 Mosaics of Mars: Clues about Time Variable Surface Features", (Edmonds, J.L, and M.S. Robinson) from the 2003 Lunar and Planetary Science Conference was recently published. She also presented at the same conference "Variations in Size and Location of Albedo Features on Mars." Jessica received sponsorship by NASA and the Illinois Space Grant Consortium to attend the NASA Academy in 2000. Jessica will be

pursuing an M.S. program at MIT in the Department of Aeronautics and Astronautics where she will be doing a research assistantship under Dr. Larry Young in the Man-Vehicle Laboratory, studying the effects of a centrifuge bed on the vestibular system. During her undergraduate career Jessica achieved a personal goal to become a licensed airplane pilot.

**Nathan Gouwens** graduated with a double major in ISP (honors) and Biological Science. He was the winner of numerous honors: the 2002 Barry M. Goldwater Scholarship, a Churchill Scholarship, a Howard Hughes Medical Institute Predoctoral Fellowship, Phi Beta Kappa, and was a College Scholar and an Oliver Macey Scholar. Nathan worked for many quarters in the Neurobiology lab of Professor Indira Raman. Some of Nathan's work was recently published, "The Contribution of Resurgent Sodium Current to High-Frequency Firing in Purkinje Neurons: An Experimental and Modeling Study" in *J. Neurosci.* 2003 23: 4899-4912. Zayd M. Khaliq, Nathan W. Gouwens, and Indira M. Raman. His work involved making electrophysiological recordings of ionic currents from the neurons in the cerebellum known as Purkinje cells. This information was used to construct a computer simulation of

an entire Purkinje cell body. Nathan will be going to study at the University of Cambridge Churchill College where he will be conducting neurobiology research in Dr. Hugh Robinson's laboratory in the Department of Physiology. Nathan was also a Student Advisory Board member for ISP and a teaching assistant for the ISP 101 Computing Applications Course.

**Michael Henninger** graduated with a triple major in ISP (with honors), Physics, and Mathematics. Mike has worked for a number of quarters in the Physics and Astronomy laboratory of Professor Vicky Kalogera. Mike is working on a project investigating the interior structure of massive stars in the context of driving and surviving mass transfer episodes on dynamical time scales. Mike will continue to work with Professor Kalogera before either going to grad school or joining the Peace Corps.

**Judy Huang** graduated with a double major in ISP and Chemistry. Judy conducted research in the Geological Sciences laboratory of Professor Brad Sageman. She also worked in the laboratory of Professor Mark Hersam in the Materials Science Department where she collected image data of a known sequence of DNA and analyzed



Spring 2003 ISP Graduates. Twenty-two students graduated this year.

# Our Outstanding 2003 Graduates

this data for information about certain physical properties such as bendability and bendedness. In addition, she used an Atomic Force Microscope to collect image data of carbon nanotubes that were used to examine how effectively a surfactant encapsulates carbon nanotubes.

**Sean Jabbar** earned a double major in ISP and Biological Science. He received a UW-Madison Fellowship for next year. Sean plans to start a Ph.D. program in cancer biology at the University of Wisconsin-Madison this fall. Sean worked for several quarters in the BMBCB laboratory of Professor Richard Morimoto. He worked to characterize the osmotic stress resistant (osr) mutagens in *C. elegans*. This included the characterization of the phenotypes of *osr-3* using 2 factor mapping, complementation experiments, and survival experiments.

**Lucas Koerner** graduated with a triple major in ISP (honors) Physics, and Mathematics. Among his many awards were a National Science Foundation Graduate Fellowship Honorable Mention, Phi Beta Kappa, and the WCAS Hurd/Kriegbaum Award. He will be attending a graduate Physics program at Cornell. Lucas conducted research with Physics Professor Paul Umbanhowar for a number of quarters in his Laboratory for Non-linear Science. He worked on a project to measure the amplitude of standing waves in vertically oscillated granular layers.

**David Kohn** graduated with a double major in ISP and Biology. He worked with Physics Professor Donald Ellis with whom he investigated acoustical properties of the violin. To this end, he also constructed a variable-speed, variable pressure bowing mechanism. David plans on attending medical school.

**Jeremy Kohn** graduated with an Integrated Science Program degree. He conducted research with Physics Professor Donald Ellis to investigate the optimal method for separating individual human voices from recordings of a capella music. This required comparing algorithms of different types to determine which

characteristics make an algorithm more effective in separating time synchronized human voice mixtures.

**Katherine Lovejoy** graduated with a double major in ISP and Chemistry. She earned many awards including an NSF graduate Fellowship, a Fulbright Fellowship, Phi Beta Kappa, a Deutscher Akademischer Austausch Dienst (DAAD) Fellowship, the NU Women in Leadership Pathbreaker Award, an NU Undergraduate Research Grant, the Marple-Schweitzer Award, the Basolo-Osper Award for citizenship in the Chemistry Department, and the Excellence in German Award. Katie was also president of the Undergraduate Chemistry Council and a representative for ISP to the WCAS Student Advisory Board. This fall, Katie will travel to Mainz Germany where she will do research on model biological membranes at the Max Planck Institute for Polymer Chemistry. This work will be supported by her Fulbright grant. Katie recently had a paper published in *Angewandte Chemie* "Archae Thiolipies for Tethered Bilayer Lipid Membranes on Ultrasmooth Gold Surfaces" (2003, 2, 208). In August 2004, she will begin work on her PhD at MIT.

**Alia Majeed** graduated with a double major in ISP and Biology. Alia conducted research for several quarters in the NBP lab of Professor Ravi Allada where she established an assay for general anesthesia using an inebriometer. She also used the assay to screen for anesthetic mutants.

**Emily McGuiness** earned a triple major in ISP, Math, and Physics. She worked for several quarters in the Physics laboratory of ISP Director, William Halperin. Emily worked on a research project in which she studied the normal state and superconducting properties of single crystals of the high temperature superconductor BSCCO,

which has high isotope exchange for  $^{17}\text{O}$ . Her work was recently presented at the annual March meeting of the American Physical Society.

**William Salerno** graduated with a double major in ISP (honors) and Mathematics. Will conducted research for a number of quarters in the BMBCB laboratory of Professor Ishwar Radhakrishnan. Will worked to analyze protein-protein interaction motifs using a bioinformatics approach. Specifically, his analyses focused on how calmodulin (an important protein that is involved in signal transduction in the cell) binds to a range of structurally diverse targets.



Recent grads Will Salerno, Brian Alexander, Vee Verma, Lucas Koerner and Mike Henninger ham it up outside the ISP house

**Joseph Skalski** pursued his interests in the humanities in addition to science and mathematics and graduated with a double major in ISP and history.

**Shawn Stevens** graduated with a double major in ISP and Geology. Shawn participated in a number a research projects while here at Northwestern. He worked with Geology Professor Emile Okal to investigate the unpatterned disappearance of t-waves on the Easter Island of Rapa Nui. He also worked on a parallel processing research project in the Computer Engineering laboratory of Professor Valerie Taylor.

# Our Outstanding 2003 Graduates

**Adam Tenderholt** graduated with a double major in ISP and Chemistry. Adam was the recipient of an Undergraduate Summer Research Grant and a Katherine Kriegbaum Scholarship. He will be pursuing a PhD in Chemistry at Stanford in the fall. Adam was also our ISP tutor for the 2002-2003 academic year. He conducted research in the laboratory of Chemistry Professor Hilary Godwin where he investigated the metal-binding properties of DNA-Binding domains of the glucocorticoid receptor.

**Brandon Toyama** graduated with a double major in ISP and Biological Science. He was the recipient of numerous awards including two undergraduate summer research grants, a 2001 bioinformatics grant, an Erwin Macey Research grant, and the Emmanuel Margoliash Prize in Basic Research. Brandon also received honors from the Biological Sciences Department. He will be attending the graduate program in Biology at the University of California at San Francisco. Brandon conducted research in the laboratory of Professor Richard

Morimoto in the BMBCB department. His project concerned characterization of a protein named p60. Another project of Brandon's focused on a binding study of Hsp70 and the co-chaperone Bag1.

**Vishal Verma** graduated with a double major in ISP (honors) and chemistry. Vee was awarded a Rosaline Cohn Scholarship, an NU Undergraduate Summer Research Grant, in addition to other NU Undergraduate Research grants. He plans on attending the graduate program at Stanford University in Chemistry. Vishal conducted research in the laboratory of Professor Terry Sheppard where he worked on a project to use nucleic acid conjugates for directed molecular synthesis.

**Laura Wysocki** was the recipient of an Undergraduate Summer Research Grant, earned Phi Beta Kappa, a member of the Order of Omega, Rho Lambda, Gamma, Sigma Alpha, the Lucent Technologies Fellowship for Graduate Research for Women. She graduated with a double major in ISP (with honors) and Chemistry. She will be participating

in a summer internship at Bell Labs this summer. In the fall, she will start graduate school at the University of Wisconsin-Madison in Organic Chemistry. Laura conducted research in the Chemistry laboratory of Dr. Richard Silverman where she worked on methods to increase the yields of several solid-phase synthetic reactions. She also assisted high school teachers at Evanston Township High School in physics, chemistry, and biology classes and is interested in a career in teaching

**Kenneth Yu** graduated with a double major in ISP and Physics (with honors). Ken worked for several quarters in the Physics and Astronomy laboratory of Professor Fred Rasio. His research focused on studying the dynamics of planetary systems with a view of explaining observed orbital properties of extrasolar planetary systems. Some of his work is to be published in the ASP Conference Series' Scientific Frontiers in Research on Extrasolar Planets. The article is titled "*Dynamical Instabilities in Extrasolar Planetary Systems*." by Ford, E.B., Rasio, F.A., & Yu, K. Ken will continue his research in the Rasio lab next year.

## Summer Plans



ISP EC02'ers Audrey Thompson and Chiaki Nakanishi

Many ISP students keep busy in the summer months by continuing their research both here at NU and in many academic institutions across the country. Here is a sampling of what our students are up to this summer:

Goldwater winner **Wenliu Hao (EC01)** is participating in an REU program at MIT's Materials Processing

Center. He is investigating solid-state solvation effect in organic thin films. This phenomenon allows the same molecule to emit different colors of light by simply changing its surroundings. This has applications in organic LED devices and in making future flat panel displays that are thin enough to be folded like a piece of paper.

**Audrey Thompson (EC02)** is working in the Chemistry laboratory of Professor Hilary Godwin. Her research involves the effect of heavy metals, specifically lead, on proteins in the human body. She will also be working on an independent physics project with Professor Michael Schmitt.

**Becky Miller (EC02)** will be working with Dr. Michael Schmitt in a relativistic particle physics project this summer.

**Mike Henninger (EC99)** will be working in the theoretical astrophysics

group with Professor Vicky Kalogera. This work is being funded by a NASA summer grant.

**Jon Fidler (EC00)** will be working in Chicago at the NU Medical School in the laboratory of Dr. Richard Miller. He will be working with a line of ubiquitous-mutant mouse stem cells and learning and performing electro-physiology techniques.

**Taylor Raack (EC01)** will be working at the NASA Glenn Research Center in Cleveland Ohio. He is working in the Electro-Physics branch of the Power and On-Board Propulsion Division of the Research and Technology Directorate. He will be creating a computer model that simulates ion beam sputter deposition of thin gradated cermet films on solar panels and studying the electrical and optical properties of those films.

# Alumni News

Please drop us a note at [info@isp.northwestern.edu](mailto:info@isp.northwestern.edu) or write us at ISP, 616 Noyes Street, Evanston, IL 60208 if you will be changing addresses. We also love to hear about your career and personal accomplishments.

We got word from quite a few of our alumni this year. We're glad to hear everyone is doing so well. Keep in touch!

**Kevin Curran (EC90)** left New York in October to work for SAP AG at their world headquarters near Heidelberg Germany. SAP AG is one of the world's largest software manufacturers. He has been working as an Intellectual Property (IP) counsel/IP strategist. His responsibilities include prosecution, litigation, and management issues relating to SAP technology.

**Dr. Sapan Shah (EC89)** is currently President and CEO of the US subsidiary of Shionogi & Co, Ltd, a Japanese pharmaceutical company. His company works to develop drugs for the US market in areas including HIV, cancer, Alzheimer's, and stroke. Dr. Shah received his PhD in Molecular Biophysics and Biochemistry from Yale University before leaving for the business world.

**Jen Vomasse (EC98)** is working with the Peace Corps on a public health project in Kenya, mostly concerning HIV/AIDS education and prevention. Her project included 3 months of training and she will spend two years overseas.

**Brian White (EC96)** recently completed his master's degree in geophysics at Washington University in St. Louis and has begun work on his PhD. He has been heavily involved in fieldwork installing seismometers in Fiji, Tonga, Antarctica and all across North America. His current research involves studying plate bending at subduction zones.

**Noura Dabbouseh (EC98)** has been awarded a Fulbright Grant to perform Bioinformatics research in Barcelona, Spain this fall. Great work Noura! She

writes "For fields such as bioinformatics that do rely on multiple disciplines (math, biology, computer science), the ISP program was invaluable as academic preparation. Noura finished her Master's in Computer Science at NU last year. Her thesis was titled "Counting Possible Splicing Patterns in a Genomic Sequence".

**Ethan Siegel (EC96)** is studying theoretical astrophysics at the University of Florida and is taking courses in particle physics, quantum field theory, and general relativity. He is working with Dr. Jim Fry in Cosmology and writes that he "even managed to come up with a few original ideas-who knows if one of them may pan out to be good and useful?"

**Peter Schroeder (EC91)** earned an MA at UC Berkeley. He is currently involved in several projects at the Berkeley Space Science Lab with his research advisor Dr. Bob Lin. Their work involves measuring the plasma in the solar wind and magnetopause as well as monitoring conditions on the sun. Their goal is to better predict "space weather" which can cause radio blackouts, failure of electrical grids on Earth, and jeopardize the safety of astronauts. All of their projects are funded through NASA or the European Space Agency.

**Tim Harline (EC87)** and **Kirsten Frank (EC85)** sent us a note announcing the birth of their daughter Emily. Congratulations and best wishes!

## Donor Thanks:

Thanks to all of our donors over the last year: David Aaronson, James Chapko, Dr. David Darwin, Suzanne Casement, Dr. Philip Kaldon, Jim Pendleton, Howard Schwartz, Dr. Paul Kenji Seo, Bradford Friedman, Jeff Goldman, David Kohn, Rebecca Levin-Goodman, Susan McMonigal, Robert Singer, Chris Vargas, Heather Viles, and to Tim Krauskopf for his advice and guidance and his continuing support of the ISP Program over the years! Remember, if you make a gift to NU, write ISP on the comment line of the

check, to make sure it goes to the Integrated Science Program. Keep in mind that many companies have matching programs for gifts. This could effectively double or triple the amount that you give. Ask in your human resources department for information on how to do this.



*Nathan Brown and Oliver Chen show off their gastronomical skills at the ISP Spring BBQ. Who said ISP'ers weren't well rounded?*

Visit our Website at  
[www.isp.northwestern.edu](http://www.isp.northwestern.edu)

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