

Mining, Metallurgical and Petroleum Engineering

Professor: Dr. Patchett

The purpose of our project is to study the "spheroidization of steels." Steel is an alloy of iron and carbon (up to 1%). Steel occurs as a mixture of pure iron and Fe_3C . Our project is trying to find when and under what conditions Fe_3C will form spherical particles within the iron. Spherical particles reduce the boundary area and therefore the steel is in its softest and most useful state. These states of particles are called pearlite.

To create these pearlite particles a piece of steel is wrapped in a stainless steel wrap (looks like aluminum foil) called "tool wrap." The steel is heated in an oven for a certain amount of time at 1100°C . after it has been heated for the desired amount of time the steel is annealed. Annealing is very slow cooling of the steel (First the temperature is turned down in the oven to cool the steel slowly, and then the steel is removed from the oven to cool in the air). After the steel has cooled a small piece of it is cut off using a large grinding blade. The cut off piece is put into a mold by using a machine that applies both heat and pressure to melt and mold plastic beads around the piece of steel. With the steel in the mold it is now possible to grip it so that it can be sanded to a perfectly flat surface. Starting on coarse sanding machines the sample is sanded on progressively finer machines all the way down to a diamond sand paper machine. (a total of six different types of sand paper machines are used.) after the steel is sanded a weak acid is applied to it to expose and etch the particles. The sample is then

placed on an electron microscope to see if the desired spherical pearlite particles have formed. A photograph of the sample is then taken.

We were only able to really get started with the project in the fourth week because the "tool wrap" which had been ordered over two months ago had not arrived until then. Without the "tool wrap" the steel would decarburize while being heated. Decarburization takes place when the high temperatures cause oxygen to react with the carbon at the surface of the steel. The reaction between the carbon and the oxygen make CO_2 and it will distort the results. Hard, brittle, and difficult to work with martensite particles will be produced instead of the desired pearlite. So it would be impossible to do any of the project without the "tool wrap."

While waiting for the "tool wrap" to come in I did a lot of reading to prepare for the project. I read books on strong materials and structures. Also I read many chapters about steels in different text books. I made notes on these chapters to help me understand what I would be doing. I went to the machine shop in the building and worked on the lathe. Also I tested a new Macintosh computer demo program. In the welding research room I saw all the different and difficult weld types and I learned what an important skill welding is. In my building I was shown a lot of strange complex machines I never knew existed. So even though my project was put on hold I was still learning about my department.

By reading the books and touring my department building I have gained new insight and learned about an area of science I had never been exposed to before, and normally would not have the opportunity to be exposed to.

Report on WISEST Summer Job

I worked in the department of botany under the supervision of two graduate students and two technicians. All worked under Dr. Vitt.

For the first week I basically did technician work. I worked mainly with dried Sphagnum (peat moss) samples. I cleaned unwanted foreign plants from the samples and put them into labelled dishes. The samples were then ground with a coffee grinder and I weighed out the desired amounts on a digital scale and placed the Sphagnum into test tubes.

I then began working on my own project. My research involved growing Sphagnum nemoreum plants at different water levels to examine the effect of water level on the shape of the plants' capitula (a capitulum is the cluster of young branches at the top of a plant). I did a field collection of the plants near Heatherdown Alberta (about 1½ hours out of Edmonton). To find my results, I used a machine called a digitizer, which is a computer, microscope, and grid all connected. The machine is used to measure distances.

I had to write a complete report, including introduction (which I could only write after reading many books about Sphagnum), materials and method, results, and discussion. For my results, I typed my report and made my graphs and tables using the Macintosh computer. This was very good experience, as I was very unfamiliar with computers before this job. My completed report was handed in to Dr. Vitt at the end of the six weeks. It stated that yes, water level has an effect on the shape of the capitula of Sphagnum nemoreum plants.

During my 6 weeks, I spent one week doing field work at Elk Island with a graduate student. We went to various wetlands and measured peat depth, took water samples, measured pH, and measured water depth. We went to a total of 14 sites, many of them being far into the woods. I had to use a compass at times, and we did a great deal of walking wearing rubber boots. It was a great experience!

My job was not only very educational, I learned many, many new things, but it was also very enjoyable. The work I did gave me some important insight into what research involves on a daily basis. I found that plants can be interesting, too!

I am very thankful that I got this job. I can't imagine any other job that I would have preferred over this!

Thanks!

Leah Williams

My name is Terri Johnston and I worked in the department of Botany. My supervisor was Dr. Dale Vitt. He felt that each of his three students should complete a small project from start to finish. The purpose was to get a true understanding of what research entails.

My project was to research the methane and carbon dioxide flux of Wagner Bog. Samples of the gas were taken once a week for four weeks. I ran the samples through the gas chromatographer and calculated the percent of carbon dioxide and methane in the bog.

This data is important. It is vital to know exactly how much of these gases nature is producing. Then it can be determined whether nature is encouraging the greenhouse effect or not.

I wrote my paper with help from the graduate students in the lab. Dr. Vitt will be continuing this research for a number of years but hopefully my report will be an aid to further research.

In addition to my own project, I helped the graduate students with some of their technical work. I also went to Elk Island Park to take water samples and make other observations.

I feel the WISEST program is very interesting and helpful. I have reviewed my university goals as a direct result of my experiences here. I have obtained invaluable information about the university and how it works. I am looking forward to studying here in one year without too much apprehension.

I think that the program should be expanded to include more male projects. I would like to thank WISEST for giving me this opportunity to learn about research and I hope you maintain this program to educate students so that they may continue to make intelligent career choices.

What Sean Brosseau did with six weeks
of his summer.

Sean Brosseau
Faculty of Nursing
DR. P.A. Field
Holy Trinity High School.
August 11 1989

The day in which I received my letter of acceptance for the Ulvest Program I was very happy. The selection said nursing and I would be working under a Dr. P. A. Field. The first ^{day} I was very nervous. I only recognized a few people from the conference and none of them were boys. Once I was brought over to third floor of the clinical sciences building I met my boss. For the five weeks I worked for her I encountered many various experiences. The thing that she did that flattered me the most was arriving there the second day and giving me my own personal key to her office. That day we went to the Royal Alexandra Hospital for a meeting with its head nurses from stations 27, 28 and 37. This meeting was another new experience for me.

For the entire summer I always tried to put in some personal input. For the rest of the five weeks that I was working under Dr. Field I worked on a questionnaire dealing with women's thoughts on early discharge after and before their pregnancy. I would help with the wording of the question, developing the entire coding sheet, coding the answers into the computer, running the data on the computer, picking up a hard copy either downstairs or at the general service building, getting help for the computer at the general services building, typing in the variables and their codes. I would also do a lot of library work. Getting and photocopying journals, getting references and getting books. A trip to the photocopying room was also very common. During the time

I was with her when she also reorganized her office.

For the other week in which I worked I moved only ~~to~~ about ten metres from Dr. Field's office. It was under Anita E. Molgahn, RN, MN, PhD candidate assistant professor who was very nice to me. I helped her with her questionnaire which dealt with the quality of life of heart transplant patients over a five year period. This was very joyful because at one time a person would say they wished their life was over and one year later they would say their present life is as good as it has ever been. I would enter the data into a computer for Mrs. Molgahn. I also did some library research for her and entered all of Canada's hospitals with over 500 beds into a computer with their addresses. This

was done so she could invite representatives from these hospitals to a conference.

I can't remember every little thing I did over a six week period. I really enjoyed the opportunities I had working at the university and really enjoyed the long complicated talks about football with Dr. Peggy Anne Field.

WISEST REPORT
EVALUATION OF PROGRAMS FOR EVALUATION
OF PHOTOVOLTAIC SYSTEMS
(and Time testing of Pyranometers)
Monica Miles
Electrical Engineering
University of Alberta.
Furugh Ardakani
August 11, 1989

I worked with three programs for evaluating photovoltaic power systems; PVDESIGN, WATSUN, and PVFCHART. I also did some work with pyranometers, measuring their response time to change in the level of solar radiation.

PVDESIGN is the least workable of the three; it only has incident radiation data for 43 Australian cities and towns, it is possible to input data for other cities, but there is no way of saving that data onto the disk. The only way of permanently putting new data into the program would be to change the actual data within the program. Aside from the radiation data already within the program, all other information must be given to the computer (latitude of the site, array tilt angle, average load, system voltage, number of days battery storage, minimum battery charge level, cost (\$/Amp) of array @ system voltage, cost (\$/Amp-Hr) of battery @ system voltage).

WATSUN is better. It is designed so that it runs off of a .TMY program, which contains all of the necessary weather information about the location that is being analyzed. Different .TMY programs can be bought for different cities although I only worked with the one for Vancouver. Multiple data files are created to display/ change variables (number of modules, area of modules, array azimuth, array slope, reference array operating temperature, reference insolation level, reference modules output power, temperature coefficient of efficiency, solar absorptance, emissivity of front and back panels, transmittance (visual and infrared)). In order to run the program, 3 data files must be created; one to control the simulation that the computer runs as well as hold data about the array and regulator of the system. Another to hold information about the battery (charge capacity, voltage, state of charge, discharge efficiency, charge efficiency) and yet another to hold information about the load that will be hooked up to the photovoltaic system. The output is placed in a .LIS file which can be printed out for analysis (see Appendix A for example of .LIS file print-out)

PVFCHART is the most versatile of the three programs. It has incident radiation data for 329 North American locations (see Appendix B for list of locations and matching code #s). Each location has a code number (1-345) by which it can be identified, stored each data file there is information on monthly average temperature, radiation, and reflectance as well as the location's latitude and name. In a user file any information kept in a data file can be changed, either permanently, by KEEPing it, or just saved in the user file's copy of the data. User files are created to store data in (cell temperature at NOCT, the array reference efficiency, array reference temperature, array temperature coefficient, power tracking efficiency, power conditioning efficiency, percent standard deviation of load, effective battery capacity, battery efficiency, array area, array slope, array azimuth). With a user file the program will run a simulation; the output consists of hourly monthly averages for incident solar radiation, array efficiency, percent of load supplied by system, percent of monthly total energy in excess of load (for example of output see Appendix C). PVFCHART also has an economic analysis built in, which can evaluate a system over a period of years to see if it is feasible.

All measuring devices have some time lag between their receiving a change in incoming data and their ability to respond to this change. Pyranometers are devices for measuring incoming solar radiation, they, like all devices, do not respond immediately to changes in radiation. I was measuring the response time of pyranometers. A typical response (on the X-Y plotter) would be an exponential curve, but when plotted as a log it isn't perfect, it breaks into two lines. The second line isn't due to a time response lag on the X-Y plotter: we repeated the measurements using the PILOT program (which responds in under 0.5 seconds) and there were still two lines.

Measuring the pyranometer with PILOT is accomplished by having one person stay with the computer and telling the other, by radio, when to

cover the pyranometer. When the information fills one page completely it is printed off and saved onto the disk. The person on the roof at the signal drops a cover over the pyranometer, preferably a black object that covers the pyranometer completely, like a black felt bolero hat. The solar radiation is cut off. Then when the next signal is given that hat is removed, quickly, so that the radiation levels will go back up to normal. Two tests are done for each pyranometer, so that experimental error is minimized.

WISEST Summer Research Program

A report by Prudence Hoffman

NAME

WISEST Summer Research Program

DESCRIPTION

This is a program for grade eleven high school students. It involves six weeks of research in an area of their choice at the University of Alberta. Its goal is to encourage more women to enter the sciences and to encourage more men to enter the traditional female occupations. From this program, it is felt that the students should learn something about the department they are working in and become familiar with the university campus.

PERSONAL

This summer I had the opportunity to take part in this extraordinary program. I worked in the Department of Computing Science, under the supervision of Carol Smith. As expected, I have learned about Computing Science and have become familiar with the campus. Each week, I started on something new and challenging.

The first week was spent getting used to the terminals and to the building. I learned about the operating system at the university, UNIX, and began to learn about *editor*, a word processor. To get used to *editor*, Carol had me enter a document about *Aufs*. From this I learned how one was able to use a Macintosh on the UNIX system. It described how the "apple language" was translated into the "UNIX language" by way of a translator, called a gateway. Since my terminal was a Macintosh, I found this to be very useful in understanding how the system worked.

The second week was filled with more activity. The gateway was down, so Carol put me on a SUN workstation. I learned how to use the stations and take advantage of the games that were (and still are) available. The first few days were spent editing the document that I had entered the week before. When I was finished, Carol started me on *S*, a program available on cavell used for graphing data and statistics. It took a few days to read about this program and to understand how it worked, but eventually I was able to graph some data. This data was from Carol's laser printer account and I graphed the number of pages used and jobs received by each printer. This was not as difficult as I originally thought it would be.

The next week was less busy. I missed two days because I was sick and, because of this, not much was accomplished. However, I did start reading about *awk*, a simple programming language. I had problems at first, but this was because I was used to *BASIC*, another language. As I got used to the syntax of *awk*, I began to understand it more. Soon I had written a program, with almost no help from Carol.

The following week she wanted a program that would list out, for a specific printer, how many pages and how many jobs had been sent by each machine. It took some trial and error, but I eventually figured it out, with some help. On the last day I did some more work on S, and graphed the number of pages for each month that were sent to lw776. This was for seven months, starting in October of 1988.

The fifth week was spent learning about C, a complicated programming language. I read a book explaining C and started on some simple programs. Two of these programs were one that counted from one to 200, in increments of two and one that converted degrees Fahrenheit to degrees Celsius. After having done these correctly, I started the program that Carol wanted. It was to do the same thing as my awk program, only written in a different language. This was very difficult and I had problems getting it to work. Eventually Carol and I sat down and talked about what needed to be done in order to fulfill the purpose of the program. When it came to the actual programming, I had the basic but not the whole idea. Carol had to polish my program and she was the one who got it working smoothly. However, I am not saying that I did not do anything, I just was unable to get the syntax right. By watching her 'fix' my program, I learned about proper syntax and am now a little less confused.

The sixth and final week was spent printing a report for Carol and for the *WISEST* people and documenting my programs. From this program I have gained insight into the meaning and importance of computers that I would not have gained elsewhere. I am thankful for this opportunity to experience the university atmosphere and way of life without the pressures of starting new classes.

WISEST REPORT

Elke Appersbach
dept. of microbiology
summer of 1989
August 8, 1989

After our initial WISEST meeting I was brought to meet my professor. He was slightly surprised to see me so early - I suppose he was expecting me later in the day. At any rate we discussed the work I would be doing this summer and Dr. Page gave me a tour of the impressive biological sciences building. Now that I know where most of the halls lead, and where the roof drips it seems less impressive and I laugh at how imposing I thought it was before.

Dr. Page's research involves the bacterium the *Azotobacter* which is related to research into the *Pseudomonas* bacteria and, therefore, into the genetic disease, cystic fibrosis. My first job, "an easy one" was not involved with the *Azotobacter*. really, it was to get me acquainted with the laboratory. Easy or not, I made a mistake and ended up preparing 80 new slants but it was, in fact, a great introduction to the laboratory. Soon after I began helping Brent Rudy with his experiments. I learned how to do the three major assays used for my research, namely the protein, carbohydrate and carbazole assays. All involve setting up and plotting standard graphs, using absorbance wavelengths read on the spectrophotometer and calculating the amount of (for example

protein) in the sample by comparison to the standard graph. I worked with Brent doing assays and in the 3rd week was given my own experiment to carry through from start to finish. It kept me quite busy but after awhile got repetitive. By the 5th week I was excited to start a new, totally different project - plasmid mini prep. The plasmid I was working on was PkanIT (pronounced - I'm not kidding - pecan pie-) I ~~didn't~~ experienced a delay when my bacteria didn't grow but I grew more and soon started my isolation. In the end I got a great result which was photographed for the write up of the work. In the 6th week I will be finishing the plasmid prep and doing an inventory of the laboratory's chemicals.

As for my general experience with WISEST, I could not have imagined a better summer. The people in my lab were extremely friendly and helpful. Dr Page, especially, was very concerned that I was enjoying myself. Department waterfights that included professors, techs, grad students and a few assorted kids, coffee breaks, and hallway and elevator conversations were great ways to meet people in my department. I learned alot this summer and judging from my conversations

with other WISEST students over lunch - I was not the only one who had fun and learned a lot. It's a great program which I will highly recommend to any of my younger friends!

WISEST Summary Report
by
Cindy Chiam
Dept. of Food Science
1989

During the past six weeks, I've had hands-on experience as to the nature of laboratory research and the many applications thereof. However the one major flaw that I found about the project I was working on is the lack of the scientific aspect.

The main project that I actively participated in involved the determination of total dietary fibres in various grains and vegetables as well as the soluble and insoluble fibre content. The ground-up sample to be tested is treated with the enzymes amylase, protease and amyloglucosidase to break down the starch. The next section of the procedure involved filtering to obtain the residue. This process brings me to Lesson #1 - research involves patience. Some of the filtrations spanned more than 1 hour! But the suction apparatus and glass-bottom filters are interesting.

Following the filtration the residue is further tested for ash weight (mineral content) and pectin content. To determine pectin content a spectrometer is used. Ash weight is simply determined by burning the substance.

Samples are also tested for malic and oxalic acid using a liquid chromatograph. As well, protein content is derived using the Kjeldahl method. The apparatus is very interesting and what was 'exciting' was the potential danger inherent of the process (the chemicals react to produce noxious fumes and sometimes the fumes 'bump' a lot). This is 'scientific'.

I also went to Leduc to the Food Processing Development Centre. Neat facilities! A suggestion for future wheat endeavours would be more field trips. What I witnessed here was not 'scientific'.

Other activities included going to the Cameron Library to look up materials for research and

washing many many test tubes and flasks. At least I had a mini-tour of the facilities.

A further suggestion would be to approach Dr. Monica Palsic next year. She researches enzymes, and the research involves many processes and technical skills.* Not as a negative remark but Dr. Corakal's projects are of a more commercial value.

Furthermore, it would have been nice if my supervisor actually "supervised" me. I suppose that may be one of the reasons why many times I had nothing to do.

Perhaps another discipline to consider for next year is to approach medical sciences. I am interested in a medical career as well as others and I am sure that such exposure would help me career-wise.

Anyways, I would just like to say that I certainly had an interesting + educating experience with Wisest. Thank you for the opportunity.

* Also recommended by a research associate is Dr. Peter Sporns.

Mary Modayil

Furugh Ardakani
Department of Chemistry
WISEST Summer Program

Dear Furugh,

Thank you for the experience gained by enrolling me in the WISEST program. Although I do not feel that the Botany department I worked in was a male-dominated workplace, I did understand how tiresome but eventually rewarding research can be.

My research included working under a graduate student, Barbara Nicholson, who was earning her doctorate by analyzing 63 different wetland sites in Elk Island National Park. I was given four different sites on which I had to gain background information by reading many books. Sometimes the books became tedious while I looked for reasons on how minerals entered the certain type of wetland. The actual work involved measuring the masses of wetland peat soil obtained previously that were at consecutive depths further down in that wetland. Samples were measured for mass when wet and after air drying. Then, about 0.300 grams of peat put in crucibles were ashed at 470 degrees Celsius in a muffle oven for sixteen hours. The weight after sixteen hours told how much inorganic matter or ash was actually in the 0.300 grams of peat put in earlier. Graphs and tables were drawn for easier comparison between sites and between depths in same sites. by determining each sample's bulk density and percentage of ash. From these graphs, an analysis was made by comparing sites and discussing how ash may have come into that wetland in certain quantities at certain depths. I wrote up a research paper in which I included my methods, evidence and discussion and submitted it to Dr. Vitt, our supervisor.

I think it was an educative experience because it gave me a hands-on opportunity to understand what actual research felt like. Before this, I actually thought research to be interesting but not a field in which I would enter in future studies. But now I may do some research even if it is not in the department of Botany. As well, it let me do something during the summer that I enjoyed and opened future opportunities for me. I am grateful for the experience the WISEST program gave me. Hoping to see you next fall when I enter the sciences,

Yours sincerely,

Mary Modayil
Mary Modayil

August 10, 1989

SIX

WEEKS

IN

THE

WIKEST
PROGRAM

By:
Lesley
Fraser

6 WEEKS IN THE WISEST PROGRAM

I was very excited to have been chosen to participate in this summer's WISEST program. This initial feeling has deepened into one of joy. To put it simply, I have had a blast these past six weeks. The people I have worked with, the support and tolerance they have shown towards me, has been very encouraging.

I must admit to feeling a bit insecure about being able to accomplish what was asked of me. As well, I worried about whether or not I would jeopardize the existing harmony in the lab. By the end of the first week these fears had evaporated. A friendly camaraderie developed between myself and my labmates, and I feel that I have gained four new friends. As well, they helped me in any way they could so that all the experiments I was asked to do were completed successfully.

I've learned a lot of things during my six week stay. First of all, my knowledge concerning the apparatus used in organic chemistry research has been vastly broadened. I never realized that there could be so many different pieces of equipment that needed to be used in one experiment alone. Therefore, since I hadn't a clue as to what a separatory funnel was or what it even looked like, I basically spent the first week reading about the different apparatuses from an organic chemistry textbook. Doing this first was very beneficial. It gave me time to get used to the lab and to familiarize myself with my first assignment.

I also learned that organic research is

2.

very repetitive, and at times, quite monotonous. But this can become a trap. For with repetition and monotony, carelessness can follow close behind. I remember once that when I was doing this one experiment for like the fifth or sixth time, my mind started to wander. Unfortunately, this started to happen when I was transferring the mother liquid in one flask to another. As you can imagine, I ended up spilling some of it.

I found that doing research requires a great amount of will power combined with an insatiable curiosity to find the answers to problems. It is the intertwined power of these two forces that drives the average chemist to work seven days a week, often until late at night, winter and summer.

I've also learned how to play a game called hackysack, which was introduced to me by the guys in my lab. The fundamentals of the game are easy to grasp. However, it takes some practice before they can be mastered. Lord knows that I haven't fully mastered the game yet. My timing has improved a lot but there are days when it is absolutely hopeless. There are good days though. It is these days that encourage me to try every lunch hour, and to withstand the goodnatured abuse thrown at me by my labmates as they make fun of my efforts.

When I first entered the WISEST program I thought that it would be like school in a lot of respects. It isn't. I mean, there are assignments that have to be completed, but the

atmosphere in this program is so much more congenial. I received the impression that the supervisors, graduate students, and people connected with the program really had my best interests at heart, and did their best to make my stay as enjoyable as possible. They succeeded quite effectively.

Unlike school, this program didn't really have a set timetable. Things didn't have to be rushed to get done. A relaxed atmosphere always permeated the environment. I wish this atmosphere was present at school.

In conclusion, I would just like to say that I shall certainly mention this program to my friends, who will mention it to theirs, and so on and so forth. It will be much like a chain reaction. I know already that my sister is greatly looking forward to participating in this program next summer. I thank everyone for giving me this chance to try something new and different this summer.

It was nice meeting you all.

Written by:
Lesley
Fraser

1989

beetlesbeetlesbeetlesbeetlesbeetlesbeetles

T h e W I S E S T E x p e r i e n c e

August 11, 1989
Heather Nychka
Victoria Composite High School
Entomology
Dr. R.H.Gooding/ Greg Pohl

As the first student from Victoria Composite High School to attend WISEST, I feel that I have experienced and accomplished many things these last six weeks that I will bring back and share with my classmates. Working under Dr. R.H. Gooding and a graduate student, Greg Pohl, has exposed me to research work in the Department of Entomology. As well, I have discovered a lot about other people's projects in the building.

I was directly involved with Greg Pohl and his Masters project, studying genetic differences between two closely related species of ground beetles, the environment in which they live, and the surrounding ecology. We made several trips around and north of Edmonton to collect these beetles, and for a two week period of time, Greg went on an extended search through British Columbia, Washington, Idaho, and southern Alberta. While he was gone, I remained in the lab measuring previously collected beetles, pinning others for collection purposes, and doing odd jobs for Dr. Gooding. I estimate, (from recorded data), that I measured a total of 219 beetles, pinned over 700 creatures, and labelled half of those same creatures in nine hours! My other jobs consisted of fetching computer printouts, washing petri dishes, getting dry ice for Dr. Gooding's work with tsetse flies, and proofreading a manuscript of his.

I mentioned before that I have also had the opportunity to talk to other people in the Department about their research. The other WISEST student in Entomology, Sophia Khan, and I associated with each other a lot; we helped each other out with our work. She accompanied me down into the River Valley, sometimes twice a week, to help me collect beetles from pitfall traps setup down there.

In exchange for her time, I assisted her in scooping flies from gerrid tubs in John Spence's lab. Both our supervisors were enthusiastic to have us working together, if only in these small areas, so that we were exposed, even more, to the different projects in the Department.

I think that the project sharing session was definitely a wonderful experience, but I think it would be even better if we could see the other WISEST students in action in their labs. Maybe one session could involve a rotation of students, or each week 5 students could be given a tour of 5 labs; something to create active interaction amongst the WISEST students.

Another important issue is the matter of insurance. I was very upset when I was denied the opportunity to go on a field trip to Saskatchewan, because we had no knowledge of what kind, if any, insurance coverage I had. I hope that in the future all supervisors are aware of their student's situations, so that they will not be denied valuable experiences in their respective fields.

Page 2

The most valuable experience I gained from being involved with WISEST is the exposure to the different aspects of the University that I received. When registering in the future, I will feel comfortable in the surroundings, I will be aware of the expectations and work methods necessary, and I will have been emmersed in the attitudes of the professors and the students. I feel that I am at a thorough advantage compared to other future students who have not been as fortunate as myself to have completed the WISEST experience.

I have been asked to apply for a job in the Entomology Department next summer, if I so wish, if there are funds available, and if there is a job for me to do. I will definitely consider the offer, because I have enjoyed working with the people in the Department as friends and as colleagues.

I hope that the WISEST program continues to provide similar experiences to more high school students of both sexes. I feel that it is important that knowledge of available job opportunities can only help create a better informed and educated population.

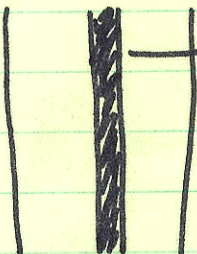
WISEST SUMMER RESEARCH
PROGRAM REPORT
by Janya Daum

WHERE: Department of Mechanical Engineering

SUPERVISORS: Iwona (pronounced "Yvonna") Smuga-Otto
Craig Owens
* under Dr. Bellow

RESEARCH: corrosion, fatigue, & wear of sucker rods.

Sucker rods are the rods inside of the main pipe of an oil well, which move up and down so as to pump the oil to the surface. The amount of corrosion, fatigue, and wear under certain conditions replicated from the field, is studied. Rods composed of different materials, or manufactured by various processes are compared. Data is gathered from these experiments and the samples are examined for details in cracking, wear, & corrosion. From this information gathered, conclusions are drawn about the best materials & processes of manufacturing to be used for sucker rods so as to gain superior stress resistance and long lifetimes.



sucker rod in motion up & down

WEEK 1: *performed corrosion experiments and gathered data concerning these experiments
*researched topics in the library and read about subjects concerning Iwona & Craig's research.

WEEK 2-6 : * library research and studies.

* prepared samples of sucker rods and tubing for microscopic analysis and photographing.

* used processes of cleaning, cutting, and polishing in the Metallurgical Preparation Lab.

* measured hardness, distances, diameters, roundness, flatness and other characteristics of samples for data comparison.

* prepared graphs and charts displaying the data gathered from experiments

CONCLUSIONS: I learned a great deal concerning modern research methods, the operation of many instruments and machines, and what Mechanical Engineering involves. We were given a 2-3 hour tour of the building and we experienced first-hand what research was done in the mech. eng. area of science. Also, the people in the building were very friendly, helpful, and understanding. They were always willing to answer any questions.

The friends and acquaintances I made during these last 6 weeks will be a support when I attend the University in a year or so, and I appreciate the opportunity given to me to meet these great people.

I feel that the WISST program provided an excellent opportunity for me to understand a career

possibility which I had been contemplating). My awareness of scientific research and areas of career choices was expanded greatly. I ~~also~~ learned that patience and preciseness is critical to scientific research and I also gained an interest into the specific research topics I were helping with.

The library and campus tours were very helpful to my activities around the University this summer, but, they will also be beneficial in the years to come. All-in-all, I had a wonderful time this summer and learned a lot. Thank-you for allowing me this opportunity.

Tanya
Kaur

WISEST RESEARCH PROJECT SUMMARY.

Catherine Elliott.

For a six-week period this summer, (July 4 to August 11), I worked in the Department of Zoology at the University of Alberta. I was placed in the Limnology laboratory under the supervision of Dr. E.E. Prepas and Mrs. G. Hutchinson.

Limnology is the science that deals with the physical, chemical, and biological properties of fresh waters, especially ponds and lakes. Dr. Prepas is concerned with a project to help purify various lakes in Alberta that are polluted by troublesome blue-green algae. High levels of phosphorus encourage rapid growth of this algae which robs the fish of oxygen and also disrupts the lake's biological community. The project involves adding lime to lake water; this neutralizes the phosphorus and thus slows algal growth. Samples were taken from different lakes in Alberta and brought back once a week to the Limnology laboratory where different tests were performed. These tests monitor the cleansing process.

In my first week of work, I was taught how to run two of the tests: Colour and Turbidity. For the Colour testing, 40 mL of sample was placed in each of two plastic tubes; the tubes were then run through a centrifuge for 10 minutes. Afterwards they were poured one at a time into a machine that shone light into the water. The colours of the samples were then matched to standards provided on colour reels and the results recorded. A turbidometer was used to measure Turbidity. After the machine had warmed up, it was standardized. Then 25 mL of sample was measured out in a graduated cylinder and poured into a glass cylinder-shaped tube. The

exterior was wiped clean and the tube placed inside the turbidometer and covered with a black cylinder. Light was passed through the sample and the machine presented a measurement of turbidity. The results were again recorded. This test was duplicated for each sample. After all the samples had been tested, the data was written up on sheets and then entered into a computer. I was involved with these two experiments for the majority of the six-week period.

When I had finished Colour and Turbidity testing, I often filtered samples to prepare them for sulfate and nitrate testing. The actual tests were done by other members of the laboratory. I also tested Total Dissolved Solids (TDS). This experiment involved weighing a crucible that had been pre-heated in an oven and then cooled for 20 minutes. 50 mL of filtered sample was then poured into the crucible which was placed in the oven overnight to evaporate the water. The next day, the crucible was cooled for 20 minutes and weighed again. The difference in the weights of the crucible before and after gave the amount of TDS. The test was repeated twice for each sample.

A final technique I learnt was how to prepare samples for phosphorus testing. This was a complicated test involving many steps and various chemicals which had to be added to the sample. Basically, 9 test-tubes were needed for each sample; 50 mL of filtered water was poured in 6 tubes and 3 tubes were filled with unfiltered water. 3 tubes containing filtered water were removed and placed in another rack. A chemical powder^(potassium persulfate) was added to the remaining 6 tubes and they were then placed in the autoclave, (a machine for heating using steam under pressure). After they had cooled, all samples were mixed with a chemical reagent and then measured for phosphorus in a spectrometer. (Using the

same procedures, standards were also prepared for comparison). All results were recorded.

For one day in the middle of my working period, I went with four members of my laboratory to rake algae from two of the lakes treated with lime. It was hard work, but it was interesting to see some of the lakes that we had been testing.

As well as learning about laboratory research, I also learnt other techniques that were necessary for the laboratory to remain functional. For example, every night dirty glassware was placed in an acid bath and the next morning this glassware had to be rinsed with distilled water 7 times. Metal equipment was placed in a soap bath and this also had to be rinsed.

The six weeks I spent in the Limnology laboratory were extremely rewarding. It was an educational experience that will certainly be beneficial throughout the rest of my schooling, (including my university years). I learnt many different things about working in a laboratory and discovered how a research laboratory operates. Although hard work and patience are needed, I learnt how to work quickly and efficiently, whilst still retaining an important degree of accuracy. I would like to thank the WISEST program, and the companies that provided funding, for presenting me with the rare opportunity to work at the University, and for an experience that I shall never forget.

I really enjoyed working in the Department of Immunology. My experience was most exciting and rewarding. I had the opportunity to work with human blood cells and practise valuable empirical skills. During the 6 week program, I learned how to purify & count cells of a buffy coat, do immunofluorescence assays, set up proliferation assays, pulse & harvest cells, and use FACSscan. These techniques were the major empirical approaches within my project. I also learned a great deal about scientists and careers in research. I was also fortunate enough to have good relations with the other people in my lab and to make valuable friendships.

The following sheets are copies of my lab reports from my project. These sheets will clearly portray the details of my summer research program. Thank you ^(wisely) for providing the opportunity.

Jameda Kherani

"Department of Nursing". These words glared at me from the page that I held in my hand. What was I getting myself into? All I knew was that my summer, my freedom was about to be infringed upon.

"Is this the room?" I asked myself rhetorically as I stood transfixed, staring at the glossy black numbers on the door. With a sigh, I gathered my courage and stepped into the room. Almost immediately heads turned and beady, keen eyes pierced my skin with their stare. I felt out of place, and rightly so, for there I stood in a room full of thirty some odd females. A bead of perspiration formed on my brow. I brought my hand to my mouth and produced a meek, nervous cough. My spine tingled as I dragged myself towards an open seat at the far end of the room.

My fears had already begun to materialize. I scanned the conglomeration of faces, but I found none to be familiar. Then, as though by chance, my eyes drifted to my right and met with another half-frightened, half-stunned boy. Wearily, I smiled at him, thankful of the fact that I was not the only boy, and for that brief moment my fears subsided.

After the meeting, I walked over to the boy and introduced myself. He informed me his name was Jeff. I did not know at that time that he and I would be partners...

Our six week work period was a whirlwind of new and unusual experiences. In the first week the skill of using the photocopier was mastered. My ability to perform thorough library searches, using the advanced library computer system, was honed. I was enjoying my work, but still I felt unchallenged. Interestingly, that only lasted until the beginning of my third week of employ.

"We are designing a revolutionary bed alarm system," Dr. Jan Morse, our supervisor said with a smile, "and you two are in charge of testing its reliability." My blood coursed through my veins and I felt an uplifting surge of energy. The challenge of actual research excited me tremendously. Jeff and I were left pretty well on our own to perform the sometimes gruelling tests. My initial excitement began to wear off and it was

replaced by a sense of realism, for now I knew that research, too, was difficult and somewhat mundane. I must mention, although, that I felt great satisfaction upon completing this task. As I watched the shiny, printed pages of data slide out of the gaping mouth of the computer printer, I experienced a feeling of heightened self-worth.

My next surprise was plotted by Pat Donahue, one of the graduate students working for Dr. Morse. Pat smiled and handed Jeff and I several large jugs of dull yellow-orange fluid. "So much apple juice?" I said slyly, not knowing what lay in store. Seconds later it was imparted to me that this fluid was a urine sample from a research study of postpartum mothers and that we were in charge of measuring the volume and specific gravity of the putrid samples. Strangely enough, I extracted some form of deranged enjoyment out of this experience.

If I look back upon the experiences of the last six weeks, I am filled with uneasy satisfaction. My uneasiness is not result of frustration or dissatisfaction, but rather due to the fact that it has ended so soon, something I never thought I would hear myself say.



Dinesh Deonarain
August 9, 1989.

WISEST Summer Program

July 4 - August 11, 1989

Who I Am:

My name is Christa Heinrichs, and I live in Fort Saskatchewan. This fall I will be completing the International Baccalaureate diploma program at Salisbury Composite High School in Sherwood Park.

How I Heard About WISEST and its student work program:

I initially heard about WISEST when Dr. Armour spoke to grade 12's at my school last winter/spring. I found out more at the WISEST display in CAB during University Orientation Days in spring.

Where and Who I Have Been Working For the last 6 weeks:

I received my second choice and have been working in the Department of Mechanical Engineering under official supervision of Dr. Bellow. Dr. Bellow has had less time to spend in Mech. Eng. after recently becoming a Vice-President of the University, so he appointed Iwona Amuga-Otto and Craig Owens as our (Tanya Daum and mine) supervisors.

Iwona is a chemical engineer and Craig is a mechanical engineer. They research they work on is fatigue and corrosion and the wear of sucker rods used for downhole in the oil wells.

What I Did:

I ran Iwona's corrosion experiments for the last 6 weeks. They are run by a machine called a potentiostat/galvanostat, connected to an IBM computer. The Princeton Applied Research program allows for a specimen to be 'artificially' ^{vs} system of nature's corrosion in

by applying ^{potential (voltage)} either at a scan rate of 0.1 mV/s (slow) or 5 mV/s (fast) (5 days) connected and the corrosion rate calculated.

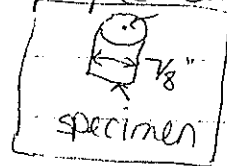
The experiment is set up as an electrochemical cell, with graphite (carbon) electrodes as cathode and anode, a hydrogen reference electrode for calomel cell which serves also as the salt bridge, using KCl sol'n. A purger with inlet/outlet supplies air, and/or gas, which is controlled by a rotameter.

The set of experiments ran were called FAT3, FAT4, FAT5 and FAT6. There was also a repetition run of each cell. The metals tested were called QA/Pass, QAS/Pass, QA/Pass, and Norris-75. They were of varying surface preparation, glass blasted, fabricated, fabricated, and as manufactured respectively. This set of experiments was in a 8% NaCl aerated and CO_2 saturated solution. Each experiment was carried for 1% of specimen equilibration.

6 experiments were run a day; cyclic polarization technique and polarization resistance technique. Graphs were then computer plotted & printed, and analysis & calculations done. Comparison graphs and manual calculations.

I also learned/did:

- 1) a practical use of Chemistry 30's unit on Electrochemistry.
- 2) measure pH before & after each experiment.
- 3) how to operate an ultrasonic cleaner to clean specimens with detergent, acetone, and finally ethanol.
- 4) mixed up Ameron protective coating paint and the perfection needed to paint 2 coats on the sample top & bottom.
- 5) how to calibrate a pH meter using buffers.
- 6) how to operate LOTUS 123 to make spreadsheets, graphs, and charts to store data.



- ① the important part - kept accurate and neat records of all data.
- ② glass cleaning methods + general setup of cells, experiments.
- ③ clear rods from fatigue/corr. experiment.
- ④ how to prepare 8% NaCl and 3.5% NaCl solutions.

And I:

- used a strobe light
- " ultraviolet light
- had a tour of the whole mech. engineering building.
- had my picture in the paper.
- OF COURSE! - I had lots of fun and I it was a great experience.

Now, I:

I am possibly going to become either a mechanical or a chemical engineer. The experience showed me the things engineers can do, and the importance of the career and the great ^{need and} future opportunities.

I appreciate being selected for the program, and feel it is an eye-opening experience that can change your future. I am sure it will have an impact on me.

The WISEST summer research program

Chantal Richard

Although this program lasted six weeks, it did not seem like it. I enjoyed it so much that time flew by very quickly. During this time I met many people at the university that I will definitely keep in touch with and learned many different things.

The first week I became more familiar with the lab. I mainly worked with the many chemicals found there, getting various information from each chemical and putting it on a new computer my supervisor had gotten. Basically I was making an inventory list of the chemicals found in the lab.

The second week and the ones that followed were when I actually worked more on my research project. I started off by making culture media and growing various stocks of *Neurospora crassa*. These included wild type species and mutant species called Met 9 that were temperature sensitive. I then inoculated Vogels media, which I had made, and grew these various types of *Neurospora crassa*. After one type had finished growing I would harvest it and do a cell extraction. This was followed by various cleavage procedures such as acidifications, reductions, base treatments and zinc reductions. The next step would be the formation of azo dyes and this was followed by other various steps to prepare the solution for the HPLC. This separated the p - Aminobenzoylpolyglutamates according to chain lengths. I didn't get to see many of the results from the HPLC since this took a lot of time for each sample and I wasn't the only person using the machine but I will probably go back to see more of the results.

During the six weeks I also made different buffers for the HPLC, various strengths of acids and many other solutions. I learned how to use diverse machines and instruments such as the centrifuge, the flash evaporator, the autoclave, the pH machine and the dishwasher. I also helped the graduate student I worked with with some of the tests he was doing. One of these things included enzyme assays.

I found this a great opportunity and was glad I was able to experience it. I am definitely not ruling out research as a career. The WISEST program is something I will certainly recommend to others.

Wisist Summer Research Project

I was assigned to the department of chemistry, under Dr. Allen Hunter. I was going to be working on organometallic compounds, and knew I had a lot of learning to do in the next six weeks.

I was quite overwhelmed by the equipment in the lab when I first arrived. However, I had a very helpful undergrad student who spent about a week showing me around the lab and chemistry building. By the second week I was ready for my own reactions.

Dr. Hunter was very trusting and confident in me, and I was actually a part of the research. In the five weeks before this one, I made a total of seven compounds. The last week I used mainly to tie all the loose ends together. Six of the reactions turned out great, but one was destroyed when it fell out of the fudge.

Our main research goal was to analyze the properties of various arene compounds and how well they conduct electricity. We are searching for a "perfect conductor". Arene compounds have certain bonding characteristics which help in this research.

To all the starting compounds was added chromium hexacarbonyl. This solid has bonding properties which are easy to detect by our methods of analysis. A typical

reaction process would go as follows:

- the reactants were reacted in a flask under $N_2(g)$
- the solution was filtered to rid of impurities
- the solvents were removed under vacuum
- the crystals were recrystallized to ensure maximum purity.

After the crystals are obtained, they are put through four tests:

INFRARED: Which measures the frequency of bonds

MASS SPECTROSCOPY: Which shoots an electron into the crystals to separate it into all its different parts

ELEMENTAL ANALYSIS: Which detects the purity of the compound

NMR: Which detects the different carbon bonds present.

By applying the above four methods, we can tell if we have the product we wanted. We then have it tested with electrochemistry.

One thing I have learned is patience. Compounds may be air, light, water, or moisture sensitive. Often great pains must be taken to keep the compound from decomposing. Still, many compounds must be redone many times until desired results are achieved.

This WISEST program is an excellent learning and teaching tool. I not only learned a lot about chemistry, but about the entire University, which will be useful in a couple of years. I hope this program continues for many more years.

KATHY MATTHEWS

A WISEST SUMMER

By Karen Chen

For Furugh Ardakani

August 11 , 1989

A WISEST SUMMER

Report by Karen Chen

About two months ago, I was overjoyed to receive a letter informing me that I had been accepted at the WISEST summer research program. At the time, all that I was really concerned with was that there was an opportunity for me to earn some money at a job which was not as easy to get as the typical high school students' jobs. However, I was to learn soon that WISEST was more than just an opportunity to earn some money. It was also a valuable learning experience about past and present views on sexual discrimination and past inequality of opportunities in certain career fields. Also, it made me aware new and different possibilities for a future career.

In actual fact, I had already had my mind set on a medical career before I attended the WISEST program. Now that it has come to its close, I still have to say that I most likely am not changing my mind and entering the Department of Chemistry and becoming a research chemist. Initially, I had been under the misconception that research was always involving new and exciting things. However, from my experience in natural products chemistry, separating compounds, I have learned that research is repetitive, frustrating, and, as said by one person at the WISEST luncheon, glimmers of excitement surrounded by clouds of drudgery. This is not the only reason I have ruled out a career as a research chemist. Another is the health hazards involved.

Natural products chemistry, or at least the project I was working on, involves a great deal of use of solvents, many of which are harmful to one's health. Some are carcinogens, both directly and indirectly, and others cause damage to the central nervous system and major organs if inhaled. And of course, inhalation of some of the solvent is nearly inevitable. I don't think that I feel so strong about having a career as a research chemist that I would sacrifice my health.

During the six weeks of WISEST, I worked on a project involving the isolation of fungus metabolites. The fungus, Sirococcus has two strains, Sirococcus 20 and Sirococcus 33B. It is a pathogenic parasite of pine trees in areas of western Canada. The project involves preparing cultures of the different strains of fungus, in different media, and different areas (parts) of the fungus being studied. The fungus metabolites are extracted and isolated. Sandra, the graduate student I worked with, extracts from the mixture a certain compound, and the rest, I attempt to separate, using column chromatography. Separations was almost all I did as well as attempts to stockpile the fractions. The separations were not as successful as hoped, and I never got to isolating actual compounds (pure) and doing the bioassays which, as I recall was part of what was expected. Separations got quite tedious, as well as doing TLC's to see whether or not I had had any pure compounds - all disappointments as none were even close - from the fractions.

First, cultures of the fungus are made. After 4-7 weeks, The fungi is filtered out from the media, dried, ground up, and run through a reflux condenser with Dichloromethane as a solvent to extract the metabolites. The fungi is in the condenser for about two days. The mixture of metabolites extracted is then run through a column, and Sandra takes out a specific compound which she has been researching. The rest, I attempt to roughly separate into fractions and combine similar fractions. This past week, I have attempted to isolate a specific compound and to run a spectrum. I have not yet succeeded, though I hope to on the last day. I have been doing only separations from about the fourth week on. Besides that, I have washed many culture flasks, Erlenmeyer flasks, beakers, and round bottom flasks as numerous ones are needed for each separation and the supplies are limited.

My experience at WISEST has made me have more respect for scientific research and those who do it, for now I can appreciate the long hours of work just to come up with one thing. For example, in attempting to purify a compound, a column is run again and again, as many times as needed to get it pure. Even though I do not plan on becoming a research chemist, this experience, I think, has given me preparation for the scientific studies I must do before getting into medicine. I will have to take chemistry courses, most of which consists of this type of work.

Just before I forget, after a compound is isolated, bio-assays are done with pine seedlings to see which ones are the truly pathogenic ones. However, I never got to that stage.

Though I realize that there are many fields in the sciences which are dominated by one sex or the other, and that this often intimidates the opposite sex from the choice of this career, I have also realized from this experience that it is not traditional modes of thinking and peer pressure which may keep someone from choosing a particular field, but a lack of liking for the particular type of career. I seem to find that a great deal of students in the WISEST program will not choose the type of career they have been placed in simply because they are not suited to it or they simply dislike it. Equality of opportunity, not necessarily of result (i.e. 50% male, 50% female) is what should be emphasized, though there is the possibility of equality of result as well.

Another thing I learned at WISEST was that many of the common stereotypes simply were not true. I found the atmosphere of the workplace quite relaxed and easygoing, and the faculty members normal, with good senses of humour and fulfilling lives.

All in all, WISEST has been one of the best and enriching experiences I have had. It will likely influence greatly my choices later on.

August 11, 1989

WISEST 1989
By Melanie R. Bodnar

John Chapman expressed the educational value of the WISEST SUMMER RESEARCH PROGRAM when he said that the "gift of teaching is a peculiar talent, and implies a need and a craving in the teacher himself". As one of the thirty-six participants in this program, I had the opportunity to learn from a man who possessed this "peculiar talent", and am sure that I will continually rediscover the wealth of knowledge that he and his co-workers passed on to me. Not only was I exposed to the field of science, but, perhaps more importantly, I glimpsed the personal and emotional aspects of a career in research. The enthusiasm generated by Dr. Cass kindled my interest in his current project and inspired me to pursue a career in the sciences. With my interests awakened, the philosophy of WISEST has made me believe in my ability to achieve my goals.

From July 4 to August 11 I worked in the department of plant anatomy under the supervision of Dr. David D. Cass, along with Janice, Leanne, and June (all three women are continuing their studies at the U of A this year); Bill and Zoran (graduate students); and many others from different departments who kindly took the time to acquaint Carolyn (my fellow WISEST student) and I with their respective areas of interest. Everyone was friendly and hospitable, making me feel completely at ease to ask questions and enjoy myself. I never imagined that a summer job could be so rewarding, but this summer I found the perfect combination of fun, friendship, and discovery.

Dr. Cass specializes in the reproduction of angiosperms and is currently focussing on the growth of pollen tubes in Papaver rhoeas (poppies). Dr. Cass, Janice, Leanne, Carolyn, and I worked as a team to solve the mystery of pollen tube growth in this particular species. We used a number of different approaches and in the process I acquired skills in planning and preparation, observation and interpretation, as well as communicative and cooperational skills. The experience I have gained will be valuable regardless of the field I go into--fortunately I will have a head start and can go into a lab with confidence. Realizing the importance of honesty and accuracy in research, I am careful not to draw premature conclusions, but rather speculate on alternate possibilities and develop an open mind. Curiosity and creativity go hand in hand when it comes to science. Whether it's finding new techniques, theorizing, or presenting new information, the ability to be original and resourceful characterize those who are successful. Patience is a scientific virtue, especially when coupled with an unsatiable desire to know. Genuine interest in one's field of study should be the primary motivation in choosing that career, (\$\$\$ should run a close second!) since a researcher's wealth is in his personal

achievements. Dr. Cass exemplifies these qualities. At first I thought "Is this man crazy? How can anyone get excited over a flower's sex life?!" ... the next thing I knew I was sharing his excitement, fully realizing what barriers ignorance constructs. My friends expressed the same amazement when I excitedly spoke of pollen tubes growing through seaways of stigmatic hairs into ovules, repeatedly exclaiming "WICKED".

And in a word that describes my encounters with science this summer. I spent my first week getting acquainted with the lab and the people in it. I did alot of voluntary reading which allowed me to fully appreciate the work I was embarking on. Something must here be clarified: "work" does not at all describe what I did for six weeks of the summer, as my experiences were too enlightening and entertaining to be thought of as work (** thanks to the very nature of the people in my lab-- they really did make all the difference**). Dr. Cass familiarized Carolyn and me with the botanical jargon, and we agreed that learning the specialized language of a field is half the battle. The other half (generally speaking) is a more hands-on approach and involves a little more risk of personal and pocket-book injury. The microtome a.k.a. the meat slicer is a greater environmental threat as opposed to the economic dangers posed by lab glassware. Fortunately I was not a microtome victim, although I can't say I was spared of glassware woes. Carolyn and I prepared tissue for paraffin microtomy. Following infiltration and embedding, the wax-bound gynoecia was mounted on a wooden block, trimmed and fastened in the microtome. Precise adjustment of the microtome allowed us to produce ribboned sections which were mounted on slides using a chemical mounting medium and then left to dry for a couple days. We then put our sections through a staining series, mounted the cover slips, and prepared for our journey into the miniscule universe of the microscope. Trusting one's own judgement is not always a comfortable feeling, but is essential to lab work.

Ahh... the microscope... I'm spoiled and cannot help but to frown on our primitive microscopes back at little old Harry Ainlay. I gradually became competent in various types of microscopy: brightfield microscopy, Nomarsky differential interference, fluorescence microscopy, and techniques using oil immersion and polaroid lenses. I must interrupt my scientific description with a bit of a romantic interlude. The microscope is man's passage to another dimension; much exploring remains to be done for in this infinitely small world lies the answers to some very large and devastating problems. Now, back to science. After scanning what seemed to be thousands of slides we were prepared to capture our microtomy expertise on film. Luckily, neither Carolyn nor I contracted microscope sickness which Leanne assures me is a very real thing. "Photomicrography With Carl Zeiss"--- learning to take pictures with the microscope really made me feel like a scientist, and is another area where creativity is

appreciated. My ability to work with the microscope is the most valuable of all my technical skills. I had the good fortune of being informally introduced to the electron microscope, where I saw organelles become reality and not merely textbook artifacts.

Live and learn—how true of the scientific process. Not until we had actually followed the procedures did we understand the value of meticulously recording what we did. Nonetheless, our results were incredible! The sections had an abundance of pollen tubes of various patterns. The staining brought out sufficient detail without creating annoying blobs of colour. Knowing that I was jointly responsible for these results continues to give me great personal satisfaction. I can imagine how Dr. Cass must feel when he gets a paper published.

Scientific research does require a bit of luck. I got a dose of it one day when I came across two sperm nuclei travelling down a pollen tube en route to an ovule. To capture this voyage in paraffin is a rare event and produced quite a sensation. I felt as though I had contributed to Dr. Cass' project, and to me that is the biggest reward: knowing that my efforts produced something of use to someone.

The summer of 1989 has been an unforgettable experience. I thoroughly enjoyed being on the university campus. I feel as though I truly belong here. I have found my haven, a place where the things that I value are an intricate part of the atmosphere. I would like to thank everyone for giving me the opportunity to learn and to "grow". I wish you all the best of luck.

Thank you very much for allowing me to participate in your program. I look forward to sending you my plans for "publicizing" WISEST at my school. The media attention has been great, Carolyn and I really enjoyed ourselves. Good luck with your studies.

Melanie

August 11/89.
Carolyn Ransum

This summer, Melanie (another WISEST student) and I worked in the field of Botany. Our supervisor Dr. Cass. put us to work on one of his numerous projects:

How do pollen tubes get from the stigma of the *Papaver rhoeas* (a species of poppy) gynoecium into the cavity of the ovary?

At first, because I knew little about angiosperm reproduction, this question made little sense to me. However, after a mere six weeks I can not only partially explain the answer to the question posed; but, I can also speak reasonably intelligently on a subject that was once alien to me.

The first few weeks in the lab were

pretty much a quick general botany course. On top of learning the jargon that is used in angiosperm reproduction, Melanie and I also found it necessary to perfect the skills required to prepare Papaver tissue for the various types of microscopy. I was surprised at just how much delicate manual work was necessary to prepare slides. Melanie and I had to learn the difficult and frustrating art of microtoming or cutting thin pieces of tissue into ribbons for mounting, placing and securing the sections on slides without damaging the tissue, with toxic chemicals when preserving and staining the tissue and other.

techniques. Through trial and error, Melanie and I quickly realized that the attainment of manual agility in slide preparation was vital in order to obtain accurate and consistent results.

During the last six weeks Melanie and I also taught the skill of microscopy. It was necessary for us to know how to make numerous adjustments to the microscope in order to correctly interpret the information we found on our slides. In all, Dr. Cass exposed Melanie and me to seven different types of microscopy (Brightfield, florescence, polarizing, transmitting electron, scanning

election, Nomarski interference and oil immersion). I had worked with microscopes before, but I had never realized that there were so many ways to examine the same section. ^{It is amazing} ~~that~~ each type of microscopy reveals something different about the section.

It took us about four weeks to prepare, mount and stain our tissue. It was only after this long process that we could deal with the problem that had been presented. Melanie ^{and I} discovered the channels that the pollen tubes ^{travelled} ~~followed~~ en route to the placentae, on the slides that we, ourselves, had

made!

Finally, Melanie and I had to learn another seemingly unrelated scientific procedure - photography. ^{This was because} Dr. Cass.

asked us to use the photomicroscope to take pictures of the channels.

that we had found. Though this sounds amazingly easy, it required a certain expertise. ^{justly,} this process.

requires a great deal of legwork; we examined our slides and then chose the section that best illustrated what we wished to photograph. Then we had to adjust the rheostat.

(strength of light), play with different filters and magnifications in order

to get the best picture possible. As well. Melanie and I were given the opportunity to learn how to roll, load and develop film. Photography was often a trying and tedious task, but it had its rewards. When I examine the negatives of the pictures we took, the sum of the work we did during our six weeks in the program, it fills me with a sense of accomplishment.

The people in the lab where we worked ~~are~~ were great. Dr. Cass, Leanne, Janice, Bill and Zoran were extremely kind, helpful and, above all, patient. They were always willing to stop what

They were doing and answer our questions, regardless how stupid.

The six weeks I have spent in the WISEST program has been time well spent. Botany is a science that we do not cover extensively in school. and the program has given me an opportunity to "expand my horizons." I have gained insight into the amount and type of work which is done by scientific researchers as well as the employment possibilities of people in this field. All in all, its been a great summer!

Wiseest Report

Huong Nguyen
Chemistry Department
Supervisor: Dr. M. D. Armour
Fri, Aug 11-89

Aug 11-89

Summer gone by so fast for me. During this past six weeks, I had been exploring the university, acknowledging new information, and performing experiments with chemicals.

I had been touring around the university lots and becoming familiar with the university, and its system. At first, I thought that I would get lost in this huge place, but little did I know, it was like a home to me. With curiosity, I sneaked through every room I past. This gave me an opportunity to see most of the weird, unique and expensive equipments and the different style or designing of each building and each room. The thing that was scary to me was the large lecture theatre which could hold up to four hundreds students or more. This was totally different from high school.

By listening, asking and seeing many stuff, I had ~~to~~ learned so many things during this past six weeks on campus. People here are way different than what I had ever expected. I always thought that professors are mean and that they won't answer any question from a dumb or unexperience student. How wrong I was; the professors are so nice to an extend where I can interrupt them with a stupidest question without having an insult.

My marvellous supervisor, Dr. M. J. Amour, a very tough, intelligent and energetic woman, had been supporting and helping me throughout this past six week. My group - the people there made me felt like home. I had learned so much also by listening to the conversation of the professors and graduate students. It provided me with alot of interesting and helpful information.

Working in the lab is the most exciting and interesting part which made this summer the most unforgettable year ever. I ~~at~~ actually got a chance to work in an university lab with many different chemicals and equipments which is way different from the high school lab. For the first few week, I began to learned the basic chemistry laboratory equipments and safety. I became familiar with ~~most~~ a few chemical and its property. I did a few laboratory experiments in the Organic Chemistry 250. I had been learning how to used the Gallenkamp (thermometer calibration), ~~determination~~, determining the melting point of a substance, and many more. After getting used to the equipment, I began to worked on my project. My project was to find the procedure to make a substance call bitrex (the bitterest chemical known to men). In order to make bitrex, I first had to make lidocaine. It took me approximately

two days to make lidocaine which is only about 1.0 g. And I needed more lidocaine than that (about 3.5 g). So, for ~~the~~ about a week, I began continuously making lots and lots of lidocaine. For the last two week, I started on my major ~~to~~ project. I had been trying many way of producing litrex and finally on my fifth trials, I had succeed. I couldn't done it with Joanna, Alonna, Pat, John, and Mr. Armour. (They are all working in my group) I never thought I can ever make litrex but I did.

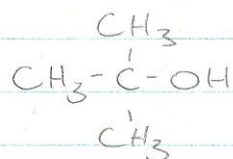
This is the most enthusiasm summer holiday ever. I ~~feel~~ feel that I'm very lucky to ~~get to~~ be chosen to be one of the wisest students. This program is both an educational and fun experience to me. I can't emphasize how much I love this program and appreciate people who help and support ~~to~~ it. No matter ~~no~~ how much I say, words can't describe what I had been doing for the last six weeks. Only if you had been there, you'll know what I meant.

My six weeks

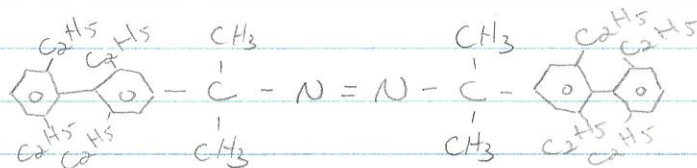
by Pat Portwood

Tuesday, 3
July 4th

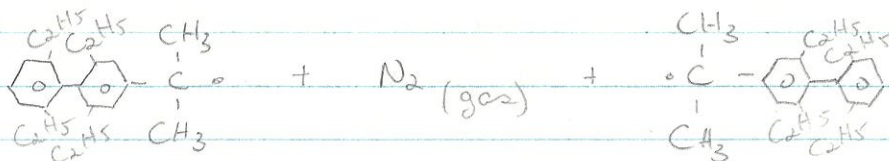
Today I was introduced to Dr. Karl Kopecky, the researcher I'll be working under. I am stationed in the Chemistry Department, and the work I'll be doing for the next six weeks will be done within the laboratory. My job is to determine the ratio between disproportionation and coupling with large molecules. By doing this, I am testing a theory; I'll determine that if by increasing the molecules size, whether the probability for disproportionation does in fact increase, thus following the trend already set, or whether coupling becomes more prominent. I'll be starting with a base compound, t-butyl alcohol.



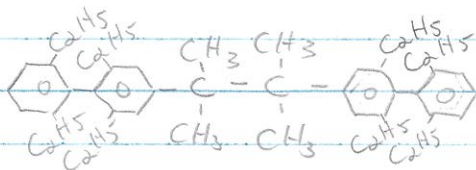
By adding various chemicals at different stages the end product will be:



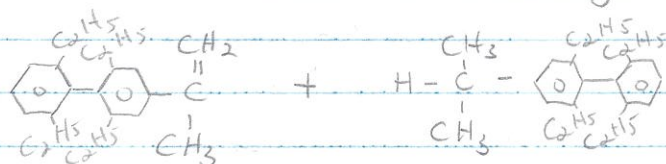
From this compound, the two Nitrogen (N) atoms will bond, forming Nitrogen gas (N₂). What will remain is:



The two radicals will either form a bond together, a process known as coupling.



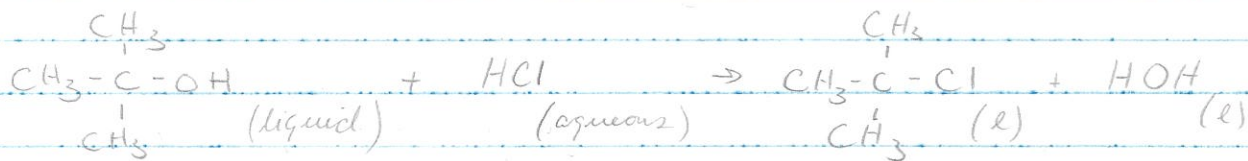
... or go through disproportionation,



where one carbon atom gives up its hydrogen and forms a double bond.

First, I'll be going through the whole procedure with reduced amounts. The second time I do the procedure, it will be with the amounts doubled.

Wednesday:
July 5th.



t-butyl alcohol + hydrochloric acid $\rightarrow$ t-butyl chloride + water

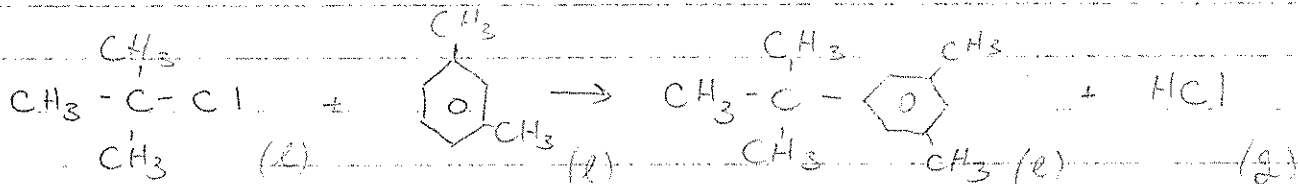
Under the fume-hood, I placed 50 ml of t-butyl alcohol and 150 ml of concentrated HCl into a separatory funnel. T-butyl alcohol is a solid at room temperature that looks a lot like ice. In order to measure out the 50 ml, I first had to melt the t-butyl alcohol by placing it in a hot water bath.

Once both compounds were in the separatory funnel (a separatory funnel is a container with an opening in the top, and a spout on the bottom, this makes it easy to separate layers.), I had to shake it hard for 10 minutes, and then let it stand. After awhile, three layers had formed, a clear layer at the top and bottom, and in the middle, a cloudy layer. Only the liquid at the top layer, the t-butyl chloride was needed. The two bottom layers were merely water.

I then "dried" the t-butyl chloride, that is, I placed some Calcium Chloride (CaCl_2) into the container. Calcium Chloride is a solid at room temperature, and is about the same size as beads. When some Calcium Chloride is put into a solution containing water, it will absorb all the H_2O molecules, expand in size and glue to the other CaCl_2 "beads" within the solution. Thus, by removing H_2O molecules from the solution, CaCl_2 "dries" the liquid.

Next, I had to distill the t-butyl chloride to remove any remaining HCl . The boiling point was approximately 49°C . After distillation the mass of the product was 42.18 g.

Thursday:
July 6th



t-butyl chloride + m-xylene $\rightarrow$ 1-t-butyl, 3,5-dimethyl benzene + hydrochloric acid

The number of moles of *t*-butylchloride was calculated to be 0.2600 mol. The ratio for the number of moles of *t*-butylchloride to *m*-xylene was 1:1, therefore 0.2600 mol of *m*-xylene was needed in the reaction. This converts to 48.84 g or 56.26 ml.

Under the fume hood, I placed both chemicals into one 500 ml filter flask. A filter flask is shaped much like an Erlenmeyer flask except it has an extension coming out from the side. From out of the extension I attached a funnel, which was in turn attached to some tubing, and finally, the water pump. The large end of the funnel would trap the HCl gas released in the reaction, then it would be pulled through the tubing by a vacuum force and then enter the rushing water which dilutes the HCl to render it harmless.

The filter flask was placed in an ice bath because when *t*-butylchloride and *m*-xylene react, they give off heat (exothermic reaction). After both chemicals were well stirred, I added about 5.0 g of Aluminum Chloride ($AlCl_3$) slowly. I had to be careful not to get it wet, because water, even just the moisture in the air, can ruin $AlCl_3$. The $AlCl_3$ in the solution caused green bubble formation (HCl gas). I had to let it stand a while to ensure the reaction had completed.

After one hour, I poured the solution into a separatory funnel already containing 50 ml of H_2O and 20 ml of HCl . I shook the contents, then drained the water. I washed the organic layer twice with water, and once with Sodium Bicarbonate ($NaHCO_3$). This is done to make the solution free of acid and somewhat purer.

I then dried the solution with $CaCl_2$, and distilled it.

The product mass was 38.89 g, equivalent to 0.2400 mol.

Today, I also went down to the library, and Dr. Kopecky showed me how to look up the procedure for doing a Bromination reaction, (adding a Bromine atom to a compound). I will start the reaction tomorrow.

Friday,
July 7th



1-t-butyl, 3,5-dimethylbenzene + Bromine $\rightarrow$

2-bromo, 5-t-butyl, 1,3-dimethylbenzene +
hydrobromic acid

Unfortunately, the reaction that I copied out yesterday turned out to be the wrong one needed for my particular experiment. Dr. Kopecky had to therefore go back down to the library and photocopy,

due to time pressure, the right procedure.

In a 3-neck flask I put the 38.89 g of 1-t-butyl, 3-5-dimethylbenzene, and added 20 ml of Carbon tetrachloride (CCl_4) which acted as a solvent to slow down the reaction. I then employed the magnetic stirrer, it consists of a magnet shaped like a capsule which goes into the solution, and a cylinder which is placed underneath. When switched on, the capsule rotates, and thus stirs the solution.

Through the left neck was placed a thermometer, the right neck had a condensing cylinder, and the center neck held the separatory funnel filled with 13.04 ml (.2300 mol) of Bromine (Br_2) and 26 ml of Carbon tetrachloride (CCl_4).

The 3-neck flask was placed in an ice bath, and once the solution had reached a temperature of 0°C , I added Br_2 solution drop by drop. There was however, no reaction taking place. I then removed the ice bath & at approximately 14°C , HBr gas was being produced and escaping through the condensing cylinder. This was discovered by testing with litmus paper. It turned a dark pink when acid was being released. At 21°C , I could actually see gas escaping. The solution had to then sit for 3 hours.

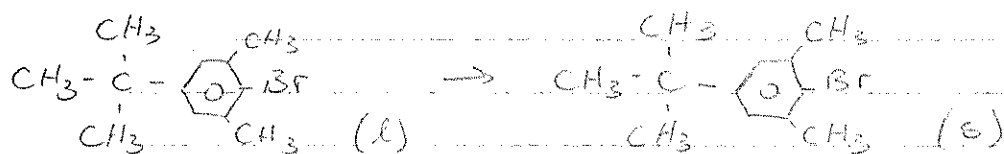
After all the Bromine had entered the flask, the solution had to stand for another hour until it turned a pale yellow.

The solution did not turn yellow after an hour had gone by, I therefore continued along with the procedure despite this. I put the solution in a separatory funnel, washed it with H_2O once, and then with two 50% concentrations of $NaOH$ dissolved in H_2O . After the first $NaOH$ and H_2O wash, the solution had a rapid color change from red to yellow.

The liquid was dried with $CaCl_2$, then put in the fridge to see if it would crystallize over the weekend.

Today, during the 3-hour wait for reactions to complete, I started from the very beginning of the series of reactions, but the time doubled the amounts. When I finished the day I was ready to react *t*-butyl chloride and *m*-xylene.

Monday,
July 10th



2-bromo, 5-*t*-butyl, 1,3-dimethylbenzene liquid $\rightarrow$
2-bromo, 5-*t*-butyl, 1,3-dimethylbenzene solid

Some of the solution did crystallize over the weekend. To separate the solid from the liquid, a filter flask was set up with a vacuum pump attached to it. A vacuum adapter (piece of rubber used to create an air-tight seal) was placed over

the opening and a Buchner funnel with filter paper in it was placed over that. The result is a vacuum force pulling the liquid down through the filter paper, into the flask. The mass of the crystals was 3.93 g. The liquid was then distilled with a good column (a column which is included a several points) to remove any CCl_4 that could be remaining. It started boiling at 78°C and after it had reached $13-14^\circ\text{C}$ (approximate boiling point of CCl_4) and gone down rapidly, I stopped distilling. The liquid that had been distilled and gone to the other side was saved so that it can be checked under the UVR, a machine I will soon learn to operate. I added 30 ml of methanol, (CH_3OH) to the liquid 2-bromo-5-tert-butyl-1,3-cyclohexadiene. The methanol was supposed to cause crystal formation, however it was determined that too much methanol had been added. I therefore put the flask over a steam bath and evaporated approximately 15 ml of CH_3OH . The boiling point was 57°C . I then put it into an ice bath to cool it down to zero degrees, and put it in the fridge.

Tuesday: Overnight, crystals had formed again. Using July 11th the same procedure as before mentioned, I evaporated the solid from the liquid and determined the mass to be 9.88 g. I put the solution

into an ice bath, and I yielded another 1.72 g of crystals. These crystals, however, instead of being pure white, had a yellow tinge in them caused from oil. To remove the oil from the crystals, I used 20 ml of cold CCl_4 to wash them. The CCl_4 did whiten some of the crystals, but it also dissolved some as well. All the crystals were put on round filter paper too dry.

For the experiment in which I'm doubling the amounts, I made an error which was disastrous! Things started out fine; I mixed the *t*-butyl chloride and *m*-xylene, added AlCl_3 , put it all in the separatory funnel and shook it with HCl and water. The problem started when I began distillation. Because the containers I'd been using were too small for the amount I planned to distill, I had to find bigger containers. I settled on two Erlenmeyer flasks. I started heating the solution which had a boiling point of 192°C . As I soon learned, an Erlenmeyer flask is not good to use because they do not form an air-tight seal with the rest of the distillation equipment, so gas can escape. Gas did in fact escape, flammable gas, very, very flammable gas. It took fire and burned until I turned the burner burner off. Half of the distillation gear was covered in soot, and all throughout the lab, soot particles were floating in the air and landing everywhere.

Thanks to this episode I learnt a very important lesson; I will never ever use an Erlenmeyer flask for distillation ever again. Before the clay was out I cleaned up enough courage to distill what remained of my solution, and by tomorrow I'll be prepared to start the bromination reaction.

Today I learnt how to use the NMR Spectrometer. It's a machine which can help you determine the identity of your solution and its purity by graphing the hydrogen protons.

Wednesday
July 12th

Today I took samples of 1,4-butyl, 3,5-dimethyl benzene, 2-bromo, 5-t-butyl, 1,3-dimethyl benzene, and the solution which had distilled with the good column before 80°C to see if it possibly contained some 2-bromo, 5-t-butyl, 1,3-dimethyl benzene.

To use NMR (nuclear magnetic resonance) Spectroscopy, you must put your sample in a special container which is smaller than a test tube, then you place it in a flexible shape which will spin the contents. After adjusting and readjusting various knobs, you get your print-out.

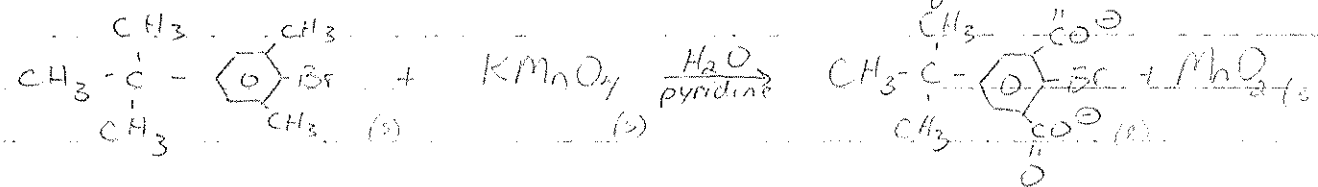
Today I also started the bromination reaction for the double bond compounds.

Thursday
July 13th

I took the crystals off the round piece of filter paper and put them in an Erlenmeyer flask already containing 30 ml of methanol. The mass of

crystals was 14.96 g. I recrystallized the compound in CH_3OH because methanol is the perfect solvent. The crystals have a high solubility in hot methanol, but a low solubility in cold methanol. I heated the flask until the crystals dissolved, then cooled it in an ice bath. After filtering and washing, the final mass was 13.26 g.

I started a new reaction today:



2-bromo, 5-*t*-butyl, 1,3-dimethylbenzene + potassium permanganate
 $\longrightarrow$ 2-bromo, 5-*t*-butylbenzene, 1,3-dicarboxylate + manganese dioxide

I placed 12 g of 2-bromo, 5-*t*-butyl, 1,3-dimethylbenzene, 100 ml of H_2O (as a solvent) and 30 ml of pyridine (as a solvent) into a 3-neck flask. (One neck held a mechanical stirrer, one a stopper, and the last held the condensing tube.) The pyridine had to be measured under the fume hood because it smelled terrible. I had to boil the mixture and once it started boiling, add KMnO_4 gradually over a 20-minute period. I was "refluxing", boiling the condensing; this is done to maintain a constant temperature.

Today, I also managed to finish the Braunstein reaction I had started yesterday.

Friday July 14th Today I boiled the compound in the 3-neck flask for two hours. After the two hours, I was supposed to add ethanol (C_2H_5OH) dropwise till the color left, this however was unnecessary because the purple color had already gone when the two hours were up.

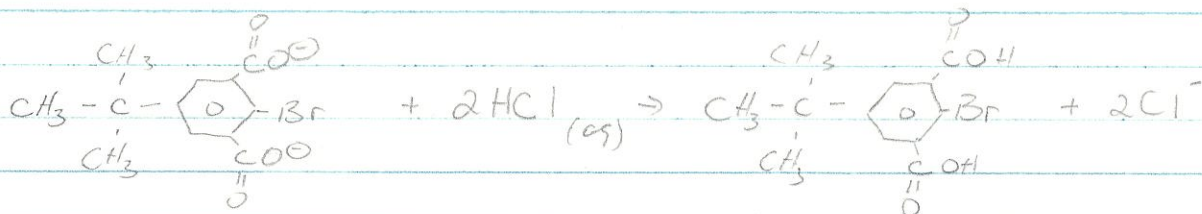
I let the flask cool, then filtered the contents. I then washed the black MnO_2 which remained in the funnel with two oz of hot H_2O . In the filter flask, a layer of oil had settled on the bottom. This was the 2-bromo-5-ethyl-1,4-dimethyl compound which had not reacted. Upon crystallization, it was determined that of the 12 g of crystals, only 3.79 g had reacted.

The crystals were removed and what remained in the flask was distilled to about $\frac{1}{3}$ of its original volume. After $\frac{2}{3}$ had been distilled, the solution left was cooled.

In the reaction with the same 7, distillation, I distilled the solution using a good column. I then added 10 ml of C_2H_5OH , heated it to remove the phases, cooled it, and filtered out 21.67 g of crystals.

Today I also learnt how to use the melting point apparatus, an instrument useful in identifying chemicals.

Monday,
July 17th



2-bromo, 5-*t*-butylbenzene-1,3-dicarboxylate + hydrochloric acid
 $\longrightarrow$ 2-bromo, 5-*t*-butylbenzene-1,3-dicarboxylic acid

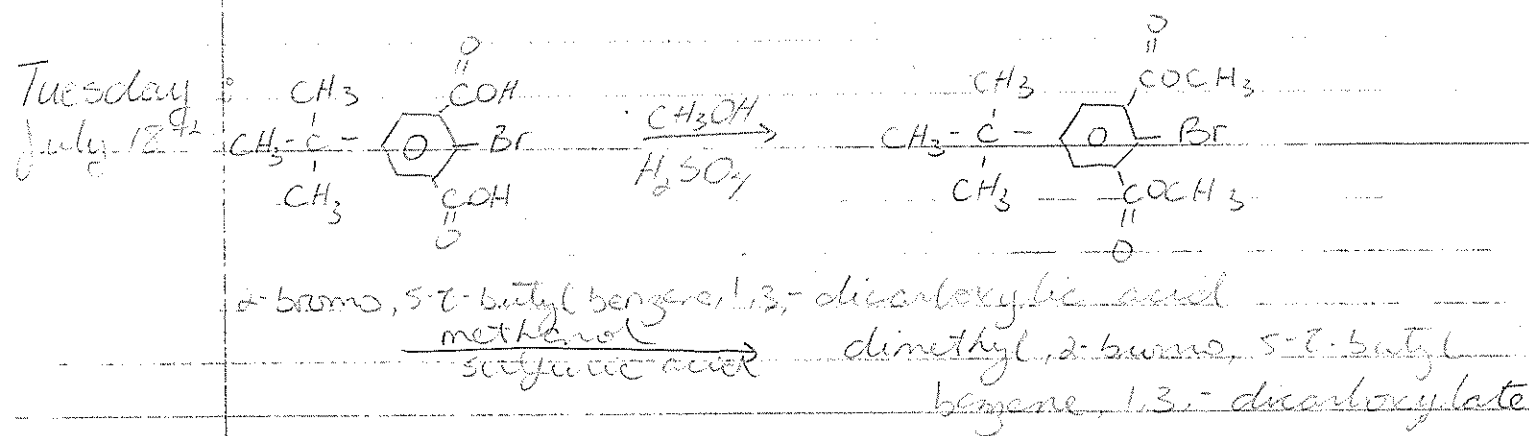
To the remaining $\frac{1}{3}$ solution, (the 2-bromo, 5-*t*-butylbenzene-1,3-dicarboxylate), I added HCl dropwise until the solution had a pH of 2. As soon as HCl hit the solution, a white precipitate was formed. The precipitate was filtered, and determined to weigh approximately 7.51 g. This measure however is inaccurate because the precipitate was still wet. The correct weight should be about 3-4 g.

The precipitate was then put in about 23 ml of ethyl-acetate, dissolved, and boiled over the steam bath. When all the contents had dissolved, a few drops of benzene were added to the reaction. The solution was then cooled and filtered. There was .35 g of precipitate. The melting point of the precipitate was determined to be about 255°C, corresponding with the melting point found in a reference book for this same compound. To ensure that all the product was recovered, the filtrate was evaporated using a machine which lowers the internal pressure, thus lowering the boiling point. The mass of the solid recovered was 2.69 g, and when its melting point

was tested, it turned out to be about 200°C , 30° lower than the product which was needed. Possibly, this compound had only one of its carboxyl groups oxidized.

Regarding the reactions with doubled amounts, today I recrystallized the 2-bromo, 5-*t*-butyl, 1,3-dimethyl benzene. I started out with 21.67g of product and ended up with 20.27g.

I started the oxidizing reaction with KMnO_4 , but instead of using 24g (which would be doubled the amount from before), I used only 12g because of the large amount which had not reacted the last time I did this reaction. Perhaps with a greater amount of KMnO_4 , all the crystals will react.



In a 100 ml round-bottomed flask, I poured 75 ml of CH_3OH and added 5 ml of H_2SO_4 slowly (exothermic reaction). I then added the precipitate from yesterday and placed it in in the steam bath over night.

Concerning the other reactions I am doing, I kept adding KMnO_4 until the purple no longer faded. It took about 77 g of KMnO_4 . I then filtered the solution and washed it with hot water. Approximately 6.55 g of crystals did not react. The solution was distilled to $\frac{1}{3}$ its original volume, to that was added HCl till it had a pH of 2, and the solution was filtered. The mass of the ppt formed was 3.61 g.

Wednesday
July 19th

Today I took the round-bottomed flask off the steam bath and poured its contents over approximately 200 ml of ice. I then put all of this into a separatory funnel and rinsed the beaker that contained the ice and solution with wash ether to ensure all the matter was in the separatory funnel. I then shook it all with water, and then with a Sodium Bicarbonate (NaHCO_3) solution. All the water layers were dumped out, however it was still necessary to dry the liquid. Instead of using CaCl_2 , MgSO_4 was used. The Magnesium Sulfate was filtered out, and the ether evaporated.

Concerning the other reactions I am doing, I took the MnO_2 precipitate, dissolved it in H_2O_2 , boiled, then filtered it. This was done because of the low yield; perhaps some product was trapped with this precipitate. I added HCl to the filtrate, and no reaction occurred, apparently none of the compound was within the MnO_2 .

I therefore continued on as I had before by recrystallizing in 30.00 ml of ethyl-acetate and benzene, yielding 2.67 g of 2-bromo-5-*t*-butylbenzene 1,3-dicarboxylic acid. This was placed in a solution of H_2SO_4 and CH_3OH , and placed over the steam bath overnight.

Thursday
July 20th I recrystallized twice what remained after all the ether had evaporated and determined after the second recrystallization that the melting point was between $55^\circ C - 60^\circ C$.

Today I went to a lecture given by Dieter Seebach.

For the doubled amounts reactions, I took the flask off the steam bath, poured it in ice and did the same procedure as I had done yesterday. After the first recrystallization, the melting point was approximately $92^\circ C$; after the second, the melting point was between $97-100^\circ C$.

Friday
July 21st My second set of reactions has now caught up to my first set. The first sample refers to the first time around and the second sample to the second time around.

I was very disappointed to discover that I had left the round bottomed flask containing sample 1 in the ice bath last day, and that this morning, the same round-bottomed flask was tipped onto its side, immersed in water. Luckily, none of the crystals had escaped, so all

I had to do was evaporate the water. I recrystallized once more, getting a melting point between 80°C - 95°C .

Today I also went to another lecture by Dieter Seebach.

Today I used NMR on the second sample (which has been recrystallized 3 times). The results were very satisfactory. I will be submitting a sample to the micro-analyst, but before I do that, I must figure out the percentage composition of my compound and the compound must be completely purified. I determined the percentage composition to be:

C $\rightarrow$ 51.07%

H $\rightarrow$ 5.22%

Br $\rightarrow$ 24.27%

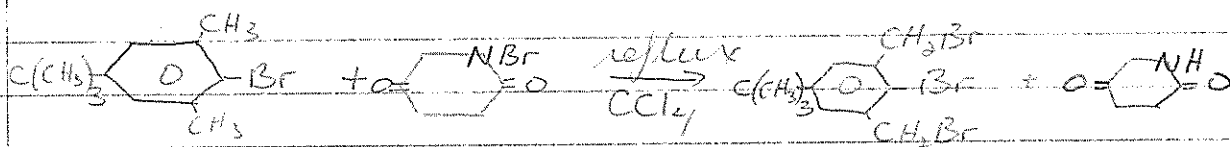
To remove any traces of solvent, a drying pistol was used. The sample stayed in there for 18 hours and was removed at 4:00 pm on Saturday. I also evaporated the filtrate from sample 2 and recovered some crystals.

Monday:
July 24th

I recrystallized sample 1 again, for a total of 4 recrystallizations. The total amount of crystals is now 1.96 g.

I did an Activation Process today. Copper Bronze was made more reactive by treating it with 50 ml of a 2% solution of Iodine (I) in acetone for about 5 minutes. The solution is filtered and the precipitate washed with HCl and acetone. The precipitate

is then dried in a vacuum desiccator.

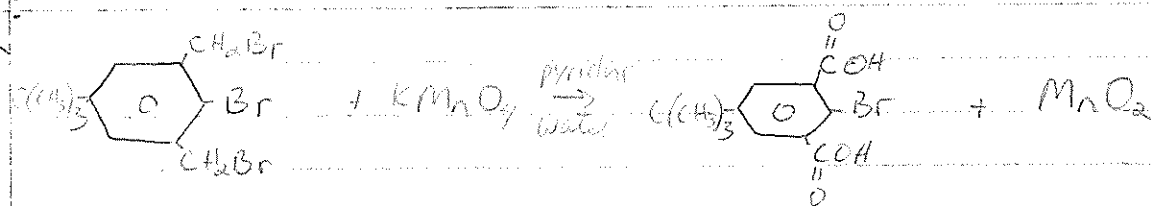


2-bromo, 5-t-butyl, 1,3-dimethyl benzene + NBS $\rightarrow$

2-bromo, 1,3-dibromomethyl, 5-t-butyl benzene + succinimide

Because of the poor yield produced from the oxidative reaction, (with pyridine and KMnO_4), another method was used. The 12 g of 2-bromo, 5-t-butyl, 1,3-dimethyl benzene were treated with 24 g of N-bromosuccinimide (NBS), and 50 ml of CCl_4 . The solution was heated and refluxed overnight.

Tuesday:
July 25th



2-bromo, 1,3-di(bromomethyl), 5-t-butyl benzene + potassium permanganate $\rightarrow$ 2-bromo, 5-t-butyl benzene, 1,3-dicarboxylic acid + manganese dioxide.

Today I filtered the solution which had been heating overnight and washed the precipitate with CCl_4 . The filtrate was then evaporated to get

rid of all the CCl_4 . The oil was put into a 3-neck flask with 50 ml of pyridine, and boiled. Once the temperature reached 115°C , 100 ml of H_2O was added. When the solution was boiling, 37 g of KMnO_4 was added gradually. Because of the two extra bromine atoms on the starting compound, the substance is much more reactive. So reactive in fact that after the first few scoopfuls of KMnO_4 were added, it started bubbling very fast, and jove itself up through the condensing tube and onto the counter. This happened quite a few times until I realized that if I didn't put quite so much KMnO_4 in at once, the solution would not react so violently.

Wednesday:
July 20th

Today I only continued adding KMnO_4 and wiping up what bubbled out.

Thursday:
July 27th

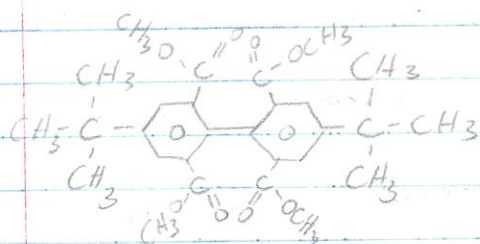
Today I continued adding KMnO_4 to the solution. The copper bronze activation process I did on Monday is useless now because the activated CuBronze must be used soon after activation.

Therefore today I did another activation process using the same method as before.

In a small, 30 ml round bottomed flask, I placed the crystals (dimethyl, 2-bromo, 5-t-butyl benzene, 1,3-dicarboxylate), 1.5 g of activated CuBronze, and 10 ml of dimethylformamide. The solution was heated (refluxed) for 8 hours. After the first

four hours, another 1.5 g of CuBr₂ was added.
Today we went out to play some golf also.

Friday, July 28th: I filtered the CuBr₂ reaction and washed the precipitate with hot DMF (dimethylformamide). I then put the filtrate in 200 ml of H₂O, and filtered that. The compound is now:



4,4'-di-t-butyl, 2,2';6,6'-tetracarbomethoxybiphenyl

The copper bronze reaction had joined two molecules to make one larger one. The yield was 2.7 g.

I tried to recrystallize it in methanol, but apparently methanol is not a good solvent, tomorrow I'll try with DMF.

For my other sets of reactions (with the bromo-crystals that were made more reactive), I distilled it to $\frac{1}{3}$ its original volume, reacted it with HCl, and yielded 3.72 g. I'll recrystallize it in ethyl-acetate benzene.

Monday, July 31st: Today I recrystallized both samples in their respective solvents. Because of the difficulties encountered while recrystallizing, a new procedure was used, Decanting. Decanting is when you separate the solid from the liquid without filtering, but by pouring. Hopefully, this will involve crystallization.

Tuesday
August 1st

Today I continued recrystallizing and got a melting point of $80-85^{\circ}\text{C}$ with the newest compound, the 2,4'-di-*n*-butyl, 2,2',6,6'-tetracarboxy biphényl. I also did the oxidation reaction (using KMnO_4) for the 20g of crystals which remained from my doubled amounts reactions.

Wednesday
August 2nd

I continued the oxidation reaction, filtered, distilled, and reacted the compound with HCl . The mass of ppt formed was approximately 25.97g. The liquid which had distilled to the other side was put in an ice bath and parts of it crystallized. There is about 1.12g of it, and the melting point is about 45°C or 50°C . This compound is useless. I'm also continuing recrystallizing. I have given up on recrystallizing the ethyl-acetate solution. It is now flowing somewhere in the North Saskatchewan.

Thursday
August 3rd

The mass of the compound recrystallized in DMF was .77g with a melting point of about 360°C . This compound is however extremely impure, instead of melting completely, it decomposed. The compound that is required is soluble in ethyl-acetate, so some of the crystals were put in a test tube and some ethyl-acetate was added. It was put over the steam bath to ensure all the necessary compound had dissolved. The test tube was then put in the centrifuge to force all the solids to the bottom of the test tube. The liquid was

decanted and evaporated. There was some compound after evaporation that had a melting point of $80-85^{\circ}\text{C}$.

Friday August 4th Today I continued the same process as I did yesterday with all the precipitate. I then did an NMR of the light green compound and discovered that it is still very impure.

I also continued recrystallizing the other crystals in ethyl-acetate and benzene.

Monday August 7th Holiday, (Bank Day)

Tuesday August 8th Dr. Kopecky has left for his summer holiday, so the last remaining week will be spent recrystallizing the light green compound and reacting my ethyl-acetate recrystallizing until they get to the same point as the most advanced ones. It is, of course, obvious that I can't complete my objective, however I still feel as though I've contributed something to the world of Chemistry.

Today I recovered 4.00 g. of crystals from the ethyl-acetate. I reacted them with a solution of 315 ml of CH_3OH and 57 ml of H_2SO_4 and put them on the steam bath. I then poured the contents of the flask into 2 L of ice, and poured in some wash ether. Tomorrow I will begin washing the compound.

I also continued recrystallizing the light green compound.

Wednesday:
August 9th

I wasted the organic layer, but forgot to save the NaHCO_3 layer to react with HCl . This would have shown me if any crystals were there, and explain the low yield. I continued on, and recrystallized it in CH_3OH .

The light green crystals are still being recrystallized.

Thursday:
August 10th

I continued crystallizing and did a copper bronze reaction.

Friday:
August 11th

Started from the very beginning once again to make some more bromo-crystals. I also continued crystallizing.

WISEST Essay
Andrea Hodges
Computing Science
August 11, 1989

When first coming to the University I did not know what to expect. Thoughts of being assigned projects that were beyond my understanding were present, so when I reached the department of Computing Science and was shown a Macintosh Plus™, I was relieved. Then when I was introduced to all the members in Computing Science and saw how many researchers were using Apple computers™ I was surprised. I was then shown into an office, and even though I was familiar with the Macintosh™, I was given the "Approaching Macintosh" manual. I reviewed what I was comfortable with and then learned new concepts that I would be using. I was able to work independently while learning at my own pace.

After I had reviewed how to use the Macintosh™, I was given several applications so there would always be something new to look at. I also received many manuals to assist in learning these applications. I was given some applications that my supervisor, Marion, was familiar with so I could always ask questions about any problems I had. Then nearing the end of six weeks, I was given applications that she was not familiar with so I could test the skills I had learned over the summer. This boosted my confidence with computers. I was able to figure out the problems on my own which increased my knowledge of how a computer works and how to use it effectively.

After working on the Macintosh™, I began working on an operating system (UNIX computer). This was very different from the Apple™ as it spoke in a different computer language. I started working on a learning program where I learned that 'cat' meant 'print'. It actually was not as difficult as I thought at first and I understood most of it! UNIX was a change for me since I had been 'brought up' on Apples™, and after realising the difference in computers, now I would like to learn more about the many types of computers.

I was given projects to work on throughout the six - week period. These projects varied from scheduling labs for computing courses, enrollment for the courses, and money allotment for research and teaching. Most of these were from different applications so I got 'hands - on' experience for the applications I had studied in the beginning. I worked with Macdraw, Macwrite, Microsoft Excel, and Microsoft Works for most of these projects. Some projects involved linking two documents together and others involved formulas using more than one cell.

My supervisor, Marion Paproski, asked me what kind of projects I would be interested in. One of these projects involved designing a budget applicable to myself on a spread sheet. After comparing two applications which a budget could be designed on, I chose Microsoft Excel which had more options for what I was interested in.

Another project I had chosen involved another spread sheet. This time though, the spread sheet was in Microsoft Works. Since I was soon going on a trip I decided to display attractions, restaurants and activities in the region where I was going.

After my spread sheet for travel was finished, I began a data base. At first glance a spread sheet and data base look familiar, and the only notable difference is that there is a separate "card" on which the data is inputted. With this card you can input all the information relevant to one topic at once without looking at the other topics also present in the data base. The data base I worked on dealt with addresses and phone numbers.

Other applications I worked with were more specialized. Hypercard, a "hypermedia toolkit", deals in the Hypertalk language. This computer language is very easy to understand, making Hypercard understandable for everyone. Hypercard is also very useful - it has organizing stacks, art clips, quotations and much more. Another application I enjoyed working with was Power Point. This application is for the preparation of slide presentations. It includes defaults for slides, notes pages, and notes for the presenter. This is also very simple to use. These applications were new to me and therefore very interesting - I wanted to learn everything about them and I did!

In finishing these projects I was faced with outstanding examples of technology, the printers. One printer, the Laserwriter, I had never even heard of. This is one advantage that a University computing lab has over a High School lab because they have a bigger budget and can afford the latest computer 'gadgets'. The Laserwriter does a faster and more professional job. It prints in a few seconds what a normal printer prints in several minutes.

In finishing up the six - week term, I started to do some programming in the language BASIC. My assignment was straight from the Computing 261 course. It dealt with writing a program to update the bank account balances of a number of customers in two versions. One version involved inputting data through READ / DATA statements. The other version dealt with the input of data via INPUT statements. I had some documentation on BASIC so the actual programming was not that hard.

Since I had not had much experience with editing in UNIX, my supervisor asked someone who was working with projects on UNIX to let me do something. Finally, Rod, a programmer analyst, came up with some editing I could do. For this I had to learn a new editor (vi), which is a visual screen - oriented editor. There were some similarities in the two editors I had worked with and a lot of differences. Basically, I called forth a spell checker and made note of any errors in the file (the other 'spelling errors' were only words that the editor did not recognize as they were specific to the file). Then I went into the file with vi and physically made any changes.

My final project involved the Powerpoint application. I made a slide presentation for my supervisor that she would use at a later date. The presentation described the registration for the computing department which is separate from the University telephone registration. Involved in the presentation were flow charts, outlines as well as handout pages, and note pages for the slides. I made the decisions regarding title pages, borders etc., so I had the chance to do something on my own.

I really enjoyed the WISEST program at the University of Alberta for many reasons. I became better acquainted with the campus and library and therefore I will not be as intimidated when I come as a student. Before this summer, I had no real plans for my future, but as a result of Wednesday meetings, many new fields have opened up. By sharing insights into their own faculties, many other WISEST students have benefited. The faculty of Computing Science has definitely become a possibility whether it be a degree, or a few courses. I have learned the value of computers in today's world and the WISEST program has definitely helped.

Name: Angelina Lo

Supervisor: Dr. M.R.T. Dale

Department: Biology

Project: Self-thinning in sand and hydroponics.

Ever since July 4, the 1st day of this Wisest Summer Research Program, I have been learning a lot of new things and also experiencing quite amount of difficulties. But all these experiences did help me a lot. May be I should explain what it is meant by self-thinning. Self-thinning could be called as $-3/2$ power law. $-3/2$ is the slope which is the relationship between log mean plant weight and log plant densities. As the log plant densities go up the slope will finally reach $-3/2$. In dense populations, density-dependent mortality will occur due to the competition for nutrients and light.

In the first week, mainly what I did was preparing the "proposal" for my project. Then came the preparation of the seeds for germination.

In the 2nd week, I prepared the buckets for my plants. I met up the experimental design with Ken who helped me a lot with my experiment.

The design has to be randomized in order to eliminate as many ~~as~~ errors as possible. There are 15 buckets for hydroponics and another 15 for sand in 2 growth chambers.

On the 17th July, I set up the buckets with hydroponic solution and sand also soaked in hydroponics. The next day, I started planting my bean plants in 3 different densities, 1, 4 and 11. ~~for the~~

On the following few weeks, I moved the buckets around every other day. I also checked the pH level so that the nutrient level is kept constant. So I had to change the solutions every Monday, Wednesday and Friday. The moving of the buckets enables the plants to get to grow in every position within the growth chamber. Though I changed the solutions for the hydroponic ones, I left the sand ones alone. However, I did water them every day so as to keep the sand moist enough for the beans to grow. But the nutrient would not be added. Since there were limited amount of nutrients available, competition will occur and self-thinning will be the possible result. The last week of the

Pinest program was the busiest week
It was the harvesting time. I had
to sort out the plant into roots,
shoots and flowers. With 160 bean
plants sorted out, I put them in
the oven for drying in $1\frac{1}{2}$ day.
Then I weighed the plant out with
the scale. After the process, I had
to analyze the results and write a
lab. report for my supervisor.

After the 6-week period, as
a summer research student, there is
no doubt that I have benefitted
from the Program. At least I know
my way around the campus from
now on and get to know the fact
that women could also work in
non-traditional jobs. I think I
would tell the Grade 11 student
next year in my school to apply
for the pinest program.

REPORT to

WISEST Summer Research Program

by

Brendan Maloney

with

Professor E. A. Richards

Department of Clothing and Textiles

August 1989

During the six week WISEST summer research program, I have been privileged enough to both observe and become a part of the Clothing and Textiles department. At first, my experiences dealt in a large joint research project headed by Prof. E.A. Richards and Dr. N. Kerr from Clothing and Textiles in conjunction with Dr. J. D. Scott from Civil Engineering. This project, funded by AOSTRA, is intended to design geotextile filters for sand control in oil wells. This requires a variety of testing and a large amount of research which calls for the assistance from both fields. Secondly, I began to work on the Historic Costume Study Collection. This collection is primarily oriented toward the studies of graduate students and is always in constant use. It was this variety in my work schedule which enriched my experience and allowed me to participate in so many activities.

One of my individual projects has dealt in the testing of the durability of certain selected geotextiles to the chemical environment typical of a heavy oil well. While testing textiles in oil, the specimens become soiled with residue which has to be removed before further testing can be done. Therefore, a solvent was required to clean them without harming the filters. To test their durability, many fabric specimens were soaked in the solvent which would be used for this operation. Then, to determine if any incompatibility or degradation was present, random samples of fibers were selected and their diameter was measured with a polarized microscope equipped with a micrometer. Of course, any swelling of the filter fibers would alter the physical properties of the filter, so such data would be helpful in selecting an appropriate solvent.

Secondly, and primarily, I completed testing which determined the Apparent Opening Size (AOS) of seven geotextiles. By taking glass beads of regulated sizes and sieving them through the textile, the openings between the fibers could be estimated. The textile is then assigned a number which

corresponds to the bead size where ninety-five percent was retained on top. These results, in conjunction with the known grain sizes of the soil, help to approximate how the textile would operate in actual on-field conditions.

My experiences were not limited to the laboratory, however. In the mornings of my final few weeks on campus, I assisted in the preparation and reorganization of the Historic Costume Study Collection found in the Home Economics building. Supervised by Suzanne Peterson, I became acquainted with both the restoration and preservation of historic textiles. Such an activity helped give me a more educational experience in both the working field and toward the diversity within the faculty. In general, it was a very rewarding experience.

Throughout this summer, by both observing and participating in many varied situations, my overall understanding has grown and matured. Not only have I been exposed to the tremendous occupational areas available, I also have been conditioned towards the regular discipline of working in a laboratory. Truly, without reservation, it can be said that the WISEST program is an excellent method in which students may be introduced to the university.

Agricultural Engineering

Week 1 - The first day, we basically got a tour of the University's farm facilities. After that we worked steadily in the library collecting abstracts - my topic was the environmental impact of agriculture. In this week I did a lot of reading summarizing and copying - but, I ~~also~~ did learn how to use the library. It was rather monotonous, at first.

Week 2 - The first half of this week was spent the same way as the first - more library work. We had to collect at least 100 abstracts before we could start typing on the computers. This was interesting because of my limited knowledge about computers. I learned how to use "Word Perfect" which I can now put on a resume'. This week we also got a field trip to Red Deer and Lacombe - basically more farms - but it was interesting.

Week 3 - started with more word processing. We had a field trip to 3 different farms: a dairy farm; an egg/pullet farm; and a cattle farm. This was really neat - I saw a lot! In the middle of the week we were moved to the electronics division of Agricultural Engineering - I

really enjoyed this! We started out learning more computer skills by doing the computer "artwork" of a small circuit board for a swather. The drawing of the circuit board took a long time.

Week 4 - We continued and completed the computer work for the circuit board. It took a lot of patience and thought. We also had a tour of the underground of the University - that was really interesting. We got ~~to~~ to ride a ~~very~~ vertical conveyor belt 165 feet down and then back up.

Week 5 - We moved back to word processing so that we could finish and revise our "books". We were able, however, to go back to electronics because we got the "photograph" of the circuit board back. Now began the construction of the circuit board.

Week 6 - I guess I learned more this week than in any other. We completed the construction of our circuit boards - and they worked. I was amazed at the finished product of our efforts. I got ~~us~~ to wear a lab coat and special glasses and I ~~just~~ was able to deal

chemicals and different machinery.
I've learned a lot and I feel that
I have gained so much from this
program. I may have changed my
career decision. I find it very
difficult to leave for I have made
new friends and I ^{have} enjoyed my job.
This program did so much for
me and I am very grateful.

WISEST activities

Name: Roxanne Felix
Depts: Agricultural Engineering
Supervisor: Dr. Jerry Leonard

WEEK ONE: Tuesday, July 4:

First, in the morning, we had an orientation with WISEST members and other WISEST students. After being dropped off in our dept., we got a tour of the Ag. Eng. offices in the General Services Building and the Ag-Forestry building. (We" being myself and 3 other WISEST students). We also got introduced to the Faculty's engineers, technicians, grad + undergrad students and exchange students. This faculty is very small compared to other faculties.

In the afternoon, we got a tour of the "out-of-town" research station - Ellerslie - and the "in-town" research station - the Neil Crawford Centre. In these tours, we were exposed to the many different research projects, different machinery and all the different crops in Alberta.

Wednesday, July 5:

In the morning, myself and one other WISEST student cut ^{out} and pasted graph summaries of voltage readings. These graphs represented the voltage disturbances occurring on outlying farms. Continuing through the day, we also photocopied these graphs, and entered their information into a spreadsheet program - using an IBM computer and the 123 Lotus program. Then, we went to a WISEST meeting.

Thursday, July 6:

to do

In the morning, I continued "data entry" into the IBM 123 Lotus program.

In the afternoon, I went to Cameron library with an engineer. We searched for, took out, and photocopied periodicals that are important to his research project on turkey growth.

Friday, July 7:

I went through an "orientation" computer program that explained the functions ^{+ capabilities} of a 123 Lotus program. In the afternoon, I did some library research and xeroxing at Cameron Library.

WEEK TWO: Monday, July 10:

I was put under the supervision of the dept.'s electronic technologist - Sandy Yakimchuk. I was taught the binary number system, logic symbols, and the basics of computer language. Then, I started work on an electronic circuit. The circuit I was building would be built in 4 parts. Then, at the end, all 4 parts would be attached to create one final, large electronic circuit. The electronic circuits ^{will} measure air flow throughout the ventilation system of a turkey barn. Thus, the effects of air circulation among turkey performance can be observed. Then, I started to build the first part of the circuit.

Tuesday, July 11:

I continued to build the first part of the electronic circuit. The first part of the circuit board required the wiring and attachment of 1 microchips. I also labelled the circuit and was taught the hexadecimal number system.

Wednesday, July 12:

I finished the first part of the board. I tested it and it worked! Then, I started the second part and I attended a WISEST meeting.

Thursday, July 13:

On this day, my "other" supervisor (an engineer) and two other researchers from outside the University staff took myself, 3 other WISEST students, and 2 exchange students (one from Holland, the other from Israel) on a field trip. In the morning, we went to the Red Deer Broom. ("Dept. of Agriculture" -) building. We met the regional "leaders" and ministers of different fields and regions for Alberta agriculture. We also visited a cattle farm and the site of a new project. This project consisted of the operation of a solar-powered water regulator for the cattle. In the afternoon, we visited the Hacombe Research station where we were exposed to the process of genetic development in crops. We saw many different breeds of the same plant at this research station whose operation is the 2nd largest in the world.

Friday, July 14:

I continued ^{building} the second part of my electronic circuit. I also learned about the operation of a logic analyzer and the functions of a computer microprocessor → it translates basic computer programming into more complex computer language. In the afternoon, our dept. (very small dept.) got together for coffee and had ice cream cake in celebration of two of our dept.'s workers' birthdays!

WEEK THREE: Monday, July 17:

I continued to build the 2nd part of my circuit and finished it.

Tuesday, July 18:

I hooked up the 2nd part of my circuit and prepared it for testing.

In the afternoon, two supervisors took myself, 2 other WISEST students and 2 exchange students on a field trip. We went to a field lot just outside of Stony Plain where cattle are professionally & commercially raised. Then, we visited the second largest poultry farm in Alberta. (They "commercially" are known as "LILYDALE" and gave us each a free dozen of eggs). Then, we visited a Dairy Farm. We saw the mechanical milking of cows and got to feed young calves their milk.

Wednesday, July 19:

I tested the 2nd part of my circuit and it worked! Then, I started the 3rd and 4th parts of my circuit simultaneously as I would be putting both circuits on the same

board. Then, I learned ^{about} some more computer and electronic components such as "or" gates, inverters and others. We had a WISEST meeting as well that day.

Thursday, July 20

I continued working on my electronic circuit. Then, everyone ^{in the dept.} went to a wine and cheese party ~~(in)~~ in the main office because an engineer from Chile was leaving.

Friday, July 21:

I continued working on the electronic circuit

WEEK

FOUR: Monday, July 24:

I continued work on the electronic circuit board.

Tuesday, July 25:

I continued work on the circuit board.

Wednesday, July 26

I continued work on the circuit board.

Thursday, July 27

I finished my 3rd + 4th circuit board. Then, I attached all 4 circuit boards together. (I worked overtime until 5 p.m.)

Friday, July 28

In the morning, I took out the "bugs" out of my electronic circuits and tested it. It worked! Then, our "bosses-for-the-moment" that our supervisors took us out for
1 + 2 others WISEST

leench. Then, they (and 2 other University personnel) took us on a tour of the underground piping systems/tunnels. The University Campus' heating and cooling plants are all centrally controlled from one control centre. There are 8 miles of track underground campus and we covered 5 miles of it. The pipes in the tunnel carried gas, cold water, hot water, heat, phone lines, etc. and were 10 ft. underground. We visited the heating plant and the cooling plant. The cooling plant was 155 ft. underground and by the river. To get to the cooling plant we had to take a vertical conveyor belt down 155 ft.! It was lots of fun - but a little scary!!

WEEK FIVE: Monday, July 31

In the morning, I put the "finishing touches" on my circuit board. (e.g. labels, cutting wires evenly, ^{putting} resistors on to lessen voltage flow) etc. In the afternoon, I tested my COMPLETE circuit board and it worked! Then, me and my "boss" designed a circuit board on the computer. We used a "TAN60" computer program. This board would be used to display characters on a screen that is similar to a calculator's screen. Eventually, it would be used in a project that involves the optimum performance of certain farm machinery.

Tuesday, August 1

I continued putting "Finishing", non-crucial "touches" on my circuit board that I had fully tested on Monday, July 31.

Wednesday, August 2

I experimented with my circuit board. I tested the wave forms it gave on an oscilloscope and read its wave pulses on a logic analyzer.

Thursday, August 3

On this day, I would build the circuit board I designed while 2 other WISEST students would build the circuit boards they designed. Thus, we got to work together. The circuit boards we were building were different than the one board I built last week. The board I built last week involved wires. The board we were making this week would be on a copper-plated board and certain connections would be etched into the board. We also would build not just one - but

(or more)

twenty in total. No wires were involved. That day we just put the boards and cleaned them with erasers and acetone.

Friday, August 4

This day, we would go through a process called "photofinishing". First, we would wash the board with acetone to ensure there was no oil or dust on the board. Then, we sprayed the board with a substance called "photofinish". This had to be sprayed perfectly or else we would have to start the process over again. Then, we let it dry in the dark. After, we would place a film of the circuit board designed on the copper-plated board. (The film resembled "overhead" sheets). After we placed the film on the board we would leave it in the cabinet with an ultraviolet

lamp. After 1 minute, we turn off the lamp and place the board in developing solution (Fell) ferric chloride. Then, the pattern of the board designed would show up on the copper-plated board.

WEEK SIX: Monday, August 7

We continued this process by dipping the board into a solution of NaOH . This way, the pattern was etched into the copper-plated board. Then, we'd scrub the board clean, wipe it with acetone, and check for faults. If there were any mistakes, we'd have to fix them using a variety of methods. Once the board is perfect we would silver-plate the board by dipping it in silver chloride.

Tuesday, August 8

?/We went through the same process as Monday's process. (↑)

Wednesday, August 9

We went through the same process as Monday for the morning. We went to the WISEST lunch. Then, we began to "populate" the boards. This term means drilling holes and attaching chips, resistors, capacitors and sockets into the board. Then, we would solder ("attaching" using liquid iron which hardens after heat from solder iron is removed) the components onto the board.

Thursday, August 10

We continued populating the boards.

Friday, August 11

We finished populating the boards.

Extra Notes:

I worked from 8 A.M. to 4 p.m. with an hour lunch, and two half-hour coffee breaks. However, the dept. was not strict when it came to hours. Often, I (as well as other WISEST students) would work overtime. But it was not forced and, in fact, it was enjoyable to work on certain projects. From the very first day, we were informed of all the different projects being done in the dept. and introduced to the faculty. The dept. even gave myself and the 3 other WISEST students our own little office on the 2nd floor. Because the Ag. Eng. Dept. is smaller than most depts, the atmosphere there is very relaxed, comfortable, and easygoing. Everyone knows everyone! Personally, now, when I look back over the six weeks, I consider myself lucky to be placed in Ag. Eng.!! I had wonderful experiences in the Ag. Eng. Dept.!! These past six weeks have provided me with knowledge, memories + experience that will not easily be forgotten!!

~~WIFE~~

On July 4th met WISEST students and heard a guest speaker. In the morning met the department head of agricultural engineering and had a tour of all of their facilities and in the afternoon went to the university farms, at Ellenslie and Parkland. July 5th and 6th I cut, and mounted graphs ~~from~~ about voltage disturbances in rural electricity supplies. After I mounted them Roxanne Fila and I entered them into the computer. On Wednesday we heard 3 people in non-traditional fields talk about their jobs, it was very interesting. On Thursday afternoon I met a grad student I would be helping with his thesis project. His project had to do with fibre optic cables, which I would be polishing.

July 7th, 10th, 11th I polished fibre optic cables. On July 12th I was helping the grad student by marking where he had to drill holes in some metal rings, I later threaded these holes, so screws could be put in them. I went on the library tour today and learned all about how to use the computers there.

July 13th we went for a tour to a beef ranch and the Lacombe Research Centre. We learned how they were run. It was very interesting. July 14th I washed out a growth chamber, that will be used in the experiment. I had to check the temperature every hour and record it. July 17th I polished fibre optic cables and entered the information from the experiments last day, into the computer.

July 18th I went to a turkey farm with a undergrad and took air samples to see how much dust there was in the air. I polished cables in the afternoon.

July 19th I polished cables and did temp. tests on the second growth canber and entered the information on the 20th, I also ran some errands for the grad student and polished cables. July 21st, 24th, and 25th I cut sponge that will be used as padding for the apparatus that holds the fibre optic cable. July 26 I polished cables and went on a campus tour with WISEST. July 27th and 28th I cut down screws that were too long. On the 28th we went on a tour of the physical plant, which is the heating and cooling plants and all the tunnels underneath the university. July 31st to August 10th I polished fibre optic cables every day. On August 2nd I went to an information sharing session with WISEST and on August 9th I went to a luncheon for us students and our supervisor.

This was a very good experience for me, I learned a lot about the university and how it works. I think this program is a very good experience for students.

Six Weeks In The Life

of a

WISEST Student

- presented to: WISEST
- August 11, 1989
- by: Marlene Pasay

That I would be one of thirty-six select students chosen to participate in the 1989 WISEST Summer Research Program was welcome news. The opportunity was mine to meet new people, to do different things, to explore on campus and, best of all, to receive payment for it. What better way to spend a summer?

To begin with, I was assigned to work in the field of analytical Chemistry, under Dr. Byron Kratochvil. After having met Dr. Kratochvil, he set me to tending the "Sample File". This responsibility involved obtaining photocopies of specific articles on sampling and related topics, making file

cards for each article, and filing both,
the photocopies in a filing cabinet and the
cards in a tray placed conveniently nearby.

This was a simple task, but, when faced
with nearly one-hundred-and-twenty
articles to be put through the same process,
it soon became monotonous. However, some
days later, I discovered what a welcome
break this tedious procedure could be.

The said discovery was made when Dr.
Kratochvil asked me to translate two
papers on medicinal sampling from German
to English. Having had eleven years of
tutelage in the German language, I was
certain that this would be a relatively

simple job. How wrong I was.

It was soon apparent to me that I was dealing with literature well above my level as I glanced over the pages. The only words that I could easily translate contained five letters or less and appeared perhaps twice in a paragraph. Despite all odds, though, I managed to complete both papers in under a week, taking much time for "Sample Title Breaks", and generously employing the use of a German-English scientific dictionary which Dr. Katochwil so kindly loaned me.

During my third week, I was given a list of articles and was asked to find

and to photocopy them. This meant going to the Cameron Library and attempting to decipher the on-line catalogue. As I had had no previous experience with typewriters and even less with computers, one could not imagine the fun I had trying to figure the thing out.

Eventually, after a couple of hours, I had pried a list of call numbers from the uncooperative assembly of wires and microchips, and I went upstairs to begin the actual search. All the articles were found and photocopied before four o'clock, save two, for which I obtained interlibrary loans. I was feeling quite proud of myself

when I left for the day.

During this time, I also attended a lecture on Lithium Derivatives, given by Dr. Dieter Seebach on July 17, 1989. Though I did not comprehend most of what was said, I am sure that I would have enjoyed it had I been able to.

Dr. Kratochvil must have decided that I needed a break, because I really relished my next little chore; preparing a volume of the journal "Analytical Chemistry" for binding. This involved mercilessly ripping the magazines apart, discarding the unwanted ads, and organizing the remains into A-pages and articles. This was great fun

and, needless to say, I was done within the hour.

By this time, I had had the chance to follow some of the graduate students, and to learn about their respective projects. All were working with gas spectrometers, save one, who was working in the field of electrochemistry. Gas spectrometers are instruments which heat a minute amount of a liquid sample to the vapor phase, then heat the vapor even further to atomize it. The three different spectrometers that I saw employed the use of a) a lamp, b) a furnace and c) a plasma (which is a "flame" made of electrons) to do the heating.

For the last two weeks, I became acquainted with the Macintosh SE that was installed in my room. After having taken a "tour" of the computer, it was suggested to me that I write this report upon it, and have it printed at a later date. I wrote the report in full, but the Mac seemed to have other ideas. After holding my initial paper for three days, it erased it. I was indeed beyond belief, and doggedly began to write another. This one stayed for two days, after which it, too, vanished. Somehow, though, a title page which I had prepared had now multiplied fivefold. Having formulated the decision that the Mac hated me, I

proceeded to write my report by hand.

For a change of pace, I not only had fun working, but I enjoyed the people with whom I worked, namely Dr. Kratochvil and his research group, the people in the third floor mail room, Dr. Kratochvil's secretaries, the Cameron and Physical Sciences librarians, the other WISEST students, and, of course, Dr. Lemons and Mrs. Chdakanis.

In closing, I would like to thank the coordinators of this program for having offered me the chance to taste life at the University of Alberta first-hand. This experience has been very educational, valuable and entertaining, and one I shall

not soon forget.

Martine Pasay

August 11, 1989

A WISEST SUMMER

BY

SOPHIA KHAN

DEPARTMENT OF ENTOMOLOGY



A WISEST SUMMER

I am writing this report one day before my job officialy ends and I am so rich with experience that "now I am rampant with memory".

I first heard about WISEST in Harry Ainlay's TUMBLENOTES or announcements. It boldly declared summer research positions available to high school students. Intrigued, I enquired further.

After sending in an application, I unexpectedly received a sort of telephone interview. The interviewer asked me about Entomonlogy; she asked me how I felt about bugs. To be honest, I had no previous active interest in bugs and before WISEST I didn't even know what Entomology meant. If anything, I would describe my attitude towards the insect world as apprenhesive. Nevertheless, I said that ~~I said~~ that I would have no problem with bugs.

Weeks later, I received a confirmation --I got the job! I was really excited about working, but the project I got was what I had feared the most. I got Entomology. I seriously had no idea what the job would entail and if I even could do it. Six weeks ago those fears were very real, but as I type this report I can only smile-- I had such a good time ~~this summer~~ and learnt so much...

This is what I did over the summer:

Monday, Wednesday, and Friday mornings I worked in two culture rooms (for water striders) in the basement of



the Earth Sciences building. In the culture rooms, there were about 40 large tubs of different species/experiments of water striders. They had to be taken care of. This meant scooping flies out of the tubs, feeding the water striders fresh frozen flies, sexing them, transferring eggs, adults, etc. During these sessions, the work was split between me and an undergrad known as Hector Carcamo.

In the afternoons, I helped the lab technician, John Acorn, with predator experiments. I contributed in planning the experimental design, making data sheets on the computer, setting up the experiments (they ran for two days^{at a time}) and scoring them.

John Spence, the supervisor/professor would check in periodically and offer his guidance. Often, Spence would accompany myself, Hector, and Acorn on field days.

On Thursdays, I would go out to George Lake. Among a university research cabin and a ping pong table, were three ponds and a lake with all sorts of experiments running. The events of the day were as follows. At the lab, we all would meet in field clothes. For an hour or so we would count bugs for stocking and feed the cultures. A brief and if I may add traditional stop at the donut shop would ensue. After an hours drive we would reach our destination. Acorn and I would take a brief hike through the woods to the canoe. During the canoe trips, we would catch predators and do predator sweeps. Even though George Lake did not have

"sandy white beaches nor clear blue water" it was still beautiful. I loved being outdoors.

After lunch and watching the latest fad at George Lake--viscous ping pong games, we would go wading. Even though the department purchased the smallest size of chest waders possible, the latex space suit did not fit at all! Chest wading definitely was an experience. This adventure concluded the day. We'd arrive quite late at the University

Although very tired, I always had a fantastic time doing field work.

Throughout working, I had the opportunity to get to know Spence, Acorn, and Hector. All three were a pleasure to work with and gave me invaluable insight into all levels of the university at all different perspectives. I learned about the roles, attitudes, and contributions of the undergrad, the grad, and the professor.

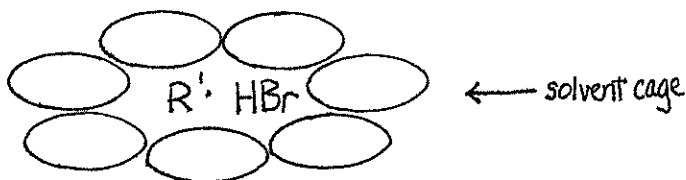
I'd like to end this report by giving a final thanks to my colleagues, the WISEST staff, the sponsors, and the university for providing me with this incredible opportunity.

I hope that this report is informative and personal enough so that the reader realizes what I've gained out of the actual working and everything beyond that.

August 11, 1989

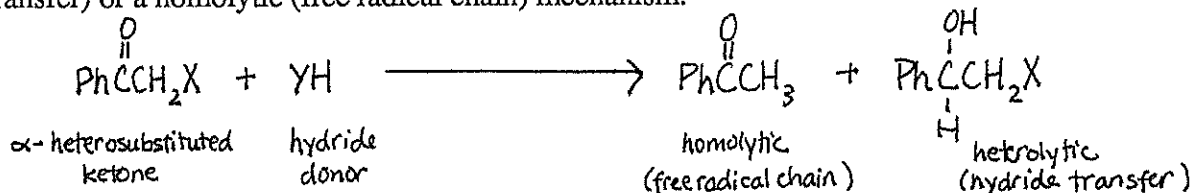
Working in the department of Chemistry was a unique and enriching experience. I had the opportunity to work side by side with other researchers and actually participate and contribute in their research as well. I was able to work with two research projects during my six weeks here. One involved free radical bromination with consideration to the solvent effect. The other project dealt with determining the reaction pathway (homolytic or heterolytic) by which α -heterosubstituted ketones proceed.

The free radical bromination reactions involved using solvents with different viscosities to determine the effect of the solvent cage in a reaction. The solvent cage is a phenomenon which occurs when the solvent molecules surround and "trap" reacting molecules (as shown below).



The reacting molecules could not escape while trapped by the solvent molecules thus a reverse reaction could take place. A very large solvent cage effect is connected with very viscous solvents while a small cage effect is connected with slightly viscous solvents. Researchers had observed that the rates for free radical bromination reactions were directly proportional to changes in temperature. Viscosity, however, also changes as temperature changes. Thus the researchers I worked with believe the rate of free radical bromination was due to the viscosity of the solvent and its subsequent solvent cage effect.

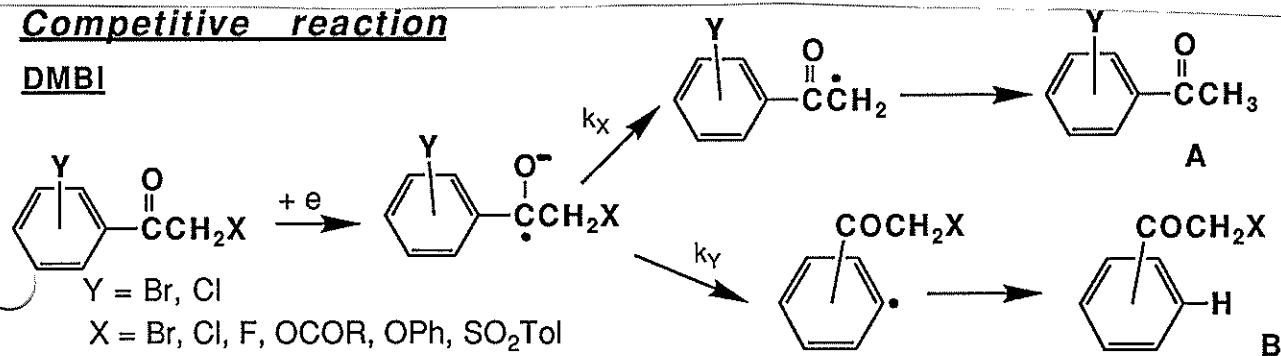
During my six weeks here in the department of Chemistry, I worked more extensively on the other project which involved determining the reaction pathway by which α -heterosubstituted ketones proceed. The α -heterosubstituted ketones could either proceed in a heterolytic (hydride transfer) or a homolytic (free radical chain) mechanism.



Techniques used to differentiate the two possible mechanisms involved product studies (PhCOCH_3 versus $\text{PhCHOHCH}_2\text{X}$), the effect of initiation (AIBN) and inhibition (dinitrobenzene), and observing EPR spectra for other electron acceptors. The studies I was involved in primarily concerned the homolytic pathway.

Competitive reaction

DMBI



Y = p-Br, $k_Y > 8 \times 10^6 \text{ s}^{-1}$, and no B was found. Thus $k_X > 10^8 \text{ s}^{-1}$

We discovered that the products for a homolytic pathway dominated and we analyzed their percent yield to help determine the rate constants for certain intermediate steps of the homolytic reaction (k_x). This would contribute to the detailed understanding of the homolytic mechanism and could assist in further understanding of the possible pathways.

Through my experience with the different research projects I learned many different lab techniques. I learned how to run reactions which involves using high precision balancing machines, making solutions, using a vacuum line to degas reaction tubes through the freeze-thaw method with liquid nitrogen, and sealing the tubes with a torch. After letting the tubes remain at a constant temperature in an oil bath for a certain period of time, I learned to open the tubes and run a gas chromatograph machine to analyze the products. I've also learned new mathematic applications to determine the percent yield of certain products by analyzing the peaks made by the gas chromatograph.

Further techniques I learned included titrations and using anhydrides to remove H_2O from solutions. I've also learned techniques to determine the melting point of compounds. This technique could also help determine the purity of a compound. I have also observed techniques to clean reaction tubes and other glassware, and techniques to purify compounds through recrystallization or distillation. I even had the opportunity to watch a lab member fuse two pieces of a reaction tube together through glass blowing.

The six weeks I spent here on campus enabled me to experience a taste of campus life. I have even attended a chemistry lecture which made me realize how complex chemistry really is. I have enjoyed meeting and working with the people in my lab and they all have been quite friendly and helpful. I also am very glad to get to know several of the other WISEST students, and even enjoyed playing hackysac at lunch with the people in another WISEST student's lab. I also have had the opportunity to use some of the University's recreational facilities by occasionally going swimming after work.

People here at the University were very friendly towards me and I feel when I come to University I will feel at ease here. I still wish I had the opportunity to discover further fields of study in science or that the WISEST students shared more of their experiences with each other. But I definitely believe now I have a pretty clear understanding of what research in science entails.

The initial reason I had gone into the WISEST program was in order to gain insight into the university lifestyle. That was before I discovered I had been assigned to the field of nursing. My expectations then changed from hopes of exploring the university, to a dreaded future of cleaning bedpans and making hospital beds. Now, looking back over my six weeks of gloom and glory (for with every job and every duty in life there are both good and bad times) I see a time of both exploration and cruel labor. I found that university was not only a learning experience, not only a working experience, and not only a social experience. It is an entity unto itself; all parts of university life must intermingle in order to make the being whole. Thus, I oftentimes found myself contemplating the mysteries of life while walking to the library to do a search, only to come back to the office and measure urine.

The experience can be broken down into two individual parts. The first could be seen as the immaterial, or soulful part. Within this area can be found those experiences which appeal to man's emotions; such as social relationships, or new discoveries that evoke new and challenging ideas, to stimulate the mind, and in turn to open one's eyes as to gain insight into the world around himself. These experiences can also prepare one for the challenge that will unknowingly erupt at anytime in the future, or even moreso, ready one for known challenges such as studying at university. The second part of the WISEST experience could be classified as the more physical part. It is here that we find ourselves putting to practice the knowledge and feelings we have recently, or far back in the past, gained from soulful experiences. Here at the university there was much of this type of application found. Again, as with the soulful part of the WISEST experience, we can learn and better prepare ourselves for life, and the upcoming future [for the future wouldn't be the future if it was not upcoming(or would it?)]. Thus it is seen, that through the WISEST experience, just as the two parts of the experience are dependant on one another, to become a whole, so does the WISEST student, who properly applies himself, and allows the two parts of the experience to further unify himself and gain knowledge.

Now, it is important to discuss the different experiences that I have had. First, let me start with those on the soulful level. The first experience, and definitely most important, would be the Wednesday afternoon meetings. At these meetings, I found out about different reactions to the situations that the others had been placed in. Through this, I could further see how personalities of people affect their job choices, or the affects of working in a field where one would

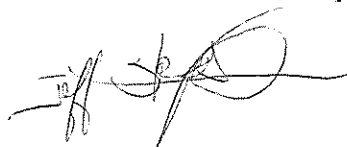
preferably stay away from. For example, I saw that several females were not assigned to the job they had applied for. As a result they did show some interest but were not greatly enthusiastic (these are observations based solely on characteristics exhibited once a week). I was also able to experience the greatly growing force of the women's movement (I was once threatened with brutality for a very conservative comment that was, of course, jokingly made). From this I realize that the world (at least the UofA) is no longer shunning the idea of non-traditional roles in the workplace. This helps me so I can prepare for this change, and be ready for extra competition no matter what field I enter.

The WISEST meetings were not the only place that I had these mental experiences. On the job I was acquainted with the true meaning of nursing research. I soon discovered it was not only cleaning bedpans (as will be discussed later) but it involved testing and experimenting outside of the hospital. My eyes were opened to the tragic realities about the redundancy of research and its boredom. As a result (and for this I greatly thank WISEST) I have become aware of what is involved in research, and unlike I had planned, I will not enter any field involving scientific research. Thus it is seen that the program has allowed me to become aware of some of the realities of the world and as I have shown, has changed my thinking greatly.

The physical side of the experience was likely most dominant in my experience with WISEST. In my first workdays I immediately found myself working with the photocopier (I copied an entire book the first day). Next I found myself learning how to use the library, and now after several weeks I am quite efficient (not to brag or anything) with most skills needed at the library (i.e. photocards, CD-ROM, on-line searches, reference desk, interlibrary loans, etc.). My first real nursing experience was making charts for an upcoming breast survey. THIS was only a prelude to the horrors that this study would bring me in the future. Very soon I found myself well acquainted with the layout of the campus. I was running all about, getting printouts, eating lunch, or retrieving and dropping off books (it was not until this week that I discovered books could be dropped off at any library location). Next I found myself testing a bed alarm system. It was here that I discovered the truths about research. The task that I had to perform (along with my partner Dinesh) was to test the amount of weight it would take to set off an alarm that had been placed under the mattress. We had labelled forty-eight points on this mattress and it was now our job to test each point thirty times with weights often in excess of twenty

pounds. To say the least we became bored of this after the first week, and when it came to doing the write-up and statistics work we were relieved. The horror I had earlier spoke of was now the task that had been assigned to us. As part of the breast feeding survey it was necessary to collect urine from the subjects. So it was that we were given huge jugs of urine of which we had to measure the volume. Of course, the first day we did this, Dinesh had a doctors appointment, so I was all alone. Eventually I made it through with only a slight headache, and minimal spillage. In the end one sees how this experience can help me to prepare for university (knowing the campus and libraries) and how it can affect my choice of careers.

Looking back at both the physical and mental strain and experiences one can see hoe they interweave with one another. Through the physical labors of research I was able to experience something new and, thus I had a mental image of what my future would hold for me in the area of research, and have now decided against it. In all, I feel that this work was likely the best that I could have had for this summer, and only wish that more jobs like this were available inside and outside of the university. Before I finish I would like to make one comment about the program. I would have to say that it would be more helpful if the campus and library tours had been given at the beginning of the six weeks, rather than near the end.

A handwritten signature in dark ink, appearing to read 'Jeff Stepnisky', with a stylized flourish extending to the right.

JEFF STEPNISKY

08/10/89