I worked in the Fermentation and Cell Culture Department at Merck in West Point during my fall 2007 term as part of the Cornell Engineering Co-op program. My job consisted of doing three studies each split up into many parts. For my first study, I had to get familiar with cell culture and growing cells in shake flasks. This involved finding ways to disaggregate cells so that they could accurately be counted. My second study introduced me to the set up and maintenance of small scale bioreactors in order to do experiments on media formulations. Finally, my third study involved a lot of cell life cycle assays and using flow cytometry in order to see if improved virus production for vaccine use could be obtained through cell cycle manipulations of the cells.

The training that was provided to me was mostly hands on and handled by my supervisor or someone else in my group. On my first week my supervisor and some of my group members were away on a conference so I used to opportunity to observe people from other groups in the lab, read up on my project, and do various online trainings that were required. The lab protocols that were necessary for my experiments were shown to me. However, the job also involved analyzing coworker's data and adapting new protocols from old ones. On my first week I was assigned a mentor in my department and I did take advantage of some of the general knowledge that she had. However, as often times it is difficult to traverse across five cubicles to talk to her, I would up bugging my cube mate about any questions that I had not specifically related to my project. (He was in a different group.) For most of my questions related to work, however, I went to my supervisor. My supervisor made herself available to discuss aspects of my projects and we had meetings to plan and check up on progress one to two times a week.

This Co-op fit in well into what I am studying as a biological engineer. I have had a few jobs in research before but my work involved molecular biology, neuroscience and proteomics. I am grateful to have had the opportunity to work with cells and learn a new set of techniques involved. When I started working here, I also realized that even though I had studied bioreactors extensively I had never seen one in person save for perhaps the fermentors you see on wine tours. Working here gave me the hands on experience to
apply what I had learned in class. If I had to opportunity to do something different about this Co-op I would take more of an opportunity to see more of the huge facility that Merck has here.

To make my life outside of Co-op more meaningful I looked to other young workers at Merck. There are not many interns of Co-ops in the fall, but I got involved in an unofficial Merck "new hire" group which was mostly made up of young people just out of college. There was many a happy hour and house parties. I found the new hires to be a great bunch. By the end of my Co-op I even ended up in a virtual Rock Band "band" with some of my coworkers. I joined the Merck volleyball team, something I'd definitely recommend. There are also a few Ultimate Frisbee leagues in the area that are fun to take part in. Finally, flag football is very popular at Merck but requires you commit to staying in the area over the weekend for the games, making it harder to visit Ithaca or friends around the area. For my summer term I hope to find some volunteer opportunities in the area.

Housing is not provided in the fall and a car is a definitely a necessity for this Co-op. Finding a place that is willing to do a short term lease can be difficult and most places that do it will jack the price up substantially. I ended up living in a nice two bedroom apartment with another Co-op at Merck from Cornell at the Timberlake Apartments in East Norriton about 15-20 minutes away from work. It was, however, pretty expensive. For future Co-ops I would recommend finding a place that's closer especially if your job involves cell culture which sometimes requires you to come in on the weekends. A lot of the new hires I know live in a really nice apartment complex called Station Square in Lansdale but I am not sure if Station Square has short term leases.

All in all, this term of my Co-op has been a great experience and has taught me a wide range of skills. This has been a great experience.
As a co-op in viral vaccine engineering services (VVES), I supported one of the buildings that manufactures a viral vaccine produced by Merck by assisting the building engineers, one of whom is my supervisor. The building engineers coordinate preventative maintenance for equipment, troubleshoot malfunctioning equipment, manage installation and qualification of new equipment, buy spare parts, and perform various other "housekeeping" activities around the building. It is a hands-on learning experience that is dynamic with unexpected situations guaranteed to arise almost on a daily basis. There is hardly a day where you sit at your desk for eight hours; you must go to the manufacturing areas to troubleshoot problems and perform various activities. This is a teaching and learning experience. As I gained more experience, I was allowed to perform activities on my own and was given more responsibilities. I learned about many different mechanical parts, their purpose, and how they function.

Besides maintenance work, I was given additional projects to improve the manufacturing process, like the installation of new equipment and removal of unused equipment, and to increase the efficiency of the maintenance schedule, like evenly distributing the preventative maintenances.

This job requires you to communicate with all types and levels of people. I had to work with mechanics in the union, supervisors from production, vendors, and engineers all over the plant site. From this co-op, I learned the best way to achieve the type of answer needed through the many types of methods of communication available (email, phone, meeting, etc.). My communication skills improved greatly during my co-op as my term went on. I became more comfortable interacting with people. Everyone was very willing to help me. I never had any fears asking questions to anyone.

I learned many documentation practices and procedures required in the pharmaceutical world, especially at Merck. Since this industry is highly regulated and monitored, there is an enormous amount of paperwork necessary for safety and documentation. The paperwork
becomes tedious, and obtaining signatures can be very painful. This is the worst aspect of the job, but it is one of the most important parts of the job because lives are dependent on everything that goes on at this site.

My chemical engineering skills were not used directly, but my logical thinking skills were challenged. When troubleshooting equipment and creating a tool to efficiently schedule maintenance, I had to critically think about the problems and all the different possibilities for the source of the each problem. Then I had to locate resources to solve the problem. It was challenging and exciting, but satisfying when the problem was solved.

This job was not what I had in mind when accepting this position, but I have learned numerous things, from interacting with all types of people to making skilled decisions. I am not exactly sure what I want to do in the future, but I managed to talk to people from many different departments to learn about the various types of jobs available for chemical engineers at Merck. This experience has been very beneficial, and I am very glad that I had the chance to work in this department.
Michael Myers  
ChemE '09  
Merck & Co. Inc.  
Fall 2007

Work Assignment
For my first co-op term, I worked in the Sterile Liquids Commercialization (SLC) group at Merck & Co. SLC along with the Sterile Liquid Pilot Plant acts as the primary link between early development and manufacturing. To do this SLC does a lot of work in the scale-up of process units from the lab scale as well as the development of process parts that may not be seen on a lab-scale production.

My primary project focused on determining the effects of Vaporous Hydrogen Peroxide (VHP) exposure on sterile products. VHP is an equipment sterilization technique being utilized more frequently in sterile pharmaceutical applications. There is relatively little known about this unit operation as compared to other sterile operations. One issue with this sterilization technique used at full scale production is that it may have effects on products not seen otherwise. For my project was split into two major parts. The first part of the project was to create a bench top scaled apparatus to investigate the effects of residual VHP. The second revolved around the effects VHP may have in tubing materials which may also contribute to the amount of hydrogen peroxide entering products.

My project was an individual project with the ability to be able to try out my own ideas to see if things would work, but there were plenty of options for me if I had questions with my project. I was assigned a supervisor for my term that was my primary contact with whom I would go to with questions. We would have weekly meetings to go over my progress on the project and plan ahead for future experiments. Beyond that I could approach any member in the group with ideas and questions.

Assessment
My project did not use my coursework directly in the respect that I did not have to determine transfer coefficients; however, I would apply principles and concepts brought up in my course work to my project as a basis for ideas that I may want to explore. Coursework I found particularly useful was Heat and Mass Transfer, Fluid Mechanics, and Mass and Energy Balances. Beyond that I found Engineering Statistics (EngrD 270) particularly useful in my analysis of results.

The problem solving techniques that I have developed taking my engineering classes were probably the biggest asset from my educational background. I would often have run in to a problem that I would not quickly be able to remedy. I would often analyze the problem and try to figure out if I had the right problem. Often after redefining the problem I would be able to figure out an appropriate solution. As I went through my term I noticed this ability to problem solve like this became easier.

Overall, my co-op experience was excellent. I was able to apply classroom knowledge. I developed my critical thinking and problem solving skills. I even improved my communication skills by explaining my project to others in the group either informal, when asking a question, or in more formal presentations. Also the ability to get some hands-on experience was truly helpful. Through experimentation, I was able to grasp some more abstract principles I have learned.
Life Outside of Co-op

Being from the area I was able to live at home which saved me a good amount of money on rent as well as letting me get in a couple extra weeks of work before going back to school. The major drawback was my commute was a bit longer than other co-ops at Merck, roughly 30 minutes in the morning. Merck being in a suburban setting I would recommend future co-ops to bring a car.
Cornell Engineering Co-op Program
Job Summary

Emily Majusiak
Chemical Engineering
Merck & Co. Inc.
Fall 2007

I worked in the Crystallization Lab, a support group in the Chemical Process Development and Commercialization department at Merck. The group was responsible for developing all final API (active pharmaceutical ingredient) crystallizations, as well as the technology development necessary to scale crystallization techniques from lab scale to pilot plant scale and factory scale. My main project was to conduct experiments to determine the effect of pressure and frequency on sonocrystallization by examining particle size. Although I had guidance and assistance from my supervisor when needed, I was responsible for carrying out experiments and analyzing the results. I did not receive any formal training for the project, but my supervisor gave me several books to read on sonication and crystallization. I was also provided with a SciFinder account to access any technical papers I required. Even though I had never studied crystallization in any detail, I found that my coursework in fluid mechanics and heat and mass transfer was very helpful in understanding new concepts. At the same time, some concepts from these courses became easier to understand when applied to the specific process of crystallization.

My supervisor also instructed me in the proper procedure for carrying out my experiments. When I ran into trouble, he was always willing to help. If he was not available when something went wrong, I learned to work with other people in the lab to solve minor problems. I learned to enjoy this interaction, especially as I gained more experience and was able to help other workers with some common problems as well.

The part of my job that I enjoyed the least was occasionally having very little work to do. Because the experiments for my sonication project had to run for several hours with little or no manipulation, I frequently did not have enough work on this project to fill an entire day. At the beginning of the term, this allowed me ample time to build my background knowledge. However, as the term went on, I found that my reading became less relevant to my project. After expressing this concern to my

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Cornell Engineering Co-op Program

Job Summary

supervisor, he arranged for me to participate in several side projects in the last couple months of my assignment. Through these projects, I was able to work with many more people than if I had focused solely on my main project. I also got some exposure to other groups in the company, and also learned several new techniques for material characterization.

The hardest part of this co-op term was finding housing. Although Merck has a subsidized housing program for the summer term, fall co-op students must find their own housing. My search was complicated by the fact that I would only living in the area for a few months and that, because of my class schedule; I was unable to visit until I would have to move in. I had attempted to sublet, but most people were looking for someone to stay 8-12 months, and wanted to meet potential subletees and show them the property before signing a lease, neither of which I was able to do. I was turned down in favor of subletees who were able to stay for a longer period of time or had been able to meet the subletors prior to moving in. However, I was able to find an apartment available for six months in Plainsboro, NJ, roughly an hour's drive from Rahway. I didn't mind the commute, and frequently carpooled with a neighbor who also worked at the Rahway site.

Outside of work, I spent most of my time socializing with my neighbors, and I took a Japanese class through an adult education program at Princeton High School. These activities helped me acquaint myself with the community and provided a pleasant way to spend my evenings. Early in the semester I took several weekend trips back to Cornell, though snowy weather prevented these later in the term.
Simon Pang  
Cornell University – Chemical Engineering  
Merck & Co., Inc.  
Summer 2008

Similar to my fall 2007 co-op term, my summer 2008 term was spent working in the Biologics Pilot Plant (BPP) within Bioprocess Research and Development. Since I had already had all of the necessary training during my previous term, it was easy to rejoin the group and start off working. I returned to the same group as during my previous term, but this time my assignments were a little less hands-on, and more project-management-oriented, rather than experimentally-oriented.

My primary project was working with the methanol feed system that I worked with briefly last fall. This time, I was asked to create a comprehensive training module for operation and maintenance of the system that would be used in training the BPP personnel. This required me to gain a very in depth understanding of the system and all of its components. Again, I learned a lot about good design practices, and more importantly, good construction practices when transforming a system from a paper representation to actual piping and mechanical parts. I learned a surprising amount of mechanical and electrical engineering by analyzing each specific component on the system, from the mode of operation of various valves, which becomes important depending your fluid properties and system operating parameters, to various ways to wire and set up the equipment, which is very important when trying to design the system to be intrinsically safe for explosive mixtures.

I was also given the opportunity to work on some components of large capital projects, working on outlining upgrades to an existing bioreactor suite to facilitate operations. Additionally, I worked with some equipment that was new to the pilot plant, defining operational parameters. I was also asked to complete the trials that I had started with the filtration skids last fall. After some analysis of the current use situation in the pilot plant, I was able to come up with rationalization of why it was a better business decision to not perform the cleaning validation runs.

Unlike last fall, there were many more interns this summer in various departments across the company, and Merck provided opportunities to meet and socialize with all the interns, even those at different sites. There were three intern events throughout the summer. The first was a photo scavenger hunt in Philadelphia that occurred a couple weeks into the summer, which was a good opportunity to get to explore the area. There was a day dedicated to learning more about different areas of the company, which was held at the corporate headquarters, where the interns were given
the opportunity to speak with representatives from different departments to learn more about the company. The last was a celebration picnic at a nearby park.

Also different from last fall was the fact that Merck provided housing assistance for all the interns. Whereas I had to find my own housing last fall, I was given subsidized housing in a nearby apartment complex, fully furnished with all utilities included. Other interns were given free housing in Philadelphia – the only downside being the 90-minute commute by train from the city into work every day.

Overall, I had a very positive co-op experience. I learned a lot more about project and process engineering, skills which can be applied to any industry. From a social stand point, I enjoyed the summer more than the fall due to the presence of other interns, and the get-to-know-you events that Merck held for the interns.
During the fall co-op term, I worked closely with one of the project team and the Technical Working Group in the Chemical Process Development and Commercialization department. The mission of this department is to focus on the process development, bulk drug supply and technology transfer of new active pharmaceutical ingredients (APIs) for both clinical development and market launch. Several project teams exist within the department, and each project team generally works on one or more APIs, with support from the specialty labs (reaction chemistry, crystallization, and etc.) and technical working groups. The project that I worked on was to control and potentially prevent granulation during the API drying process. Granulation is the process when small particles gather together and grow into larger masses. Formal safety training was provided in the form of interactive hands-on and online reading and checklist. My supervisor and other co-workers also provided detailed instructions and precautions to the various equipment and chemicals. I usually directed my questions to my supervisor who was very accessible and approachable. Additionally, other co-workers were extremely kind and willing to provide helps as needed.

As part of the project, I was exposed to numerous advanced laboratory equipment and the general operation in the pilot plant. I personally found my project to be quite challenging. Courses that may be beneficial to this project were fluid mechanics, heat and mass transfer, physical chemistry, general physics and statistics. Although the
knowledge in these courses might not be directly applied, it is crucial to develop the critical thinking skill. Besides technical background, communication was quite important for the daily work, as the projects often involved many people from different groups. In terms of personal development, I was given ample opportunities to communicate with other professionals. At the same time, with the help from my supervisor, I was also able to increase my ownership in the project by initiating collaboration with the formulation group in West Point, PA.

The site is located at Rahway, New Jersey, which is about half an hour to Manhattan either by train or car. Merck also provides shuttle buses for the employees who take the train to work. The working schedule is extremely flexible. Throughout the fall, there are several social events for the employees in this department, and I was able to socialize with people with different backgrounds. Gym facilities and certain types of sports teams are also available for those who are interested.

Overall, I feel that the co-op position at Merck was an exciting and rewarding experience. My supervisor gave me more responsibility as I obtained more knowledge through my project. I also found myself surrounded by a group of truly intelligent and friendly professionals, and I would recommend the future co-op to work at this place.
Shi Hang Chen  
Net ID: shc34  
Major: Chemical and Biomolecular Engineering  
Employer: Merck & Co., Inc.  
Term: Summer 2009

This was my second co-op term at Merck & Co., Inc., and the location was West Point, PA. I was working in the Vaccine and Biologic Process Development department. The function of this department is to develop and scale up processes for the production of various vaccines and biologics. In terms of my project, I was studying the impacts of different parameters on the filtration performance for the manufacturing process of a particular vaccine. I had spent most of my time, approximately 70%, in the lab carrying out experiment. At the beginning, I was working with a mentor in the lab to learn all the necessary laboratory skills. After this initial stage, I was gradually given more responsibility and gaining more independence and ownership in my project. From the technical standpoint, the opportunities available in this department can definitely help the future co-op students develop and improve their problem solving and critical thinking skills in an industrial setting as well as gaining experience in experimental design and planning.

In terms of life outside of work, Merck & Co., Inc. really put a tremendous amount of effort in improving the co-op and internship experience. Housing was provided in the summer, and it was right next to the University of Pennsylvania campus, which is in the center city of Philadelphia. Living in this area, one can certainly find all types of activities after work and on the weekend.

Overall, I would definitely recommend future co-op students to consider applying for the co-op position at Merck & Co., Inc., as it will certainly be an invaluable opportunity for one's professional and career development.
Kelly Pollock
Chemical Engineering
Merck
Fall 2008

I worked in the Biopurification Development department at Merck for my Fall 2008 co-op term. My group was working on developing the process to produce a vaccine. My project was to focus on one step of the vaccine production and determine which factors, such as temperature, pH, and concentration, would have the greatest impact on the product and therefore need to be carefully controlled during manufacturing. I also studied the kinetics of this step of the process.

I received training and guidance from many sources during my co-op assignment. When I first started at Merck, I completed many online safety trainings that are required for all new hires. When I began working in the lab, the other members of my group taught me about the process and how to use the equipment. I was also given some paper to read for background information. Merck also offers classes in subjects such as statistics which helped me learn to organize my experiments and determine which results were significant. Once I started my project, there were always people around to answer my questions and offer guidance.

One of the aspects that I really liked about this job is that I was able to design, execute, and analyze my own experiments. I could see how the results of my experiments would be useful for the overall development of the vaccine.

Merck does not provide housing for co-op students in the fall. Short-term leases are difficult to find so I ended up renting a room from someone on Craigslist. Although it was strange to live with someone I did not know, it has worked out fine. I would definitely recommend a car for anyone working here, but Merck does provide a shuttle to the site from the nearest train station. From West Point/Lansdale, it is easy to get to
Kelly Pollock  
Chemical Engineering  
Merck  
Fall 2008  

Philadelphia or New York City and I would recommend visiting these places on the 
weekends. There were not many other co-ops here this term so I ended up visiting co-op 
students in nearby cities or going back to Cornell most weekends.
Job Summary

I worked in the Chemical Process Development and Commercialization department during my second co-op term at Merck. CPDC is part of the Merck Manufacturing Division. My project focused on measuring the energy required to break particles with sonication. I learned how to use sonication equipment, different types of calorimeters, and particle size measurement instruments for my project. I was trained on this equipment by my supervisor or other people in the department. My supervisor was available whenever I had questions or needed guidance on my project.

During the summer term, Merck and CPDC organize many events to familiarize the students with the company. In the fall, I did not learn much about what was happening outside of my department. This summer, I learned about many of the departments that a chemical engineer may work in and also got to go on tours of the pilot plants.

Merck provided housing for the interns and co-ops (only in the summer). We lived at Rutgers University. This was great because I didn't have to worry about finding housing and because I was living with all of the other interns. Living in New Brunswick was nice – since it's a college town, there was more to do than in many other cities. Merck also provided us with train passes so it would have been easy to get by without a car. Another advantage of the summer term is the intern activities. We went on a cruise in Philadelphia and to a baseball game.
This job has really given me a better understanding of what types of jobs are available in the pharmaceutical industry. I also gained a lot of experience with working in a lab and trying to solve problems that may not be straightforward. Overall, I really enjoyed my co-op term at Merck.
My department was responsible for optimizing and scaling up the chemistry used to manufacture pharmaceuticals during their clinical stages and throughout their time on the market. Specifically, my group was working to optimize the chemistry for a product that was on the market and for which demand was not being met. My project was to explore the use of continuous extraction technologies in the pharmaceutical industry. I worked to characterize two pieces of equipment and create a new continuous process for use with the current chemistry. Training was provided through orientations, online classes, and personal interaction. I was assigned a mentor who I approached with most of my questions.

My work activity was most related to organic chemistry, so my chemistry background was particularly helpful. Since I was working in the lab a lot Organic chemistry lab was the largest contributor to my helpful background. I learned a lot about communication in the workplace. For instance the most effective way to communicate is to talk to someone in person or over the phone. This position has taught me about the more research driven side of chemical engineering and will be invaluable in my eventually job selection. I also learned a lot about working relationships, as well as cultivation and maintaining friendships with your coworkers. Overall I am very satisfied with the experience and would not change many things about it.

My recommendation for finding housing is to use Craig's list and talk to the people in the Department. You can either drive to work or take the train. There is a train station right next to the campus. Social activities consisted of mostly interacting with coworkers on off hours. Merck does offer several intramural sports leagues and time off for community service.

The best part of my job was the fact that I received a real project and not just busy work. My project is important to the company and I was able to use many of my own ideas. I also had an amazing boss/mentor. The worst part was the commute and the hours. I was about a bit over a half hour commute to and from work and I would continually work more than a 40 hour week; this did allow for flex time which was a plus.
Douglas Worrall – dmw248
Cornell University – Biological Engineering
Merck and Co., Inc.
Fall 2009

At the start of my Fall 2009 term I was given two binders filled with research articles and I quickly became familiar with two alternative primary recovery technologies. During these first two weeks, I also completed my laboratory safety training because safety has to be a top priority in order for a lab-oriented company to function.

These two technologies focused on purifying a protein from a media containing cells. My assignment was to evaluate the feasibility of both technologies and compare them to the traditional process. Both were first examined on a small scale, where a window of operation was defined. Then, the systems were scaled up to a more functional scale, narrowing this window to a few specific conditions. Finally, the technology was further scaled up to pilot scale. By analyzing the results, it is possible to see if either technology is an improvement in terms of process economics and productivity (yield and time cycle).

Although I was technically a part of a small bio-purification group within the Bioprocess Research and Development Department, my project allowed me to interact with the fermentation group, the analytical group, and even vendors who had a vested interest in my project. If I ever had any technical questions I would generally ask my supervisor who would always take the time to teach me about the details, even if I didn’t really need to know the information to complete the experiment. Nearly everyone was busy but I felt that if I ever had a question or needed help, they would often take time out of their day to answer my question or help me make up a buffer. It was a shock to me at first how altruistic people were to others when they needed assistance.

As a biological engineer I explored two purification technologies based around molecular interactions, heat and mass transfer, and a little fluid mechanics. On the surface it was a primarily chemical engineering project but there was a subtle aspect of biology involving the product itself. Invoking questions like is the protein stable in this medium? Under what conditions will the protein aggregate or will fragmentation occur? In the beginning my work was very hands-on and lab oriented. I followed many set experimental procedures. However, as I gained more experience I started designing my own experiments and exploring how one variable influenced another. I was able to take initiative and given the responsibility to do follow-up experiments on conditions that I wanted to test.

I developed professional communication skills quickly. I often had to determine when I would receive materials from the fermentation group or when sending off samples for the analytical group to examine for specific traits. Weekly group meetings allowed me to see how other project teams worked and expanded my technical knowledge about protein purification. If I were to do anything differently I would have made labels using a computer template much, much sooner (as opposed using a marker).

I became friends with a lot of the younger and older workers in my group. We would go out to dinner and we had a happy hour celebration when one co-worker received his PhD while working full-time at Merck. The Sunshine Committee planned out a fun picnic day where we played volleyball, kickball, bocce-ball, and competed in a scavenger hunt to get to know other people from different departments. One night we had a Rock Band Extravaganza which consisted of a lot of bad singing, mostly by me, and good times. I commuted to work by car but
many other colleagues worked in the nearby city of New Brunswick and commuted to work via the train and used the Merck shuttles to get from the train station to the Merck site which is located in Rahway, NJ. Since it is such a large company there were many different sports leagues available to participate in if you chose to do so; some people were very competitive about it while others were competitive about the office fantasy football league.

I moved through the engineering design process and gained insight into the production of therapeutic proteins on a large scale. The best thing for me was this very broad exposure to so many different techniques and machinery used to create and produce a purified protein for use by the general population. One potential drawback of working in this industry is that life does not stop, proteins can still degrade even if it is 5pm and you've worked 8 hours; sometimes full-time employees would have to work night shifts and weekends to process batches as quickly as possible. I received an overview of what it takes to get a drug to market with Safety Assessment, Phase I, Phase II, and Phase III trials and the high level of scrutiny at Good Manufacturing Practice (GMP) facilities to Food and Drug Administration (FDA) approval. I learned various analytical techniques such as High Performance Liquid Chromatography (HPLC), BCA, and SDS-Page gels and how to interpret this analytical data. Overall, I thoroughly enjoyed my co-op with Merck and I feel that I have gained valuable knowledge, hands-on experience, and close friends.
The first day, a mix of nervousness and excitement filled me as I stepped off the train alongside a hoard of interns and boarded a shuttle to the Rahway site. During the summer, the Future Talent Program (FTP) organizes events for the co-ops and interns, the first of which was an Orientation Presentation. FTP leaders introduced us to the company, reviewing its hierarchy and its mission. When the presentation concluded, I was paired with my manager, and began working in the fermentation group within the Bioprocess Research and Development Department.

Although fermentation may first conjure images of wine and beer production, cells can also be used to produce a biologically-active protein for medicinal use. Whether it's a monoclonal antibody to treat an infection, or a small therapeutic protein to treat diabetes, fermentation is ultimately responsible for manufacturing this raw protein. My project investigated proteases, native enzymes in the cells, which could be degrading our product. This protease characterization project spanned across three cellular expression systems, allowing me to interact and learn from multiple project groups. A typical day was spent in the lab, running experiments to elucidate active proteases. Since I had already worked for 18 months in the fall, I didn't have to repeat most of the safety training and was able to enter the lab the first week. I quickly gained hands-on experience with cell culture, seeding and passaging cells and using equipment to determine the viable cell density. Most techniques were learned in the lab, gaining a functional knowledge of how to prepare bioreactors and operate a bioreactor skid during a fermentation process. My supervisor entrusted me with a lot of responsibility early on, fostering an environment where I had to think for myself, formulating my own answers to questions and problems. During the second week, my manager went on vacation, and I was responsible for running the entire batch, recalibrating probes, sampling each bioreactor, feeding the cells, and analyzing all the subsequent data. One of the best things about working at Merck is the environment. While I thrived in the independence I was given, it was comforting to know that there were many people I could ask for help when I had questions.

Honestly, the people that I've met and interacted with at Merck have taught me a lot about working professionally and matters outside of Merck. I've been extremely impressed by how helpful employees are to me and one another, often sacrificing their own time to aid others when they need it. This feeling of cooperation adds to the entire experience and talking to others in the lab makes the downtime between experiments soar by.

Conducting my fermentation experiments, I saw Physiology, Biochemistry, and Genetics applied to engineering problems. While not essential, these courses helped me to formulate reasons to explain results and design experiments to test new ideas. Personally, I've found Biochemistry to be the most applicable course for both co-op terms. At the conclusion of the work term, I presented my project in an hour-long PowerPoint presentation. This helped me to improve my technical writing and public speaking skills. Furthermore, during the last week, there was a poster session and all the
interns and co-ops presented their findings. It was interesting to see what the 40 other people that I had been living with for the past 3 months did for their summer projects.

Merck provides housing over the summer to all interns and co-ops for free. However, if you bring a car, you'll have to pay $200 for a parking permit. Merck gives each intern a free train pass from New Brunswick, where your housed, to Rahway making a car a convenient for running errands and travelling but not essential. The provided housing was in a Rutgers University high-rise dorm. Merck rented out a wing on the 12th floor for all the interns and co-ops. Each apartment housed 4 people in two double rooms who shared a common kitchen, bathroom, and living room. Overall, I enjoyed living with the other interns and many people organized weekly basketball and frisbee games. If you're over 21, New Brunswick also has bars and clubs, which the older interns and co-ops visited. Also, the Future Talent Program organizes one fun event each year. Last year, all the interns across the different sights went on a "booze-cruise" on a boat outside of NYC and this year we were all taken to Six Flags Great Adventure Theme Park. It was really nice to get paid for a day to ride roller coasters and log flumes. Also, the FTP organized a paid day off from work for the interns and co-ops to visit Whitehouse Station, the Merck managerial site. While there, we listened to a panel of Merck's upper management discuss and take questions on the different aspects of the company.

I enjoyed how my project applied to Merck as a whole. When large scale batches cost over a million dollars to run, preventing proteases from degrading your final product is imperative. I moved through the entire fermentation process, starting with a strain, seeding the cells until they reached a certain cell density and volume before inoculating bioreactors to produce a product. I then operated this system through a 14 day fermentation and analyzed the material I produced for protease activity. Furthermore, I engineered zymograms to detect proteases capable of degrading our product and worked to characterize these identified proteases. All in all, I've really enjoyed contributing to a meaningful project and gaining widely applicable experience in the process.
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Term: Summer 2010

My department was responsible for optimizing and scaling up the chemistry used to manufacture pharmaceuticals during their clinical stages and throughout their time on the market. Specifically, my group was part of Legacy Schering Plough and in the process of being merged with the corresponding group at Legacy Merck. My project was to develop a continuous, on-line UV-Vis spectroscopy apparatus and demonstrate its feasibility for impurity removal process development. I worked to characterize color removal processes through activated carbon adsorption. Training was provided through orientations, online classes, and personal interaction. I was assigned a mentor who I approached with most of my questions; however, I also addressed many of my questions to my peers.

My work activity was most related to organic chemistry, so my chemistry background was particularly helpful. Since I was working in the lab, organic chemistry lab was the largest contributor to my helpful background. I learned a lot about communication in the workplace. For instance I learned how to accommodate many different personalities and styles. This position has taught me about the more research driven side of chemical engineering and will be invaluable in my eventually job selection. I also learned a lot about working relationships, as well as cultivation and maintaining friendships with your coworkers. Overall I am very satisfied with the experience and would not change many things about it.

Merck provides housing and transportation for summer terms. All of the summer interns were housed on the same floor with Rutgers’ housing. As a result the many interns socialized with each other, providing a plethora of potential activities. In addition, Merck does offer several intramural sports leagues and time off for community service.

The best part of my job was the fact that I received a real project and not just busy work. I was able to take control of my project, instead of just following directions. I also had an amazing boss/mentor. He really took an interest in my personal development and job satisfaction. The worst part was the limited amount of time during the summer term in which to work on my project.
Christopher Long  
Cpl24  
Chemical Engineering  
Merck & Co., Inc.  
Summer 2011

I spent my summer in 2011 working at Merck & Co., Inc. in the Chemical Process Development & Commercialization department. This group is responsible for, as its name suggests, developing the chemical processes for manufacturing small molecule pharmaceutical products. They are involved in the development of a compound from its early investigational stages to the transfer to full manufacturing. Additionally, there is also significant investment in researching and proving new technologies. My project was to help develop a continuous crystallization process for an investigational drug. I worked directly with a mentor, and across several functional teams within the department. My project involved some initial small scale lab work and analysis of kinetic data, followed by building a larger scale set-up and evaluating my designed system. It was a very challenging and hands-on project, which I enjoyed and from which I learned a lot.

The job and project were excellent compliments to my coursework in Chemical Engineering. I directly applied kinetics, reactor design, and separations concepts which I had learned the previous semester. I also gained valuable practical lab experience, and confidence in designing and executing experiments. I developed professionally by working within different teams, communicating results, and taking responsibility for decisions on the direction of my project.

This summer term was also very helpful in terms of my learning about the pharmaceutical industry, and in getting career advice from many different people. I worked with people from all over the world, and with a mix of educational backgrounds, from B.S. to M.S. to Ph.D (and many working part-time on obtaining further education). The Merck Future Talent Program, which runs summer internships, organized programming to encourage you to meet and talk with people at different levels and in different parts of the company. I was able to learn about the different roles and opportunities Merck has to offer.

The Future Talent Program also provides housing for all interns who do not live close to their work site. I lived in an apartment building at Rutgers University along with 40 other Merck interns. Transportation between New Brunswick and Rahway via train was easy and reimbursed, but some of us with cars tended to drive to work as well. Having cars amongst the group of interns was also important for errands and trips. This arrangement was a significant improvement over the fall semester term circumstances, both socially and financially. The group of interns living together bonded well, frequenting bars and restaurants in town as well as organizing weekend trips to NYC, the Jersey shore, and Atlantic City. It was a great opportunity to meet and befriend a new diverse and energetic group of students. I also participated in a company softball league with colleagues from my department.

On the whole, my summer experience at Merck was fantastic. I learned and significantly developed technically, professionally, and personally.
Ka-Hei(Kay) Siu  
ks594  
Chemical Engineering  
Merck & Co., Inc.  
Fall 2010

While I was at Merck's Rahway, N.J. site, I was a part of a newly created group within the Merck Research Laboratories called Biologics New and Enabling Technologies. The group was created to work on projects that focus on studying and developing novel technologies as opposed to specific production processes. For my term, I primarily worked on a single project that aimed to identify possible bottlenecks in a production platform. Training on the job was mainly comprised of electronic presentations over common laboratory practices and safety procedures, as well as a fair amount of background reading on my project. Hands-on training was given as the need arisen. For the general orientation around the work site and the company, an HR personnel in the University Recruiting team gave the incoming co-ops an hour-long information session on the first day of work. I was assigned to a supervisor from the beginning, whom I relied heavily upon for questions and concerns over the course of my co-op. Other colleagues were also very open to provide help whenever I needed it.

As a chemical engineering major with a focus on biology, my project was of great interests to myself not only because it was relevant to my studies, but also because it was a great window to glimpse at how I could apply my knowledge in a commercial/industrial setting. One of the biggest lessons I had taken from the work was that, unlike in textbooks, data and procedures were rarely so clean and definite; the challenge was to get the job done regardless of the not-so-ideal conditions. Another major lesson to take home was the need to work with others—whether during discussions or hands-on work.

Overall, this position had afforded me some valuable insights both professionally and personally. In terms of career goals, it had reinforced my conviction that a deeper, more comprehensive knowledge provided by graduate studies would aid greatly in my future work; it would thus be best if I pursue further education after undergraduate studies. With that said, interactions with my colleagues during co-op had then presented several viable options for me to pursue this course of action between which I had yet to weight, but their advice would prove helpful in the foreseeable future. As for my personal development, I could safely say that I had learnt to take on more responsibilities, for both professional and personal matters. I had also learnt to become more at ease when approaching or being approached by strangers.

Life outside of the job was generally enjoyable—lack of homework and exams certainly helped. The transition, however, was a little rough. Finding housing was probably the worst part of the transition. My HR contact at the company could not provide me with much information regarding housing, while online searching was difficult for the short time-frame of 4 months during the duration of the co-op. Fortunately for me, one of the fellow co-op also working at Merck was able to connect me to a colleague in his department who lived only about a mile and a half away from the work site, and I was able to sublease a room. As such, my recommendation for housing
would be simply to ask around, especially within the Cornell network, for information. Depending on where the housing ends up being, and whether a private car would be available, both walking and driving would be viable; however, a car would certainly help with running errands. Since I lived locally in Rahway, which was generally quiet, social opportunities locally were rather scarce, especially in comparison with the college atmosphere of Ithaca. But, my colleagues were mostly close to my age, some of whom were recent graduate of Cornell, so it wasn't too difficult to find others for a meal or a social event. The proximity of New York City, which was easily accessible by train, was also fantastic for a weekend get-a-way. In terms of organized group activities, Merck provides opportunities for sports and community services within the company via sports league and clubs.

The best parts of my co-op experience were the hands-on experiences in a commercial laboratory as well as the interactions with co-workers, both of which have undoubtedly provided invaluable guidance for my personal and professional development. I would summarize my co-op experiences in one word of advice to future co-ops: relax; you are going to do great.