A Physicist’s Peace Corps Journey

[Editor’s Note: The following article is written by Michael Majer, who graduated from UWRF in 2005 and immediately entered into the Peace Corps.]

Advanced lab, 2005: I was up late finishing the devious Physical Pendulum experiment. By this hour, I was all alone in the lab except for the sedulous Ashton Flinders, who mentioned he was applying to the Peace Corps. The idea struck me like a bolt of lightning. I started researching, and that very evening I took the long overdue step of making plans for post-graduation.

Since 1961, 210,000+ Peace Corps Volunteers have served in 139 host countries to work on issues ranging from AIDS education to information technology and environmental preservation. The application process took over a year, but finally an invitation letter came to serve in Cape Verde, a strikingly beautiful desert archipelago off the coast of Africa. My job description was vague, but learning to live in a tiny outpost, population 2000, fishing village on the cliffs jutting out of the tropical Atlantic Ocean was difficult enough. I was assigned as a Community Development Mobilizer, and ended up working on a variety of tenuous endeavors. One of the more successful was working with USAID and the villagers to construct a $15k drip irrigation system to make better use of what little water they had. The project laid pipes to bring water from a natural spring to a water tank located on a plateau favorable to gardening. My job was primarily to act as a liaison between the funding source and the local workers. I set up meetings and organized workshops for landholders to teach them how to use the system. In this project and many like it, it’s extremely useful to have a middleman overseer like a Peace Corps volunteer, because in international development, large projects can get out of control and end up stampeding down an unreasonable or infeasible path (just my opinion). It’s like a powerful, but short-sighted elephant, and all it needs is a rider to keep it on track, someone who knows the situation on the

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**Mixing Science and Art**

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ground and can analyze the effectiveness of its actions. One of the least fruitful projects I had the embarrassment of being a part of was a toy drive/hand out, where truckloads of gaudy toys showed up and were given to children. On the plus side, sure they were excited to receive them, but the pleasure waned quickly, and it arguably had little positive effect on their lives. On the negative side, a desire and dependency on western toys was created, and when the next truck shows up empty it will be met with bitterness. Unfortunately with the abundance of Non-Governmental Organizations (NGOs), aid is coming in faster than good development ideas are being churned out. My job was to evaluate current projects and plan out future projects, juggling different ideas, bouncing ideas off of different NGOs and government agencies, and weighing the costs and benefits.

The language was similar to Portuguese, and having no English speakers within 15 miles brought me up to fluency in Creole in no time, which was paramount to success in every aspect of my life. Most days were spent with the mundane adjustments to their lifestyle of fishing, drinking, dancing, soccer, and farming. Occasionally though, I got out of the village and traveled around the archipelago. On one such adventure, I set out to find a family I knew from my village who left for the island of Boa Vista to find work. It’s known for its sand dunes and pristine beaches and is quickly becoming a tourist attraction, providing jobs for locals. So I set out to find them, which is a rough task when they don’t have a cell phone. The 16 hour boat ride over was a grueling, clam-packed, sea-sick fest. But what it lacked in hygiene it made up for with the jovial mood (of those who were not sea-sick). Everyone had a story to tell about how they ended up in this boat, and they were floored that a white man was able to join in the banter. Throughout my Peace Corps experience, the most interesting people I met were on my travels. The boat finally made it ashore, and I nonchalantly combed the island over, eating and staying with people I met as I went. This kind of travel could only happen in Africa, where customs are relaxed enough to welcome strangers in as family. I was walking to a remote coastal village when a Spanish tourist drove by and offered me a ride, expediting my search. We wound through the desert for miles, and eventually dropped me off at an abandoned beach, not a soul around; just the vast, blue, cloudless sky, the uniform white sand stretching for miles in every direction without hardly a blemish, receding under the electric blue water and out to the depths. After a couple hours sitting there taking it all in, a sea turtle swam within 10m of where I was sitting. I jumped in after him, but he proved too fast a swimmer for me. It was getting dark. I had been humbled enough for one day, and had to pull myself away and walk to town. I found my friends were just outside of town, in a slum haphazardly thrown together for workers catering to the tourists. We drank and danced in celebration. I awoke to find us sleeping in what was apparently their home, but at first glance seemed more like a child’s fort, a tin roof supported on sticks and cinder blocks. I only ended up staying for 2 days, which seemed a shame considering how many days it took to get there, but the dense clouds of flies pervading the slum drove me out. Also, the close quarters with no running water was a bit stifling. But setting the little details aside, the journey as a whole was so rewarding and surreal that in 2008 I reapplied.

My experience serving in China as a University English teacher contrasted sharply. Getting water and electricity was no longer an issue. I had a professional job with regular hours. I could find English speakers if I needed them, although I preferred immersing myself in Chinese, and became quite fluent. What a difficult language. Who would invent such a ridiculously difficult language? It was interesting being the only foreigner in the middle of the bustle of a medium-sized city (population 3 million) as globalization and affluence gradually hit.

I was assigned 16 hours a week of Oral English courses at Sichuan Institute of Arts and Sciences. I designed class activities to give students the opportunity to practice speaking. Unlike most Peace Corps posts, my job was not challenging and offered little flexibility. I spent half my time working and the other half with friends drinking tea, playing Chinese chess and basketball, and trying to understand and piece the puzzle together. It was an indescribable experience. My life had all the modern conveniences of life in the US, plus restaurants serving the most delicious food of my life for under a dollar, so in 2010 I reapplied.

I was assigned by the Senegalese Ministry of Agriculture to a remote village of 80, among the forests of the south-east
corner of Senegal, to distribute improved varieties of seed to local farmers. Since the 70’s food aid has been steadily shipped over to prevent famine, and the population has been steadily increasing, becoming less and less sustainable. Senegal currently imports 55% of its food. My job was to extend genetically modified seeds, which produce more than local varieties, and hence improve the sustainability situation.

Secondarily, I took on other food security related projects. But formalities aside, the biggest difference I made in peoples’ lives wasn’t shoving projects in villager’s faces. It was sitting around the camp fire talking to villagers, understanding them, and crafting ideas and solutions on the small scale. For example, the nemesis of national agricultural sustainability is crop residue burning. Each dry season fields are burned to destroy weed seeds and clear debris for wet season plowing, generally facilitating the whole process. Unfortunately, burning also volatizes nitrogen and kills beneficial microorganisms in the soil, harming the soil over the long-term. Way back when, the farmer could simply move on to a new patch of land, but when they combine crop residue burning with over-population, they eventually run out of land. International aid has long decried the practice in vain. Rural farmers are notoriously obstinate about their techniques, and are unmoved by outsiders’ campaign slogans. I found the best way to communicate the disadvantages of slash and burn agriculture, among other issues, was working in small groups, talking to friends informally. So I spent most my days in a cross between work and leisure, participating in everyday life in the village.

I was the first volunteer sent anywhere within 30 miles, so it was a novel experience both for me and the family of Malinkes I lived with. I learned their language quite thoroughly, and was amazed by the stories elders would tell me, from back in the days when the threats of war, disease, and wild animals still loomed. My life had seemed so adventurous until I talked to these guys. How puerile of me to have thought hippos were dangerous and malaria was a serious disease. We lived communally in mud huts with grass roofs, with little privacy, and sustained ourselves primarily by the river flowing along it (and the giant bags of USAID rice being shipped in).

The village had no electricity, water, or phone. One day in the rainy season my boss came out to see me in a jeep. He managed through the bogs, but couldn’t find a way across the river. He hollered to the other side and looked for a boat of sorts all to no avail. With fresh rains, the river had swollen to 1k across. Peace Corps doesn’t pay him enough to swim it, so he turned around and headed home. On the way he ran into a friend of mine coming the opposite direction on his way home, who eventually reported to me that my boss was trying to contact me. The only way to get cell phone service is to climb a nearby mountain, unfortunately on the other side of the river. So I wrapped my phone in plastic and swam across. After a couple hours of exertion, I finally got through and let him know he should probably wait until after the rainy season to come see me. From accidentally catching giant snakes in the fishing net to defending crops from baboons (which are apparently edible), my life abroad was much more interesting.

As all good things must come to an end, this year my contract ended and I’ve finally decided to slow it down a bit, and apply to civil engineering colleges.

The Peace Corps requires a two year commitment, which is definitely not for everyone, and is at times extremely difficult for anyone. A great range of experiences are offered, some exotic and some quasi-familiar, some wild and some tame. I picked up lessons at a visceral level that I could never have learned in the US. I still talk to my close friends from each country. Even considering the 6 year set-back to my real career, I don’t regret one bit that fateful night in the advanced laboratory.

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We Hear That....

**Tracy Crane** completed her Dual Degrees (Applied Physics, UWRF; Civil Engineering, UW-Madison) in December of 2011. As an undergraduate, she worked at the UW-Madison Drinking Water Treatment Plant. Upon graduation, she worked at Ramaker & Associates doing environmental site assessments and structural analysis for cell phone towers. Tracy was recently hired as a civil engineer at TSP Environmental in Livonia, Michigan.

After having his college career delayed twice by deployments to Iraq as a squad leader for the U.S. Army, **Jay Arndson** earned his physics degree in December of 2008. He then completed his Masters degree in Mechanical Engineering at the University of Wisconsin-Madison. He researched the interactions of small nozzle jets impinging surfaces at an angle. Utilizing thermocouples, SolidWorks, LabView, pressure transducers, flow meters, and heat exchangers -- and by designing, creating, and testing new parts himself -- he doubled the cooling abilities of a production process and co-authored two papers. Jay is now a Dimensional Validation Engineer for Jeep in Toledo, Ohio.

Tracy and Jay are getting married (to each other) next summer. Congratulations!
Eileen Korenic explains an illusion that could simply be called "Not a Spiral." If you follow one of the blue curves, you will see that it is actually in the shape of a circle, even though our minds perceive it as a spiral.

Science and Art explores parallels between science, mostly physics, and art, mostly western visual paintings, that occurred during the same periods in history. For example, in the early 1900’s when Albert Einstein was proposing his Special and General Theories of Relativity, the art world was embracing cubism, that strange art form invented by Pablo Picasso where the nose points one way and the eyes point in different directions. But the parallel between relativity and cubism is that there is no absolute frame of reference – there is no preferred observer. It was as if humanity was simply ready for this new way of thinking and it showed up in science and art without any collusion between the two. Another example of a science and art parallel occurred in the late 19th century. At the same time that Henri Becquerel and the Curies were beginning their studies of particles smaller than atoms, painters like George Seurat, also in France at the same time, began experimenting with dots of color, making whole paintings from the tiniest points using the handles of their brushes – again a parallel of viewing the whole as made of tiny fundamental parts. Other parallels include Diffraction and Chiaroscuro, Color Measurement and Fauvism, Graphing and Artistic Perspective, and the fascinating back-and-forth of Flying buttress construction in Gothic architecture that made stained glass window art a possibility.

Classes include science demonstrations such as diffraction, lasers, color wheels, projection of additive color slides, and hands-on activities including classic Euclidean constructions like circumscribing a triangle within a circle using only string, a compass and a straight edge.

Science and Art satisfies, quite appropriately, the requirement for UWRF students to take an upper division multidisciplinary course before graduation. It can also be used to satisfy part of the College of Arts and Science’s Liberal Arts requirement.

Dean of the College of Arts and Sciences, Brad Caskey, explains:

“The fundamental premise of a ‘liberal arts education’ first championed by the Ancient Greeks is that well-rounded thinkers in any field need to understand principles and elements from numerous ‘pillars of wisdom’ including communication, mathematics, language, science, logic, and the arts. Science and Art, one of the most popular [multidisciplinary] courses on campus, carries on this tradition. The popularity of the course is due to several factors, not the least of which is the energy, humor, and intellectual-challenge which physics professor Dr. Eileen Korenic brings to the course.”

Dr. Korenic is widely regarded as one of the best instructors on campus and this is reflected in student comments about the course:

“She’s hilarious and passionate, just the right amount of entertaining.”

“Hands down, this was the best general education class I’ve taken. I learned the most, and it was the most interesting.”

“I didn’t think science and art had anything in common but now I see connections everywhere”

“I can’t even look at a rainbow without thinking about refraction and color additivity.”

“Now whenever I watch a movie, I’m pointing out the round vs. pointed arches of the buildings like in ‘The King’s Speech’ where they used a substitute for the inside of Westminster Abbey.”

And that’s the whole point of multidisciplinary course – real life isn’t neatly packaged into departments but connected in unexpected ways that help us appreciate the richness of the whole.

-- Rellen Hardtke
Memories: How Physics Generates Friends

By Ron Weberg

I would like to tell you the simple story of how two UWRF Physics students back in the 1970’s became life long friends.

These two students were Kent Olson and I, Ron Weberg. Kent was from Baldwin and I was from Ellsworth, two bitter rivals in what at that time was called the Middle Border Conference. Even though we never played against each other on the field, this rivalry was as real to us as the one between the Packers and the Bears is today by NFL standards. Kent was a star on the football field and on the wrestling mat. I on the other hand was kind of the “Benchwarmer Bob “ who spent more time hitting the books. Kent was four years older than I, and due to some trouble passing Dr. Sukow’s Physics classes back in the late 60’s, he was asked to leave the University and join the Army due to the draft. Kent was lucky enough to not have to go to Vietnam, but was unlucky enough to get seriously injured in a car accident while home on leave. After weeks of recovering in the hospital and the eventual need for a total hip replacement, Kent was released from the Army and once again decided to try his hand at getting what seemed to be that “elusive Physics Degree”. Trying to bring up a GPA that was, let’s say “less than stellar,” was no easy task for Kent.

We met one day in Warren Campbell’s class. This was back when classes like these were held on the third floor of North Hall and there were maybe five students per class. Kent and I formed a bond together based on the need to complete our physics assignments; so, we would meet at convenient times in the library stacks and put our minds together. Kent would never let me forget that Baldwin had beaten Ellsworth in Football for the last four years or so, and I would counter with the reminder to him that Ellsworth has ALWAYS pushed Baldwin around on the wrestling mat. Over our time together at UWRF, we had taken the Electronics classes from Dr. Shepherd, E&M from Dr. Larson and anything we could from Drs. Prochnow and Campbell. After completion of these classes, (and of course with my help) Kent was able to bring his GPA back to a respectable number. I graduated in the Spring of 1972 and Kent followed in the Spring of 1973.

After graduation, we both went our separate ways, but never lost contact with each other. I started my career in St. Paul working for Sperry Univac as a Process Engineer in their “newly designed class 10,000 Semiconductor Lab”; Kent went off to eastern Wisconsin to work for Giddings and Lewis and later with Mercury Marine.

As time went on and we started to settle down, we never lost contact and started doing things together with our families. Kent and his wife Mary had three children, twin girls and a boy. It was always fun to watch Kent teaching his kids how to build things or explaining how things worked.

As for my wife and I, we never knew the enjoyment of having children, but have travelled around in our careers and for pleasure. After working at Sperry, we were then transferred to San Diego where I worked for Unisys and finally moved to Phoenix where I ended my career with Motorola.

Kent and I were not “super stars” in our field, but the training and experience that we found through our love of Physics and UWRF has given us both a good life and maybe more importantly a good friend for life.

Kent is retired now and is working on his “One Acre Ranch” trying to finish his “man-cave/shed” in Stanley, Wisconsin. It is here where he works his hobby of trying to make the perfect widget or gadget out of metal.

As for me, I too am retired and enjoy volunteer work at the local hospital, ushering at Brewer Spring Training games and trying to catch the world’s record brown trout on the fly!

Even though he is in Wisconsin and I am here in Arizona, we still talk weekly…..and I still remind him that Ellsworth can still push Baldwin all over the mat in wrestling!
Senior Projects

As usual there was a wide variety of topics chosen by the thirteen students who completed their Senior Seminar projects this past year.

Many tubers were sacrificed in the name of science when Zach Anderson investigated the exit velocity of potatoes propelled by compressed air out of a potato cannon. He used both high speed video and microphone sensors to measure the speeds of the spuds.

Alesha Radke worked to develop a process for making microfluidic channels - small devices that allow for the controlled flow and mixing of small amounts of liquids. These types of devices are becoming a favored technique in medical diagnostics, because a small amount of blood can be used to perform dozens of tests simultaneously in one device.

Extending her summer research from the Colorado School of Mines, Charlotte Evans examined the temperature dependence of the etch rate of Zinc Oxide in Benzoic acid. Zinc Oxide is used in some hybrid photovoltaic cells, and the acid etch allows for modification of the electronic properties of the surface of the oxide.

Continuing the work on optically trapped aerosol droplets at UWRF, Wes Barnes successfully made the first measurements of the position of the trapped water droplets with simultaneous precise measurements of the diameter of the droplets using a technique called Cavity Enhanced Raman Spectroscopy.

Emily Dvorak laid the groundwork for many future UWRF students by compiling information about a neutron monitor that is likely to be moved to UWRF in the future. The monitor, which has been stationed in Antarctica, is part of a global system of neutron detectors that monitor cosmic rays incident on Earth’s atmosphere.

Bill Ryan investigated the use of digital signal processors (DSP) and field-programmable gate arrays (FPGA) in feedback circuits. Specifically, Bill wanted to find a digital-based feedback system that could be used as the control system for a scanning tunneling microscope system.

Extending work started by students in the past, Tyler Capek won a grant to increase the power of a frequency-doubled laser (a laser that produces infrared light at a wavelength of 1064nm and green light at 532nm). The goal Tyler met was to have the laser produce pulses of light, which concentrate the energy output of the laser into short, powerful bursts.

Brendan Reed undertook the challenge of trying to produce sonoluminescence - light from an air bubble in water that is driven by sound waves to expand and contract. Brendan was not able to see any light produced, but he was able to keep an air bubble trapped in the center of a round flask with the sound waves for longer than previous students.

Noah Biros measured the resistance of a high temperature superconductor as it was cooled from room temperature down to 77K. His goal was to carefully determine the temperature at which the sample lost all electrical resistance as it transitioned to the superconducting state.

Some readers of this newsletter might ‘fondly’ remember using the hard sphere scattering apparatus in Advanced Lab. In that experiment, BBs are shot out of a tube and ricochet off a hard plastic target, leaving a mark on some pressure-sensitive paper where they hit the wall of apparatus. The angular distribution of the ricochets allows students to work backward to determine the size and shape of the scattering target. Ben Beaudoin set out to automate this otherwise tedious apparatus by replacing the paper with piezoelectric pressure sensors,
using a stepper motor to move the firing tube, and trying to create a way to control the loading of BBs into the tube.

Driven by his love of engines, Tyler Jacobson investigated how the efficiency and torque of a single piston engine was impacted by creating ‘dimples’ on the head of the piston. The modified piston seemed to improve the torque produced by the engine, but made little difference to its efficiency.

Laura Rogers examined the mechanical properties of several types of polylactic acid - a corn based plastic - by measuring their stress-strain relationships. She found that the plastics had similar performance to petroleum-based plastics.

Grabbing the baton from the previous students who have worked with the CO$_2$ laser system, Andrew Klitzke raced to the finish line this spring. The CO$_2$ laser is used to mark and cut materials, and Andrew finished the control system of the XY table that holds the material. Students can now design a part in a CAD program, convert the drawing into machine code that is interpreted by a computer to control the motion of the XY table, and end up with a finished part. Andrew’s seminar presentation was highlighted by a live demonstration of a part being cut out of an acrylic sheet.

Making Something Out of Nothing

This spring, nine students took a class to learn all about making and measuring nothing. They didn’t take Time Wasting 101, rather Vacuum Techniques and Thin Film Deposition - a special topics course designed to give students hands-on experience with vacuum systems and simple methods of producing patterned metallic films.

The course was spurred in part by the acquisition of a thin film deposition system that was donated by a faculty member at Michigan State University. In the class, students learned about vacuum pumps, pressure gauges, and vacuum chamber design before assembling and testing a simple system on their own. They then learned about different methods of depositing thin films onto surfaces and how to make patterned films using a simple photolithography process.

Above left: Wes Barnes prepares to spin photoresist onto a glass slide in preparation of doing some lithography. Above: Matt Tomlinson and Andrew Klitzke evaporate Aluminum in the newly donated thermal evaporator.

The Sole purpose of this newsletter is to keep everyone in the UWRF Physics community informed about the activities of our members—that’s you! We and your fellow readers want to hear what you’ve been up to recently (or not so recently, as the case may be). Please fill out the form below with your news and mail it in, or call: 715-425-3196, e-mail: Lowell.McCann@uwrf.edu, or fill out the form on the web: www.uwrf.edu/PHYS/AlumniForm.cfm

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May we share your addresses with your fellow physics alumni? _____ email _____ postal

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