The University of Iowa

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AIChE FALL 2012

Advisor's Corner

By: Prof. David Murhammer, Professor and AIChE Student Chapter Advisor

Greetings to Hawkeye Chemical Engineers!! This Fall 2012 issue of our AIChE Student Chapter Newsletter begins with an article about the 2012 National AIChE Annual Student Conference held in Pittsburgh, PA. Our student chapter won numerous awards at the meeting, including a prestigious AIChE Scholarship for Jonathan Bachman and an Outstanding Student Chapter award. In addition, our ChemE Jeopardy team finished 2nd in the national competition. This issue also contains articles about hosting a Halloween Day Camp for kids, our new Executive Mentoring program to enhance our students' professional development, and representative student internship and research experiences. Furthermore, this issue contains three student-written topical papers from our sophomore-level Process Calculations course.

Finally, I am very proud to announce two special accomplishments of our students during the last ~6 months. First, Derek Baerenwald, Jameson Schoenfelder, and Biming Wu, all 2012 BSE graduates of our program, won both safety in design awards for the 2012 AIChE National Student Design Competition ("Production of Non-Alcoholic Beer Using a Reverse Osmosis Membrane Process"), specifically the (i) Safety & Health Division National Design Competition Award for Safety and (ii) Safety and Chemical Engineering Education (SAChE) Jack Wehman Team Award. Second, Caitlin Andersen participated in the Washington Internship for Students of Engineering (WISE) 2012 summer program. Information about the WISE program, including Caitlin's paper and presentation ("Precision Agriculture Technologies: Improved Nitrogen Efficiency and Atmospheric Pollution"), can be found at http://www.wise-intern.org/.

University of Iowa American Institute of Chemical Engineers

INSIDE THIS ISSUE:

Fall 2012 National AIChE Annual Student Conference

By: Jonathan Bachman - Senior Chemical Engineer, President of AIChE Student Chapter

The National AIChE Annual Student Conference was held in Pittsburgh on October 26-29. Students from more than 100 Chemical Engineering programs attended the conference. The University of Iowa Department of Chemical and Biochemical Engineering was represented by 9 students and their faculty advisor. The conference had many fun and professional development activities, including the Chem-E-Car competition, career planning workshops, student chapter workshops, a recruitment fair, Halloween bash, ChemE jeopardy, and a research poster competition.

Although our chapter did not have representation at all of the events, we were certainly able to contribute to and benefit from the conference activities. The Chem-E-Car team from Cornell, with their car Zaptos, won the competition with a perfect score of 0.0 m, i.e., their car landed directly on the targeted finish line. Career planning workshops from a variety of different fields were presented, with advice given from graduate school advisors to industry leaders. Due to her participation in the WISE internship program, our own Caitlin Andersen presented at the 'Chemical Engineering and Policy' workshop, where they discussed the necessity of chemical engineers participating in the policy development process in order to contribute their viewpoints and expertise. Another career planning workshop that was of particular interest was 'Green Jobs for Chemical Engineers', which emphasized the growing importance of green jobs and gave insight into opportunities for soon-to-be graduates. There were a number of very valuable student-lead workshops, including one presented by our chapter. We presented a workshop called, 'Earth Day Camp for Kids', which outlined the purpose of the event as well as gave advice on how to organize and run it effectively. There was a high turnout for this presentation, and many students and advisors participated in discussions on potential demonstrations including solar cars and windmill kits. Other notable student chapter workshops included ones from the University of Illinois and the University of Michigan on corporate sponsorship and international sister chapters, respectively.

Chemical Engineering students and their faculty advisor in Pittsburgh, PA for the Annual AIChE National Conference.

Since our ChemE Jeopardy team won the 2012 Mid-America Regional Competition, we were invited to participate in the national competition along with the winning teams from the other 8 regions in the United States. Our team won the first round to earn a spot in the final round along with teams from Oregon State University and the University of Cincinnati. In the final round, our team finished second to the University of Cincinnati team. Our team members were Matt Gosse, Austin Hangartner, Ben Ungs and myself. In preparation for this competition, we played a round against the department's faculty, but ended up losing due in large part to Professor Aurand's knowledge of vice presidents (we won the majority of ChemE related categories).

Overall, this conference was a great success and those that participated greatly benefited from all aspects of the trip. The 2013 Mid-America Regional Conference will be held April 19-20 at the University of Oklahoma, where we plan to participate in the Chem-E-Car competition, ChemE Jeopardy competition, and Paper contest in which students give oral presentations about their research. This will give us the opportunity to experience numerous invaluable networking and professional development opportunities and to qualify to participate in these events at the 2013 National AIChE Annual Student Conference being held in November in San Francisco, California.

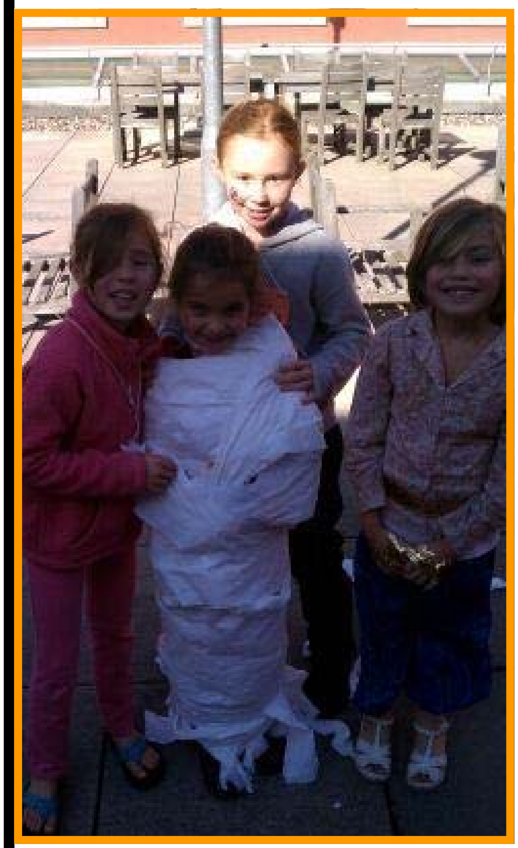
2012 Halloween Day Camp For Kids

By: Scott Shields - Senior Chemical Engineer, Fundraising Chair of AIChE Student Chapter

On October 21st, the students of AIChE once again hosted their annual Halloween Day Camp. The nearly 20 engineering students involved were given a chance to share some of their knowledge with local children in a fun, hands-on setting. The kids were given the chance to learn about topics ranging from surface tension to catalytic reactions by watching and participating in various demonstrations.

This year's event included activities such as making soap bubbles with dry ice, *magically* sucking eggs into glass bottles, and mummifying apples, to name a few. A few of the children were even mummified themselves during game time, as they were wrapped head to toe in toilet paper to mimic the classic Halloween creature. While some of the kids may have gone home a little messy due to other experiments, like making colored flubber, everyone went home with a smile on their face, ready for Halloween.

Scott Shields (Fundraising Chair) and Jonathan Bachman (AIChE President) with Crissy Canganelli, the Executive Director of the Iowa City Shelter House.



Some of the outdoor activities included mummifying some of the children with toilet paper!

Of the twenty kids to participate this year, many came in an array of costumes, ranging from Iron Man to Spanish dancers. Even some of the volunteers participated in dressing up, coming as a nerd, a construction worker, and even Cookie Monster. The day was filled with lots of laughter and intelligent questions from the young minds who were ready to learn and celebrate the holiday. It will be a challenge for the students of AIChE to come up with fun, new, and interactive activities to top this year's event, but, as always, they'll find exciting ways to present the information they've worked so hard to master!

The students of AIChE would like to thank the faculty and local community for their continued support of this event. In putting on the event, the student chapter was able to raise just over $300 for the local Iowa City Shelter House. The money will help locals restart their lives and provide financial support for the extensive number of services the shelter house offers to the community.

Executive Mentoring Network for Chemical and Biochemical Engineering Students

By: Taylor Malott - Senior Chemical Engineer, Newsletter Editor-in-Chief of AIChE Student Chapter

As all of us know, pursuing a Chemical Engineering degree is difficult to say the least. The coursework is demanding and rigorous with weekly homework sets, lab reports, quizzes, exams, group projects, presentations, not to mention the required General Education components of a ChemE student's Elective Focus Area (EFA). After completing a majority of the ChemE coursework, I have learned that attending a professor's office hours or seeking additional help can offer great clarity and direction with respect to the academic side of college. This type of supplemental support is a key ingredient for an individual's success as a student and as a person. Therefore, when a ChemE student must choose an EFA and potential career path, it would be of great benefit to have professional support.

> *"...the reality is that many students do not have that 'extra' resource..."*

Background: For those of you who are unfamiliar with the Elective Focus Area (EFA) program, it is an area of study that a student chooses for further knowledge in a specific field of interest. By their sophomore year, each ChemE student must choose an EFA. There are currently nine different EFA's that a student can pursue: Biochemical Engineering, Business, Chemical Process Engineering, Energy and Environment, Entrepreneurship, Pharmaceuticals, Polymers, Pre-Medicine, and Sustainability. Furthermore, students have the option of creating a Custom EFA to best prepare them for their career goals. Each of these EFA's tailors the coursework to a student's interest. Now a senior, I can tell you first hand that choosing an EFA was difficult because a ChemE degree offers such a wide variety of career paths. Since I have a mentor from a previous internship experience, I was able to determine what EFA would be best suited for me and my skill sets and interests. But the reality is that many students do not have that "extra" resource for advice regarding an EFA or career path.

The Program: With the direction of David Murhammer (Professor and AIChE Student Chapter Advisor) and Thomas Marriott (Chair of the EFA Advisory Board), it is the goal of the Chemical and Biochemical Engineering Department to supply students with additional professional support. The intent of this Mentoring Program is for the Mentors to contribute to the professional preparation of the Students for a successful career by interactively supplementing the Students' formal education with the Mentor's knowledge, experience, and counsel. This could include individualized help with career planning, resume preparation, interviewing savvy, internships, networking opportunities, lasting relationships and more! Mentors are chemical engineering professionals with a minimum of 5 years in industry or in their chosen profession (e.g., Law, Medicine, etc.)

The plan is to begin this mentoring program during the Spring 2013 semester. To date, Mr. Marriott has recruited a sufficient number of mentors, most of whom are Iowa ChemE Alumni, to serve as mentors for the current Sophomore students. However, the target is to match every ChemE student with a mentor. If you are interested in serving as a mentor and/or would like to learn more, then please e-mail Tom Marriott at tom.marriottjr@gmail.com for information.

Iowa Department of Natural Resources Pollution Prevention Internship Program

By: Darren Youngs - Senior Chemical Engineer, ChemE Car Coordinator of AIChE Student Chapter

My internship was through the Iowa Department of Natural Resources Pollution Prevention internship program where I was placed at Green Plains Superior, LLC. The plant is a 50 million gallon per year dry-grind ethanol facility in Superior, Iowa. My project was to conduct a water balance to identify water reduction and reuse opportunities to reduce facility water usage by 10%. The facility required an extensive water treatment process to reduce iron, calcium, and sulfate concentrations before the water could be used in the process, which resulted in the production of a significant amount of wastewater. The reverse osmosis retentate contained sulfate concentrations that were nearly twice as high as the discharge limit and was currently being diluted with softened water. The implementation of a sulfate precipitation process through the addition of hydrated lime and aluminum trihydroxide would reduce the sulfate concentration below the discharge limit, eliminating the need for dilution. The facility currently dilutes with softened water since the well influent iron concentration exceeds the permit concentration. The facility could reduce chemical use and reduce expenses by diluting with a ratio of well and soft water to achieve the required dilution. Daily monitoring of iron and sulfate concentrations was also recommended to ensure that excess dilution was avoided. The well influent is treated through a cold lime softening system to remove iron and calcium and is then passed through a sand filter to remove any additional solids before being used as process water or passed through the reverse osmosis system. Accumulation of suspended solids in the media results in flow reduction through the media and a mixture of water and air is backwashed through the filter to fluidize the media releasing the entrained solids into the backwash water. Pumping the filter backwash into the existing sludge thickening tank required by the clarifier would allow for the suspended particles to be disposed of and the remaining water recycled. My final recommendation was the installation of a disk nozzle centrifuge to remove additional solids from the thin stillage to increase evaporator efficiency by reducing fouling. It would also allow for wetcake moisture optimization to reduce natural gas usage in the drying process and increased production capacity by the removal of non-fermentable solids in the backset. Implementation of all recommended projects would result in an annual savings of $268,000 and 89.71 million gallons of water for a total reduction in water usage of 42%.

Darren Youngs at Green Plains Superior in Superior, Iowa during his internship this past summer.

My Summer with Hormel Foods

By Samantha Westerhof - Senior Chemical Engineer

During this past summer I had the pleasure of being one of 40 interns hired by the meat company Hormel Foods as a plant maintenance engineer at their Rochelle, Illinois location. I was extremely lucky to work with this company since they gave me projects to work on that were specific to my academic elective focus area (EFA).

I was given energy and water saving projects that were directly related to my Energy and Environment EFA, thereby giving me the opportunity to utilize what I have learned in school and to help save the plant money.

It was an extremely exciting experience to be able to take what I had learned in my chemical engineering classes and apply it to a working plant. Courses such as Chemical Process Safety and Process Control really helped with HAZMAT training for anhydrous ammonia and with learning the plant's processes.

During the summer, I made sure I participated in every meeting and event possible so that I could make the most of my internship. Overall, Hormel Foods was a great company to work for and I could not have asked for a better summer experience.

My Research Experience at the University of Kansas

By Jacob Nuhn - Senior Chemical Engineer

Ever since my first semester of chemistry lab, I knew I wanted to spend the rest of my life conducting research. It was there that a TA explained to me that a certain vial of nanoparticles that I was holding contained the surface area of a football field. This simple fact opened my mind and let me experience a world that is known but not yet understood. I have been chasing the feeling of discovery since that fateful day, which is why I decided to pursue a research position at the University of Kansas this past summer.

When I accepted my position as a part of the University of Kansas's Feedstock-to-tailpipe Initiative team, I had no idea what I would be doing. As it turned out, I spent my summer under Dr. Christopher Depcik and Dr. Edward Peltier researching Jatropha Methyl Ester (JME) as a potential biofuel alternative to diesel. I was put into a room with mechanical engineering graduate students and spent the first two weeks learning everything there is to know about engines. This was crucial as I am a true Chemical Engineer and knew almost nothing about how compression engines actually worked. I spent the next seven weeks reading journal and SAE articles examining results other labs across the country obtained with respect to the emission profile of JME. I took the information that I learned from summarizing over 50 articles and wrote a short literature review to be used when my work was ready to be put into a paper.

With one week to spare we obtained five gallons of JME and spent about 14 hours running tests using a single cylinder engine. From these tests, we were able to graph different emission characteristics (Nitrous Oxide, Particulate Matter, and Carbon Monoxide) versus engine load. From the work I did over the summer, the laboratory group got a conference abstract, which will be presented at the 245th National American Chemical Society Meeting being held in April 2013. The work we completed may also be combined with other work at the University of Kansas into a future journal article.

NASA: Internship at Glenn Research Center

By: Benjamin Ungs—Senior Chemical Engineer

In the summer of 2012, I was granted a fantastic opportunity: a research internship at NASA's Glenn Research Center in Cleveland, Ohio. Formerly known as the Lewis research center, Glenn is home to state-of-the-art laboratories, including the Zero Gravity and Microgravity Research facilities, Icing tunnel, Spacecraft Propulsion Research Facility, rocket engine test facility, and the (now extinct) Plum Brook nuclear fission reactor. Glenn was also involved in descent logistics for EDL (Entry, Descent, and Landing) of Mars Rover Curiosity. The beginning of my summer was highlighted by the Venus transit of the sun (of which the next occurrence will take place in 2117) and the end by the successful landing of the MRL, which I had the honor to watch while in California. My own project was to verify the use of thin-film solid oxide piezoelectric actuators for further research. A material displaying the converse piezoelectric effect is extremely useful as an actuator, as they can be used for high-accuracy (nano-level) positioning systems using very little electricity. The group I worked with also researches thermoelectric generators, which is the technology used for power on Mars Rover Curiosity. If you want to learn more about internships with NASA, please visit https://intern.nasa.gov/solar/web/public/main. Also, my e-mail is benjamin-ungs@uiowa.edu.

The Glenn Research Center in Cleveland, Ohio.

Nuclear Energy: The Solution to the World's Energy Crisis

By: Josh Grandquist - Sophomore Chemical Engineer

Many of the problems in the world today stem from the uncertain future of our energy resources. Day after day, the fossil fuels that are being used for 86.4% of the world's energy production are being depleted, such as petroleum, natural gas, and coal.[1] At the present rate, it is estimated that we will completely run out of petroleum oil and natural gas within 65 years and coal will be exhausted within 120 years. Unfortunately, experts say that a nearly 50 percent increase in energy demand is expected by 2035.[2] Therefore, the fossil fuels will more than likely be drained before these reported lengths of time. Over the past decade, many companies have begun hiring chemical engineers to examine and create new alternative energy processes and reactor designs as a solution. Recently, the likes of hydroelectric, geothermal, solar, and wind energy procedures have seen a huge spike in research and use. On the other hand, nuclear energy has seen less interest as a possible solution, especially in the United States, where a new nuclear power plant has not been built in almost three decades.[3] However, chemical engineers need to examine nuclear energy more seriously as an answer to the world's energy crisis because it is extremely cost effective, as well as being exceedingly safe for humans and the environment.

While companies are having to dig deeper and longer for the last little bits of fossil fuels, driving the costs up even more for the depleting resources, abundant nuclear fuel lies untapped all around the world. The most commonly used source of nuclear fuel, Uranium, is 600 times more abundant than gold.[4] At this time, the cost of nuclear electricity is 1.7 cents per kilowatt-hour, whereas coal is 2.4 cents, natural gas is 6.7 cents, and oil is 10.2 cents per kilowatt-hour. Additionally, one kilogram of natural uranium yields about 20,000 times as much energy as the same amount of coal.[5] However, Thorium, which is three to four times more abundant on Earth than Uranium, and Hydrogen, the most abundant element in the universe, are currently being developed into far more efficient nuclear fuels, which will, in turn, drop the price of nuclear energy significantly while the price of fossil fuels continues to skyrocket.[4] While the economical benefits of it are numerous, the safety advantages of nuclear energy are what puts nuclear energy power plants above the rest.

> *"...one kilogram of natural uranium yields about 20,000 times as much energy as the same amount of coal."*

Many people point to the terrible nuclear power plant accidents at Chernobyl and Three Mile Island as to why the world does not need nuclear power. These two instances, while very tragic, happened over thirty years ago. In that time, enormous strides have been made in the field of nuclear energy, from the constantly improving safety measures to the reactor designs, all the way to down to the fuel used. A 2007 report by the United States Environmental and Protection Agency (EPA) stated that, "Nuclear power plant operations account for less than one-hundredth (1/100) of a percent of the average American's total radiation exposure…".[3] In 2012, the United States Nuclear Regulatory Commission reported that, "If you lived within 50 miles of a nuclear power plant, you would receive an average radiation dose of about 0.01 millirem per year. To put this in perspective, the average person in the United States receives an exposure of 300 millirem per year from natural background sources of radiation."[3] In addition, a recent study of death related to power generation found that nuclear energy is five times safer than oil, ten times safer than gas and 100 times safer than hydroelectric dams. As for the environment, nuclear power plants only emit harmless steam into the environment, as opposed to very harmful green house gases given off by coal, oil, and natural gas power plants. The areas around most nuclear power plants are so clean, "they are often developed as wetlands that allow trees, flowers, and grasses to thrive and provide nesting areas for waterfowl and other birds. Many energy companies have created special nature parks or wildlife sanctuaries on plant sites."[3]

Every day, the prices at the gas pump climb higher, the cost of electricity for a family goes up and up, and the world's supply of fossil fuels gets costlier and scarcer. It is not only smart, but also increasingly essential for the new generation of chemical engineers to develop new and improved ways to produce energy for the rapidly growing world. For its inexpensive, yet efficient fuels, and safety for humans and the environment, nuclear energy needs to become a larger focus in the area of alternative energy. It has the potential to carry the world into a brightly lit future; it is now time for chemical engineers to help tap into that potential.

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Chemical Engineering in Shape Memory Alloys

By: Jacob Crome - Sophomore Chemical Engineer

Imagine using a crank-operated can-opener to open a can of vegetables. As the handle is rotated and the blade turns, the can rotates and a cut is opened in its top. Now imagine that same can, only now as the cut is opened it almost instantly repairs itself. Over and over, the blade of the opener cuts the can, only to have the lid close again. This is a possible future for some "shape memory alloys", and while they may be overqualified for kitchen applications, they are of great interest in many fields including the military, electronics, aviation, and healthcare. Paramount in the science behind these alloys is material properties and those who understand them. Chemical engineers have the potential to directly influence possible uses for these materials, factors limiting their production and use, and advances of existing shape memory alloy technology.

Before discussing these so-called "smart metals", it is important to know their composition. As the technology stands currently, there are two main types of shape memory alloys (SMAs): copper-aluminum-nickel and nickel-titanium (Nitinol) (Lin, 2008). When forged correctly, these alloys create metals whose natural tendencies are to return to their cold-forged shape, and will return as near to that shape as possible with the application of heat. Additionally, these alloys can be created such that they have two "natural shapes", thus allowing them to alternate between shapes with additional periods of heat exposure (Otsuka, 2002, p. 1). This characteristic lends itself to many applications, most notably in the form of shape memory alloy actuators. These devices take an electric current from a power source and use the heat of that current to return the smart metal to its original state. Actuators are used in a wide variety of electronics, including those within the healthcare field. For example, an insulin pump needs an actuator to operate the pump. Using normal alloys, an actuator of this type would be bulky and generate a large amount of heat. Smart metals can be used to dramatically decrease the size and heat production of the actuator, thereby making the insulin pump more practical (Shape). For all their uses, these alloys are not without fault, most notably the constraints on the environment in which they are used (Applications).

> *"Existing SMA technology is incredibly useful, but it still has potential for greater usability."*

Typical SMAs are designed to operate at relatively low temperatures, so there has yet to be an alloy created that retains its memory at temperatures higher than 390 Kelvin. Though the demand for smart metals is lower in processes within this temperature range, it does exist. Recent attempts to increase the tolerable temperatures have been mostly unsuccessful, and usually depend on including another metal, often gold or platinum, in the alloy, which greatly increases the cost (Firstov, 2006, p. 1044). Temperature is also a limiting factor in actuators, as the heat created by the electrical current must be calculated with high accuracy in order for the SMA to work properly. Lastly, shape memory alloys are entirely dependent on shape, which means that they have a very low toleration for inaccurate dimensions (Shape).

Existing SMA technology is incredibly useful, but it still has potential for greater usability. If chemical engineers, specifically those well-versed in materials science, can create a high temperature SMA, it would unlock another sector of applications. An understanding of material science is fundamentally important in the process to make these advances happen, as metal properties are rooted in material science. Furthermore, if the cost of these high temperature alloys can be lowered via increases in technology, it is up to chemical engineers to see this come to fruition. One of the most important strengths of chemical engineers is their ability to produce new and innovative ways of completing a process; this ability could certainly be applied to the production and improvement of SMAs. Future applications are entirely speculative: depending on the state of SMA technology, we could potentially see plane wings able to "heal" from being shot, or boat hulls able to automatically repair tears. Though it is impossible to say what advances this technology will undergo, it is a certainty that chemical engineering will be the driving force behind them.

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Aquaculture: Chemically Engineering a Sustainable, Profitable, and Eco-friendly Food Supply

By: Thomas Romano - Sophomore Chemical Engineer

Current fishing practices are unsustainable. An analysis of catch data, published in the peer-reviewed journal *Science* in 2006, grimly projected that if current trends continue, every commercially fished marine species will have been reduced in population by over 90% by 2048, resulting in a "global collapse" of the world's fisheries[1]. Today, approximately 1.4 billion people rely primarily on fish as a source of protein[2]. This number is expected to double by 2050[3]. Aquaculture, the cultivation of aquatic organisms, could reconcile the growing needs of humanity with dwindling natural resources. As this industry rises in prominence, the expertise of chemical engineers will be called upon to decrease environmental impact and increase production and profitability.

Aquaculture, a portmanteau of the words "aquatic" and "agriculture", applies the concept of agriculture to aquatic organisms and includes the farming of finfish, shellfish, and aquatic plants or seaweeds. It is surprisingly efficient compared to traditional agriculture. Whereas seven pounds of feed are required to produce a pound of beef, only two pounds of fishmeal are required to produce a pound of fish[2].

Aquaculture is in essence a chemical process in which the chemical reactions take place inside the desired product itself. Although some farms, such as open ocean pens, do not require artificial currents to deliver oxygenated water or carry waste away, inland facilities require a steady current to maintain water quality in spite of typically high stock density. A feed stream delivers oxygenated water and nutrients to be used as reactants in metabolic processes. Waste streams remove leftover inputs and by-products, such as ammonia.

Techniques regularly used by chemical engineers to increase the efficiency of industrial chemical processes can also be applied to aquaculture. Unreacted reactants in the waste stream can be separated and then recycled back into the feed stream to attain a more efficient conversion of raw nutrients to fish meat. Processes are often designed to reuse products of one reaction as reactants in a subsequent reaction. If process engineers treat aquatic organisms as unit processes, multiple species can be linked in series in the same way as non-biological reactors. For instance, empirical evidence shows kelp grown in the waste streams of salmon farms acts as a bio-filter, removing pollutants from the waste and reusing them as fertilizer[4]. Known as integrated multi-trophic aquaculture, a process that combines the right species in the right order reduces both pollution and the cost of feed.

As with any chemical process, engineers can manipulate the input chemicals to achieve an ideal product and crucial to the quality of aquacultured seafood is nutritional content. Farmed salmon and other fatty fish often contain a lower concentration of omega-3 fatty acids than those that are wild-caught. Colloquially referred to as "fish oil", omega-3 fatty acids have been shown to lower blood pressure as well as blood triglyceride levels and reduce the risk of death from cardiovascular disease[5]. Fish do not synthesize the fatty acid themselves, but accumulate it from oceanic algae, a part of their natural diet[2]. For farmed fish to contain a similar amount of omega-3s, aquaculturists will have to introduce fatty acids into their diets, either through artificial synthesis or by cultivating algae. A profitable process that incorporates either of these options would significantly improve the nutritional content of farmed fish. Furthermore, there is potential for aquacultured seafood to be enriched so that it is even more nutritious than wild-caught seafood, similar to how milk and cereals have been enriched for years to make it easier for consumers to get the vitamins they need.

One trait that strongly influences consumers' acceptance of aquaculture products is a natural appearance. The meat of farmed salmon, trout, and shrimp lacks a natural red pigment called astaxanthin. This gives them a much paler appearance. To make this seafood look more appealing to consumers, the biotechnology company Igene developed a process to artificially synthesize astaxanthin[3]. Now aquaculturists can decide on a product's exact shade of red.

"Aquaculture has the potential to both be the saving grace of the Earth's oceans and provide an eco-friendly, sustainable, and profitable food source."

World demand for aquaculture products is expected to increase by 70% over the next thirty years[2]. Alleviating the pollution created by aquaculture is another concern chemical engineers will address. Unnaturally dense populations of fish create high concentrations of waste that can damage the surrounding environment if not properly treated. Similar to livestock runoff, excessive nitrogen and phosphorus in waste streams can effect algal blooms that deoxygenate the water and can kill off local aquatic species[2]. The same techniques used to remove hazardous by-products from other waste streams, such as at sewage treatment plants, can be applied to aquaculture waste to reduce its environmental impact.

Organic chemicals that are used to keep fish healthy, such as medicines and hormones, pose threats unique to biological processes when not removed. Growth hormones have been known to leak into natural waterways and affect the local fish populations. Furthermore, the genetic similarity of commercially raised fish stock increases the risk of disease to the extent that preemptive use of medicine to kill bacteria, fungi, and parasites is common and helps to protect against a massive die-off[2]. However, unless removed from the runoff, they are constantly deposited into natural bodies of water where they increase the risk of diseases in natural populations evolving resistance. Resistant diseases pose a threat to ecosystems and human populations alike. As the aquaculture industry expands, greater responsibility will be required to ensure the negative effects of improperly processed waste are minimized just much as in any other industry.

Aquaculture has the potential to both be the saving grace of the Earth's oceans and provide an eco-friendly, sustainable, and profitable food source. As with any emerging industry, problems exist. In the case of aquaculture, ensuring high food quality, gaining public acceptance, and minimizing environmental impact serve as the main hurdles for chemical engineers to overcome. With adequate research and investment, aquaculture is poised to become a cornerstone of the world's food supply.

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Congratulations to the Spring 2013 AIChE Officers!

President: Kyle Owen
Vice President: Nick Schickel
Secretary: Tyler Latcham
Treasurer: Ian Armstrong
Newsletter Editor: Emily Zelino
Webmaster: Ian Smith
Historian: Joanne Amaya
Fundraising Chair: Michael Stotzer
Social Chair: Joe Brodt
ChemE Car Chair: Jacob Crome
Regional Conference Chair: Austin Hangartner

The Fall 2012 junior class

The Fall 2012 senior class

Acknowledgements

Thank you to the Fall 2012 AIChE Officers for their hard work and contributing efforts to make our AIChE Student Chapter a successful organization.

President: Jonathan Bachman

Vice President: Austin Hangartner

Secretary: Kyle Owen

Treasurer: Ian Armstrong

Newsletter Editor-in-Chief: Taylor Malott

Webmaster: Natalie Northup

Historian: Elliot Glenn

Fundraising Chair: Scott Shields and Mike Stotzer

Social Chair: Caitlin Andersen

ChemE Car Chair: Darren Youngs

Editor-In-Chief Taylor A. Malott would also like to thank the following people for their support and contributions to the Fall 2012 AIChE Student Chapter Newsletter:

Faculty Advisor: Prof. David Murhammer

Contributors: Jonathan Bachman, Jacob Crome, Elliott Glenn, Josh Grandquist, Thomas Marriott, Jacob Nuhn, Thomas Romano, Scott Shields, Benjamin Ungs, Samantha Westerhof, and Darren Youngs.

Your help is much appreciated!

Interested in speaking at professional seminar? If so, then contact AIChE Student Chapter President Kyle Owen at kyle-owen@uiowa.edu or Student Chapter Advisor Prof. David Murhammer at david-murhammer@uiowa.edu for details and availability!