Students involved in research:
We would like to include your work in our next issue.
Contact us if you are interested!

 Biochemistry Book Swap

Each Semester, the Biochemistry Advisory Board will loan out textbooks for Biochemistry courses, prerequisites and electives (including select courses in Biology and Chemistry). In exchange, the student will be asked to put down a deposit at the beginning of the semester, most of which they will be refunded upon returning each book to the Biochemistry Advisory Board. **We reserve the right to keep your deposit if you do not return the book.** Books should be returned during finals week of the semester they are borrowed, the exception being the textbooks borrowed for year-long courses (such as Organic Chemistry).

How to borrow: Keep an eye on your inbox at the beginning of next semester for more details about how to get involved.

How to donate: If you have an old copy of any Biochemistry, Biology or Chemistry textbook, and are willing to donate it to the Book Swap, please send an email to Maura Loew (mloew1@binghamton.edu).

Example: The used 7th Edition of Organic Chemistry (Carey)
You pay $135
You get back $125 upon returning the book
Dear students, alumni and friends,

As you enjoy the summer, take some time to learn about what biochem students have been doing here at BU and what our alumni are doing with their biochemistry degrees. We hope that this newsletter will enlighten current undergrads as to the benefits of engaging in research activities and summer internships. We also want to inform alumni about all the exciting work going on at their alma mater.

This year we had two helpful career-related events for biochemistry students, thanks to our alumni reaching out to us. This fall, Dr. Scott Obach ’85 visited campus to tell students about his career as a scientist for Pfizer. Dr. Obach studies drug metabolism, an important part of the drug discovery pipeline that was described in the last newsletter. His presentation shed light on careers in the pharmaceutical industry at various levels of education, from bachelor's to doctorate. For those of you who enjoyed the section of Chem 434 on drugs, a career in the pharmaceutical industry might be right for you!

Another alum, Pavel Tishchenko ’07, put us in touch with Regeneron Pharmaceuticals, where he had done an internship. This spring, representatives from Regeneron visited campus to recruit seniors. They also held an information session about the research Regeneron does and what it's like to work for them. Regeneron's drugs are fusion proteins that include antibody fragments against targets associated with disease. For example, wet macular degeneration is caused by blood vessels growing in the part of the eye responsible for central vision and fine details. Regeneron is using an antibody fragment that binds to VEGF, a necessary growth factor for blood vessels. VEGF cannot bind to receptors, and new blood vessels cannot grow. This drug may also be able to treat cancer, because tumors require new blood vessels to supply them.

Yet another tie-in to drug discovery is the newest chemistry department professor, Dr. Ming An. Dr. An did his post-doctoral work at Yale University, researching a peptide that inserts itself into cells that are in relatively acidic environments (pH ~6). Since extracellular acidity is characteristic of tumors, this peptide could be used to deliver drugs selectively to cancer cells. Dr. An will be teaching a course in the fall titled "Chemistry in Drug Discovery."

Maura's article on careers for biochemists will be helpful to current students. Even if you are planning to apply to medical school, take a look at it. Many students plan to go to medical school, but find that there are other things that interest them more. It's also a good idea to have a back-up plan in case you don't get accepted the first year you apply.

Enjoy the newsletter!

Sincerely,

Dr. Bane
Biochemistry Students 2010 Honors Thesis

Wei-Ping Chen (Dr. Carol Miles): Parasitism-Induced Effects on Chewing Activity: Timing of Feeding Suppression in the Tobacco Hornworm Larvae, *Manduca sexta* Parasitized by *Cotesia congregata*

Tak Ian Chio (Dr. Susan Bane): Solubility Improvement of Microtubule-Targeted Drugs by Hydroxypropyl-β-Cyclodextrin

Adam Hill (Dr. Anna Tan-Wilson): Proteolytic Activity Profiling in Etiolated and De-Etiolated *Arabidopsis thaliana* Seedlings

Asma Razzak Jaffar* (Dr. CJ Zhong): A Study of Size Effect on DNA-Mediated Assembly of Gold Nanoparticles

Meredith Sosulski (Dr. Alexander Rickard): Manipulation of Bacterial Cell-Cell Communication between the Oral Bacterium *Streptococcus gordonii* DL1

Benjamin Weindorf* (Dr. Karl Wilson): Survey of Proteolytic Activities in Pea and Soybean Seedlings

* BS Biology (Cell & Molecular Biology concentration)

Biochemistry Students 2011 Honors Thesis

Saamia Alam (Dr. Sadik): Immunosensors for iNOS Pain Biomarkers and Characterization of Flavonoids on Cancer Cells

Adam Blanden (Dr. Bane): 4-Amino-Phenylalanine as a Bioorthogonal Nucleophilic Catalyst for Hydrazone-Ligations at Neutral pH

Ashely Gaesser (Dr. Gal): Analysis of p53 Modifications and the Effect on its Gene Targets in Breast Cancer Cells

Emily Greene (Dr. Rozners): Hydration of Fluorine-Modified RNA and DNA as Measured by Osmotic Stress

Anthony Hisham Kashou (Dr. Tan-Wilson): Protease Profiling of Rice Seedlings by Zymography

Sabine Khan (Dr. Bane): Avian βV Tubulin & Targeted Chemotherapy: Assessing Drug Binding Properties of a Divergent Isotype

Jeffrey Michael Minucci (Dr. A. Fiumera): Effects of Atrazine Exposure on Expression of Male Reproductive Genes in *Drosophila melanogaster*
Faculty and Students Present Research at Conferences


Anthony Kashou*, Daniel Pan, Anna Tan-Wilson, Profile of Endoprotease Activities. Arabidopsis thaliana and Oryza sativa by Gelatin Zymography. 8th Annual Undergraduate Research Fair, Binghamton University (April 2010)

Anthony Kashou*, Daniel Pan, Anna Tan-Wilson, Profile of Endoprotease Activities in Arabidopsis thaliana and Oryza sativa by Gelatin Zymography. 74th Annual Meeting – Northeast Section of the American Society of Plant Biologists, Adelphi University, NY (April 2010)

Publications*

Adam Blanden, Kamalika Mukherjee, Ozlem Dilek, Maura Loew, Susan Bane. 4-Aminophenylalanine as a Biocompatible Nucleophilic Catalyst for Hydrazone-Ligations at Low Temperature and Neutral pH. Bioconjugate Chemistry, submitted.


* Publication citation is presented in a informal fashion for the purpose of recognizing Binghamton students.
+ Anthony has authored twelve papers in 2011 and presented three times at conferences on his work on the proteases of Arabidopsis thaliana and Oryza sativa. He was invited to speak at the International Conference and Exhibition on Proteomics & Bioinformatics in June 2011.
Coming into Binghamton University I envisioned my time here just as many other students do; I would major in biology, complete any pre-med classes and general requirements I needed, and go on to medical school. It wasn’t soon after I began classes that I realized a simple path to medical school was not in order. After dreading general chemistry the weeks before school started, I found once I was actually in class the subjects that we were learning were not only applicable, but interesting as well. As my curiosity grew I no longer viewed the chemistry courses that one must take to fulfill a biochemistry degree intimidating, but rather important pieces of the puzzle that are just as essential as any biology course. I quickly found that without a well-developed background in both biology and chemistry it is much more challenging to succeed within the field of science. A biochemistry curriculum encompasses everything students need to become successful in any field, especially if that includes continuing their education in medical or graduate school.

During my sophomore year, when I was fully ingrained in the biochemistry syllabus, my interest in school led me to consider that receiving my Ph.D. may suit my curiosity more so than medical school. It was then that I decided to pursue a position conducting research with a professor in one of the many labs that Binghamton University has to offer. By spring I had begun my own research project with Dr. Tan-Wilson. Working with Dr. Tan-Wilson has not only exposed me to scientific research, but also basic laboratory techniques as well as how to successfully set up and complete experiments. For the past two years I have been attempting to identify the role of a protease, beta-conglycinin, in the breakdown of storage proteins in soybeans. To dissect the role of beta-conglycinin I use gel electrophoresis and western blotting. After successfully categorizing beta-conglycinin breakdown in both intact and detached soybean cotyledons my research has since expanded to assess the same protease function in seven additional species within the Fabaceae family in an attempt to demonstrate functional conservation. Working in a lab at Binghamton University is a valuable learning experience within an exceptional environment; everyone is extremely helpful and informative. It provides outstanding practice researching in one’s field of interest and presents many opportunities for summer internships.

In addition to studying biochemistry and spending time carrying out experiments, I am also a full time athlete. I competed in both cross country and track and field. I began running early in high school and continued due to my success in, and enjoyment of, the sport, but it was nothing more than an after school activity. Once I came to Binghamton, however, I noticed throughout the years I had gained discipline and time management skills through the sport; the same skills that I needed to be successful in track were just as useful in school. In sports they have allowed me to play an essential role in achieving Binghamton’s first ever America East Cross Country title, as well as a 3000 meter steeplechase school record. It is these skills that have enabled me to become successful in my schoolwork, research, and athletics.
Potential Role of Biofilms in Atherosclerosis

I recently embarked on a new research project here at Binghamton University under Dr. David G. Davies and Dr. Karin Sauer. The research group I am involved with studies microorganisms existing in a state known as a biofilm. A biofilm is an aggregate of microorganisms that are embedded in an exopolysaccharide matrix they have produced in order to adhere to a surface and protect themselves from harm, such as biocides. In addition to this the microorganisms are able to form water channel systems that allow the transport of nutrients, making a biofilm a perfect environment for pathogenic microorganisms to grow and prosper within.

My research focuses on the potential role biofilms may play in arteriosclerosis. There are numerous studies that show certain pathogens exist within plaque build-up on the interior of carotid arteries. My objective at the moment is to extract and isolate the DNA from organisms embedded in arterial plaque from samples of carotid arteries. The DNA must be extracted, amplified and sequenced so the bacterium can be identified. Once identification is complete further research will be conducted focusing on the impact of norepinephrine on the microbial biofilm growth in the presence of transferrin.

This research is extremely exciting, and fascinating because of the different aspects of biology paired with its involvement in medicine. In order to fully understand what is going on you need a decent understanding of the biochemistry behind the interactions between transferrin and norepinephrine. Norepinephrine is able to interact with transferrin and the iron it is holding, in a way that the iron becomes free in the blood. In addition to this you need to understand metabolism of microorganisms. The free iron in the blood is now available for these pathogenic microorganisms to take up and grow at quite a rapid pace. This increased growth within microorganisms embedded in arterial plaque could be enough to induce disruption of the plaque and cause stroke. Furthermore, genetic techniques are required in order to carry out the DNA extraction, isolation and amplification.

This research has potential to be groundbreaking. Norepinephrine is excreted through the body during periods of stress, physical activity and panic. If the amount excreted through the body is enough to cause plaque disruption through biofilm growth it would change the entire approach to treating arteriosclerosis. However, there is still a lot of work to be done on the topic.

I feel that students should definitely get involved in research here at Binghamton University. Joining a research group, and putting your efforts and focus towards a research project that you are thoroughly interested in puts a completely new spin on you’re education. You’re no longer just learning about techniques, and procedures in the classroom, or from your lab manual. You get to participate in hands on research, and contribute to the overall process and progress. However, it is definitely important to make sure you choose a program that you are fully interested in, because it does take up a good chunk of your time. You have to be able to commit at least 12 hours a week, and that’s just for in lab time. If you really want the full experience you also read articles on your topic outside of the lab, and try to learn as much as you can. So make sure you are researching a topic that will fully interest and motivate you to do your best.
Hydration of Fluorine-Modified Nucleic Acids

Cells possess the machinery to execute many RNA-based defense processes. In recent years, researchers have successfully designed drugs containing short RNA strands (i.e. siRNA, shRNA, etc.) to assist these mechanisms. However, RNA is inherently unstable as it is vulnerable to abundant, naturally-occurring ribonucleases. To be useful as a therapeutic agent RNA needs to be chemically modified to increase enzymatic stability, cellular uptake and bioavailability without affecting RNA’s structure and interactions with cellular components.

The interactions between water and the backbones of modified RNA in vitro provide many insights into the in vivo structure and function of these complexes as water is such an integral part of the human body. The osmotic stress method\textsuperscript{1} is used to determine the number of water molecules released upon melting of RNA and DNA duplexes ($\Delta n_w$). The method utilizes small organic cosolutes to study the dependency of melting temperature ($T_m$) upon water activity, which, along with the change in enthalpy ($\Delta H$), is used to calculate $\Delta n_w$. A UV-Visible spectrophotometer is used to measure the thermodynamic parameters. We synthesize self-complementary oligonucleotides with and without the desired modification to compare the hydration of each species. Typically, oligonucleotides are more stable (have a higher $T_m$) when they are more hydrated. These hydration measurements are used to complement information obtained by X-ray crystallography, NMR, molecular modeling, etc., to elucidate the structure of modified RNA, supplying important information for drug design.

Our research group works to synthesize RNA containing modified bases, linkages, or sugars which are likely to fit the criteria for RNA-based drug therapies and then study their structural properties. My projects have dealt with all three classes of modifications with an emphasis on hydrophobic or nonionic modifications. DNA containing hydrophobic modifications is typically much less stable than its native DNA counterparts, but RNA has been shown to tolerate hydrophobic modifications with a negligible loss of stability when integrating several different modifications.

Currently I have focused on fluorine modifications as many fluorine-containing RNA compounds have shown great promise as therapeutic agents due to their high binding affinity and stability to nucleases. Fluorine even appears to mitigate harmful side effects compared to native RNA. It is an interesting element to work with, as it is often thought of as hydrophilic, but in biological molecules it usually behaves as a hydrophobic moiety.

Difluorotoluene (Figure 1) may be used as an alternate base for thymine and uracil as it similar in structure, which allows it to base pair nicely with adenine. We are comparing the effect of this hydrophobic modification in both RNA and DNA, with the expectation that it will have no discernable effect on RNA and greatly destabilize DNA. To do so, we synthesize analogous RNA and DNA oligonucleotides with and without difluorotolyl residues at a single thymine/uracil position. This results in two modifications per duplex. We perform osmotic stress experiments for each of the four duplexes and compare the $\Delta n_w$ with three different cosolutes: ethylene glycol, glycerol, and acetamide. Preliminary results indicate that our hypothesis is correct, confirming once again that RNA can tolerate hydrophobic modifications better than DNA.

\textsuperscript{1} Spink, C.H. and Chaires, J.B. (1999) Effects of hydration, ion release, and excluded volume on...
Michael Ulanski
Senior
Purification and characterization of *Pisum sativum* L. storage protein

*Pisum sativum* L. (pea) is a legume crop that serves as an important source of vegetable protein. Many seed proteins are mobilized during germination and seedling growth. However, only a few seed proteins that account for the major protein content of a seed are genuine storage proteins. Storage proteins are classified as biological reserves of ions and amino acids that are used by an organism. The *Pisum sativum* L. contains three of these storage proteins, legumin, vicilin, and convicilin. Both legumin and vicilin have been studied extensively, and are known to accumulate in large quantities during the formation of the pea. Accumulation of these storage proteins takes place during the middle to late maturation stages when seeds act as nitrogen sinks in the plant. They are deposited in membrane-bounded compartments from the protein storage vacuoles (PSV) (Muntz, 1998).

Numerous studies have shown that certain endopeptidases in germinating seeds, localized in the PSV and the lytic vacuoles derived from the PSV (Wilson, 1986, Shutov and Vaintrau, 1987), play a role in the mobilization of storage proteins. It is unclear whether the induced conformational changes of storage proteins, resulting from the first wave of proteolysis of storage proteins, are then degraded by additional endo- and exopeptidases. A concrete pathway remains undetermined. We primarily focus on defining the proteolytic events leading to the degradation of major and minor seed storage proteins during germination and isolating as well as characterizing the proteases involved.

Pea is an important crop cultivated worldwide. Understanding the processes involved in storage protein degradation during germination will offer valuable insight into the propagation of plants from seed stage. The degradation of storage proteins is critical for the development of genetically modified legume species.
Binghamton University-HHMI Program
Future preparation beyond the classroom
By: Stefano Quarta

Binghamton University received a four-year, $1.4 million grant from the Howard Hughes Medical Institute (HHMI) to fund undergraduate interdisciplinary life science research. Financial support has also come from the Division of Research and Graduate School at the University. The HHMI grant joins undergraduates studying in the fields of life science, physical science, mathematics, computer science and engineering to work on collaborative interdisciplinary life science research projects. Undergraduates participating in the HHMI program will receive a stipend of $4,000, starting in the summer of 2011, and continue working throughout the following academic year on eligible projects.

Current Binghamton University freshman, sophomore, and junior undergraduates who major in the life science, physical science, mathematics, computer science or engineering disciplines can apply to the HHMI Program. Underrepresented minorities in the previously mentioned disciplines are strongly encouraged to apply. For eligibility into the program, students must have earned an overall and science/engineering GPA above 3.0. Students must also be able to work full time in the summer before their sophomore, junior or senior year and must be able to continue with the research in the following fall and spring semesters for academic credit. The HHMI Program application with full details can be found in the following link: http://www2.binghamton.edu/undergraduate-research/hhmi/index.html. In addition, useful information can be found in the facebook group: BU-HHMI Program; friend using your Binghamton email, or contact Dr. Tan-Wilson at annatan@binghamton.edu

The goal of the HHMI Program is to accelerate undergraduate students beyond the spectrum of their major for preparation for their desired future careers in the biomedical and life science. Today the problems facing biomedicine and life science are rapidly growing in complexity. These problems are most effectively solved through the synergy of collaborative and interdisciplinary research, which is why students selected into the HHMI program will engage in a year-long interdisciplinary research experience with other undergraduates across STEM (science, technology, engineering and mathematics) disciplines.

This year 28 students were selected from 14 interdisciplinary research projects which emphasize their interests and academic background. The student will be working in a team of undergraduate and graduate students led by two faculty members, each from a different discipline. Research methods used in the program run the gamut from creating new programs for image analysis related to biological research to sequencing the DNA in ancient living microorganisms trapped in halite crystals.

The first round of the selection process consisted of interviews by a member of the steering committee. After the first selection, students will be interviewed by the prospective faculty mentors. This helps find the best fit between student and project, an important match because the student’s commitment to the labs and the interdisciplinary project continues for the calendar year.

There were more than three times as many applicants as there are spots. If a student wasn’t selected for the program, they can apply the following year (2012-2013) or engage in an independent study during the semesters for academic credit. (See how on the next page.)

Science is becoming more interdisciplinary; mathematics, physics, computer science, and engineering are mitigating problems faced in the fields of biology and chemistry. The collaboration between scientific disciplines produces new career opportunities and develops creative ways to solving complex problems. The HHMI grant aims to bring this collaborative force to Binghamton University.
GETTING PROACTIVE

How to Get Started in On-Campus Research

By: Stefano Quarta

So you just read some inspiring articles about students conducting their own research and are thinking about pursuing research yourself. Great! But before you apply for a research position, it is important to know why you want to do it. Research is a self-motivated responsibility, so if your reasons aren’t the strongest (i.e. “it will look good on my grad/med/vet school applications”) then maybe research isn’t for you. There are other ways to help bolster your resume and land you a great recommendation letter like internship, tutoring and teacher’s assistant opportunities. But, if you are still adamant about pursuing research, there are a few things you should know.

Most professors are looking for juniors to join their lab, so you should apply near the end of sophomore year. Some professors even accept sophomores, so you can start asking for positions at the end of freshman year. Typically it will take an undergrad one to two semesters to learn the basics of their laboratory skills, so it is best to start your independent research as early as possible. The sooner you begin your research the further it can progress over your undergraduate career thus the more you can potentially harvest from your work.

Most undergraduate laboratory positions open up during the end of the spring semester due to seniors graduating. For this reason, the middle of spring semester is the ideal time to start contacting professors asking for research opportunities. Even so, it wouldn’t be a bad move if you began contacting professors now through the end of summer. The paperwork could still be filled during the first two weeks of classes and some professors even allow their students to work in their lab over summer and winter breaks, which are ideal times to get individualized attention and to learn laboratory skills quickly.

Not all research professors have the same selection criterion, but applicants should be hard-working students that can commit 12-15 hours a week to their research. Professors will expect you to work with them until you graduate, yet if you ever want to switch laboratories or stop your research they will likely understand.

If you currently cannot devote your time to research but want to get your foot in the door at a later point, try asking for a volunteer position in a lab. Volunteer positions do not yield academic credit but require less hours per week. It’s a great way to learn what research is all about.

To land yourself an on-campus research position, follow these four steps:

Think about which field of biochemistry you would like to work in for your undergraduate career - Would your interests be more biology, chemistry, mathematics or physics related? In what field would you not want to work in? What kind of problem(s) would you like to help solve? Though it may be tough to know exactly what you want to do, the closer you are at finding your match, the more likely you are to enjoy your research.

Learn of the various research interests of professors - As a biochemistry student you can do research with almost all professors in the Biology or Chemistry Department. Follow this website http://biochem.binghamton.edu/faculty.html and click on the professor’s name to read which of their interests matches yours. What is listed is simply an overview, to get an in depth understanding of their work read into the professor’s latest publication.

Contact at least three professors – Either by email or in person (during their office hours), be sure to: express why you want to do research, provide your educational background and ask if you qualify to work for them. Some professors have specific requirements in mind – if you do not meet them, don’t give up! Just seek out another professor. Persistence is key. Also know that professors can be very busy people so if they happen to not respond after a week, do not be afraid to resend them your email with a ‘friendly reminder’ note, they want the students who follow up.

Take care of the paperwork – If you are accepted, there are two forms you must complete. The first form at http://biochem.binghamton.edu/honors.html registers you with the biochemistry program and should be given to either Dr. Bane in S2 320 or Maura in S2 321. The second form will register you in the BU brain and can be found at either the chemistry or biology department office.

I really encourage you to start your research as soon as possible if you are truly sincere about committing yourself to an independent study. Once you are involved in research many opportunities open up: constructing an Honor’s Thesis, submitting publications, giving talks, attending conferences and the list goes on. I hope this guide has helped you out.

For more information, check out the main biochem research page: http://biochem.binghamton.edu/honors.html The links provided are also very helpful.
Careers for Biochemists
By: Maura Loew

Although this article will be geared towards current students, we would love to hear from alumni whose careers have taken an interesting path. Future biochem students can really benefit from learning about careers that their degree can lead to. You can contact Maura (mloew1@binghamton.edu) with your story.

I can’t over-emphasize the importance of planning your career early. The earlier, the better! Explore various career options by shadowing a professional or getting hands-on experience. You don't have to find the "perfect" career for you, because you can always change careers later in life. If you enjoy lab work, you will probably enjoy working in the pharmaceutical industry with just a B.S. or an M.S. If you want to eventually run a lab, you have to get a Ph.D. (and do a postdoc or three!). If you don't enjoy lab work, but are interested in business, consider adding an MBA after your biochem degree. The pharmaceutical industry also employs many clinical research associates (CRAs). Rather than working in a lab, a CRA collects information from physicians who are conducting clinical trials. For more information on careers in the drug discovery pipeline (from lab work to business to clinical trials), see the book Career Opportunities in Drug Development by Toby Freeman (available in the Science Library).

If you enjoy writing, consider scientific writing or technical writing. The former is writing stories for the masses, translating interesting research findings into layman’s terms. Technical writing is the writing of manuals for scientific instruments, reagent kits, and so on. If you are a good artist, scientific illustration may be a good match for you. There are a few links at the bottom to get you started as you look into these various career options. For more professions away from the lab, the book Alternative Careers in Science by Cynthia Robbins-Roth (also in the Science Library) has many, although with a focus on Ph.D. holders. Unfortunately there is a lot of lab work required to get a Ph.D.!

Once you have a career in mind, find out what preparation employers will expect from you. Students often underestimate the importance of experience in their job search. Experience not only makes you more attractive to employers, but it gives you a chance to test out a career field. For lab-related jobs, research experience might seem the obvious choice. However, pharmaceutical industry internships will help you get your foot in the door. Many companies hire their most promising interns! For writing careers, the more writing experience you have, the better. (Contributing to this newsletter counts!) Think about writing for Pipe Dream or another campus publication. Google will be your best friend as you try to hunt down this sort of information.

I wrote this article because I talk with many students who are going through school, taking classes, but not exploring possible careers or finding ways to get hands-on experience. Don’t let this be you!

Links to information on careers:
FEATURED ALUMNI STORIES

Piyal Alam
Alumni ’10

I am a graduate of Binghamton University, Class of 2010, and during my undergraduate studies, I majored in Biochemistry and conducted Molecular Biology research in Dr. Heather Fiumera's lab. I decided to go directly to medical school after graduation and am now currently a first year student at New York College of Osteopathic Medicine, pursuing a Doctor of Osteopathic Medicine (D.O.) degree. After graduation, I wanted to go on a trip before starting school and I knew I wanted to have a very personal experience that would be very memorable. I decided I would go on a journey by myself to go visit my parent’s homeland, Bangladesh.

Bangladesh is a developing third world country, and the conditions of life, as well as the culture over there, are very different from the norms that we are accustom to here in the US. I was a little anxious at first and I was questioning the decision I made while on the airplane, but ultimately once I landed, my apprehensions went away. Both of my parents have enormous extended families, my father having 17 brothers and sisters, while my mother having 9, and most of whom reside in Bangladesh. Over my 2 weeks trip, I think I might have met every single uncle, aunt, cousin, nephew, and niece I have! However, the moments I cherished most were the times I spent with both of my grandmothers. Honestly, I was very surprised by how much love all my relatives in Bangladesh had for me. For the majority of these people, I had only heard about them in stories from my parents, but interacting with them and connecting with them personally, even if it was for a brief few weeks, was priceless.

It truly is impossible to give the full scope of what my trip was truly like in a brief blurb. From visiting national monuments and museums, to watching the world cup finals in a movie theater, getting trapped in a bus for hours while there was a massive riot taking place, to riding boats and chasing goats, eating exotic fruits, then getting food poisoning, and ultimately receiving and giving so much love to my family, words cannot describe such a trip. It truly was something that could only be experienced and it will be something I remember my whole life. All I can say is make the most of your time after graduation and do something that’s not just fun, but make sure it’s also memorable.

Andres Melo
Alumni ’06

When the academic advisor announced to the Harpur College freshman at orientation, “We advise you take a number of courses in a variety of areas that interest you...except if you are a Biochemistry major. We suggest you start with Biology, Chemistry, and Calculus,” I felt afraid and uncertain. I approached the biochemistry major as a challenge with much apprehension and doubt. It was my high school chemistry teacher that recommended I major in Biochemistry, and without knowing much about the subject, I chose it and realized that as tough as it was, it would be worth the struggle.

Continued on next page...
Upon leaving Binghamton, I began working as a scientist at Merck & Co near Philadelphia. Merck is one of the world’s largest pharmaceutical companies. They manufacture products such as Singular, Gardasil, Fosamax, etc. I particularly work in Merck’s vaccine manufacturing division. I currently help support the manufacturing of PNEUMOVAX® 23 which is a vaccine against pneumonia. I work alongside some truly brilliant people from all across America who really care not only about doing their job right but about the patients who will be using Merck’s medicines and vaccines. So far, it has been a really rewarding job.

Like many people in high school and college, I had dreams of helping to cure the world of cancer, autism, AIDS, and many other terrible diseases. I thought the best way to fulfill these dreams would be to learn about the drug discovery and manufacturing process; therefore, I chose biochemistry as my major. I chose Binghamton University because they have one of the best biochemistry programs in New York State. I was not disappointed. My classes taught me the foundations for what I need to do at my job now. I learned the basics of organic chemistry and cell biology. In bioorganic chemistry, I learned how potential drug compounds in pharmaceuticals are designed and tested. In biochemistry, I learned many of the important enzymatic pathways needed to sustain life. Most importantly, I was taught how to think like an independent researcher. During my time at Binghamton University, I did 2 internships at GlaxoSmithKline and Merck. These internships really helped me to apply what I learned in the classroom out in the field.

Continued on next page...
Joining the biochemistry program at Binghamton was one of the best decisions I ever made. I came to school as an undecided major, but soon discovered that science was the way for me. I was originally drawn to chemistry because I enjoyed the classes and seemed to have a knack for the subject. It wasn’t until late into my sophomore year, when I started to seriously consider my future that I was forced to reconsider my decision. After an intense conversation with my sister (Julie Silverman, biochemistry ‘07) that I decided that biochemistry suited me better. The coursework just seemed more interesting and provided a path to a variety of careers that I found interesting.

As a junior I took biochemistry and genetics, two courses that would come to define my interests and influence my decision to go to graduate school. The ideas and concepts I learned in these classes opened my eyes to the wonders of biological systems, far more complex than any chemical reaction. Although I lamented having to memorize glycolysis and the TCA cycle, the understanding of how all of these biological processes are interconnected truly inspired me.

Also during my junior year, I was able to get a position as an undergraduate research assistant in Dr. Davies’ lab. The learning experience in the lab was completely different from classes and really created an exciting new challenge for me. I enjoyed the ups and downs of research and decided to apply for a summer internship to see if I could be satisfied doing research full time. I ended up going to the University of Washington in Seattle to participate in the Amgen scholars program. The summer internship was an invaluable experience, reinforcing my interest in science and expanding my awareness about the opportunities that are available. I ultimately decided that I wanted to be in science and that research was my passion.

Currently I’m a first year Ph.D. student in cell and molecular biology at the University of Pennsylvania School of Medicine in Philadelphia. I am also participating in the HHMI med-into-grad program, which integrates medical knowledge into the graduate curriculum. I’m doing rotations in different labs around the school and deciding which one to pursue my thesis in. I have already completed one rotation in which I studied RNA metabolism and silencing in plants using high-throughput sequencing. Binghamton was an important stepping-stone in my progression as a scientist. The knowledge I gained as a biochemistry major at Binghamton is useful to me every single day.
LETTER FROM A PROFESSOR

Refeatured letter from Dr. Anna Tan-Wilson to the students...

Students,

A biochemistry-rich curriculum is a wise course of study for several reasons. Every life science specialization has adapted strategies and techniques of biological chemistry, biochemistry and molecular biology. Health care and other professions that you will aim for are based on studies in the life sciences. You are establishing a conceptual foundation and developing skills that you will keep building on in the future.

What is this course of study preparing you for? Look at where Binghamton alumni are. They are in top scientific and executive positions in the pharmaceutical and biotechnology industries. They are doctors, dentists, optometrists, veterinarians and other types of health care professionals. They are in education at all levels – K-12, community college, four-year colleges and universities, medical, dental, optometry and veterinary schools. They are nutritionists and genetics counselors, or work for the government in positions relating to public health or forensics. They are lawyers involved with the biotechnology industry and health care fields, science writers, artists who create animations and diagrams to convey complex scientific concepts. The list is long and keeps expanding. Read C&EN, join Science Careers.org to learn more.

Select a path that you, not your parents or friends, are interested in. Notice I don’t say that you have a “passion for”, which is what you will hear others say. Most successful scientists are absorbed in what they do, are creative, and enjoy carrying out the responsibilities of their position, without career being their one and only all-consuming preoccupation. They have families and are very much involved with their children. Lower the bar. Just choose a path that matches your talents, and that does not only mean what courses you do well in. For those of you who have done independent research, do you like everything involved, or do you only like the lab work, only the intellectual challenge? Do you pay attention to detail or do you look at the big picture and leave details to others? Are you better than the average person in developing social contacts? Do you have talent for art? Can you turn a humdrum essay written by someone else into a story that comes alive? Many students postpone selecting a career path because they are afraid to commit. You are not choosing a mate for the rest of your life. Employment data show that you will change your career several times in your life. Just choose a path you want to follow for the next two, five or ten years. If you want to explore, prepare for a shorter duration. Do not delay because students with a career goal do better in class than others with similar capability. Reach high, but be realistic. If the program you aim for emphasizes grades and high scores on standardized tests that you fall far short in, aim for a program that looks for experience that you do well in, or plan a circuitous route to your dream. Past the Bachelor’s degree, students get financial support for only a few graduate programs, the Ph.D. in the sciences being one of them. Will you be able to earn enough to pay your student loans? Are the economic foundations of that career shifting? If the work can be done as well and at lower cost in another country, plan on the work only as a short-term stepping stone.

You worked very hard to gain admission to Binghamton, one of the top-rated undergraduate institutions in the country. Take advantage of that. Here, faculty members know where their science is headed and work at preparing students not just for the present but also the future. For instance, application of mathematics and computer science to the life sciences is a growing expectation. If you have the space in your curriculum, learn statistics and computer programming. BU’s new HHMI-funded program was designed to fill such a need. Apply here and elsewhere for such experiences. As difficult it might sound now, it is easier than having to learn it totally on your own later. Work hard in courses with faculty members who challenge you to solve problems and think logically. Learn by working with classmates. With hard work and a genuine interest in a career path, you can achieve just as much as the alumni that have come before you. Binghamton faculty, staff, graduate students and peers are here to give you the tools, so strive to make the most of it!

Anna Tan-Wilson, Professor of Biology
From the Newsletter Coordinator,

So many people to thank, but most of all you, the reader, because without you this newsletter wouldn't have happened.

A Thank You goes out to... Daniel C. Pan and Maura Loew, for their important contributions and guidance in completing this newsletter. Dr. Tan-Wilson for writing us a fantastic letter, one that I appreciated so much I featured it once again for the new student readers of our newsletter. The faculty and staff who brought the HHMI program here to Binghamton. Piyal Alam, Andres Melo, Jackie Gaug and Ian Silverman for providing a fantastic primary source for readers interested in various career options. Adam Quinn, Bernard Lanter, Michael Ulanksi, and Emily Greene for explaining your work and sharing your experiences. The dedicated members of the Biochemistry Club, thank you for your ideas, comments and group collaboration. Folding, labeling and mailing a new record of 1,300 prints would have taken my sanity if it hadn’t been for your help! Dr. Bane and all the professors, staff and graduate students for supplying Binghamton’s biochemistry students with never-ending support on the administration and academic level. On behalf of the Biochemistry Club, thank you so much for reading this year’s newsletter. I hope you enjoyed it!

The Biochem Newsletter team aims to provide the most beneficial and diverse information for our readers to maximize their ideas and horizons. If there is anything you would like to read more about or if you have any ideas for the future newsletter, please email me at squarta1@binghamton.edu. I will be eager to hear from you.

Stefano Quarta
Newsletter Coordinator

The Biochemistry Club is seeking new members! If you are interested in meeting people with similar interests, taking on leadership roles, creating next year’s newsletter, peer advising, or just chatting about life as a Biochemistry major, this is the club for you! Contact us if you would like to join!

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