

University of Illinois and Zhejiang University  
**Research Apprenticeship Program 2010**  
July 15 - August 26, 2010



**Sponsored by:**  
**ACES Office of International Programs**  
**University of Illinois**  
**and**  
**Zhejiang University, China**



# Program Summary & Overview

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## International Training Modular for Agribusiness Management

The International Training Modular for Agribusiness Management (MAM) is a highly competitive program designed to immerse Zhejiang University agricultural students in a curriculum that will enhance their understanding of international agribusiness in order to prepare them for a future in a global society. Students enroll in a 27.5-credit hour curriculum in a variety of subject areas including the research apprenticeship abroad. It is the aim of the program is to prepare Zhejiang students for future leadership in agriculture.



The Chu Kechen Honors College facilitates this honorary program. MAM believes that future leaders in agriculture must have a solid understanding of modern agriculture and technologies, business and management skills, excellent leadership ability, and an international perspective on agribusiness to emerge as successful contributors to the world of agriculture.

### Origin of a Progressing Partnership

Zhejiang University, ranked among the top three Chinese institutions, began its partnership with the University of Illinois in 2002. To foster this relationship and strengthen research collaborations, the University of Illinois College of Agricultural, Consumer, and Environmental Sciences (ACES) proudly hosted 18 of Zhejiang's finest students through the College of Agriculture's MAM program in the summer of 2010. This 2010 class engaged in a six-week research internship at the University of Illinois, where they were matched with an ACES faculty member with similar research interests. Students spent their time completing a research project with their respective faculty members, learning about graduate schools in the United States, and immersing themselves in American culture through industry-focused tours in Chicago and St. Louis. The program was administered by the College of ACES Office of International Programs.



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This was the College of ACES' first year working with MAM, and the program was highly successful. The College looks forward to hosting Zhejiang University students in the coming years.

### **Scope of Research and Academic Expectations**

By the end of the six-week program, each Zhejiang student will have completed their research project and will have designed a poster that they will share with College of ACES faculty and fellow students. Not only will the Zhejiang students acquire an international understanding of agribusiness, but ACES faculty also have a great opportunity to extend their international research collaborations. Each student will spend 25 to 30 hours per week working on a research project in the College of ACES. Past research areas have included evaluating herbicide combinations for corn and cucumbers, analyzing the Western Corn Rootworm rotation-resistant mechanism, looking at the effects of actigen on gene expression profile in pigs, international agricultural and conservation policies, grey water re-use system for the future, freshwater mussel conservation, and studying synthetic circuits for enzyme production. Zhejiang students can expect to participate in many hands-on experiments while developing a solid understanding of graduate school work in the United States.



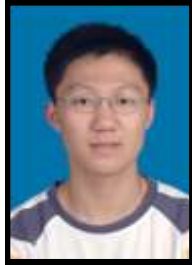
### **Campus Life and the American Culture**

Besides conducting research in their respective labs, Zhejiang students will have many exciting opportunities to explore and learn more about American culture and campus life at the University of Illinois. Students will reside at a private housing residence hall on campus and have access to the dining hall. In the 2010 program, Dr. Xinlei Wang, Professor of Agricultural and Biological Engineering, took students on a day-long field trip to Allerton Park and hosted a homemade barbeque at his home. Dr. K.C. Ting, Department Head and Professor of Agricultural and Biological Engineering, also served students lunch at the university with homemade desserts while answering questions about the college and career paths in agriculture. Some faculty took their students to states across the country to participate in research activities and conferences.



# Meet the Participants

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## Sun Li

**Major:** Agricultural Resources and Environmental Sciences

**GPA:** 3.8/4.0

**Rank:** 4/31

**Honors:** Second-class Academic Excellence Scholarship of Zhejiang University (2007-2008), Third-class Scholarship for Outstanding Students of Zhejiang University and Outstanding Student-cadre of Zhejiang University (2008-2009)

**Experiences:** Participated in the Student Research Training Program held by Zhejiang University and has two projects—one on the combination of plant nutrition and GIS, and the other on the discussion of the effects of an anonymous forum on college students.

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## Chen Pan

**Major:** Animal Science and Technology

**GPA:** 3.2/4.0

**Rank:** 7/31

**Education:** ACES Department of Animal Science, Zhejiang University

**Experiences:** Expression of Antibacterial Peptide by *Bacillus subtilis* - 12th Student Research Training Program of Zhejiang University. Molecular Improvement of Antibacterial Peptide *Apideacin* and Expression by *Bacillus subtilis*, 4th National Undergraduate Innovation Experiment Program

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## Chao Xu

**Education:** Department of Agriculture and Biotechnology Zhejiang University

**GPA:** 3.6/4.0

**Experiences:** Last summer, I organized a summer social practice team to conduct a survey on modern agriculture in Longquan, Zhejiang province. In the 4 days of practice, I visited many agricultural enterprises in Longquan and made sense of modern agriculture in southeast China.

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## Hu Yicheng

**Major:** Horticulture

**Education:** College of ACES University of Illinois,  
Zhejiang University

**GPA:** 3.6/4.0

**Rank:** 45/128

**Experiences:** Because of my SRTP, I am interested in conducting research on the carotenoid in loquat and learning more about it. Furthermore, UIUC has the advanced technology and reputed researchers in the USA, so I think I can improve my skills in performing experiments, and I can extend my scope of study in the field of horticulture.



## Dai Zhongming

**Major:** Agricultural Resource and Environmental Sciences

**GPA:** 3.8/4.0

**Rank:** 2/31

**Honors:** Zhejiang University Scholarship (2008-2009), Ping An Endeavourers Scholarship (2008-2009)

**Experiences:** For my research, I assessed the status of rural development in order to learn about modern agriculture and new rural construction and to realize the importance of ecological agriculture. I also participated in scientific research projects, such as Innovative Pilot Scheme for the State College Students, science and technology innovation project, Zhejiang University Students, and the Student Research Training Program.



## Hu Tao

**Major:** Plants Protection, Agriculture, and Biotechnology

**G.P.A.:** 3.9/4.0

**Rank:** 16/128

**Education:** Zhejiang University

**Honors:** Excellent Student in Zhejiang University (twice), Ziyuan Cheng Scholarship for Outstanding Merits

**Experience:** My research topic is on functional analysis of phosphorylation site in  $\beta$ C1 gene of DNA $\beta$  associated with tomato yellow leaf curl China virus.



## Liang Wu

**Major:** Agricultural Resources and Environmental Sciences

**GPA:** 3.7/4.0

**Rank:** 10/31

**Education:** Start Your Business Job Training Course at Zhejiang University, Chu Kechen Honors College at Zhejiang University, International Training Modular for Agribusiness Management

**Honors:** Awarded The Honor of Excellent Student at Zhejiang University, Scholarship for Outstanding Students of Zhejiang University

**Experiences:** Served as a member of the Operation Center of J&J Tomorrow Leader School, participated in the Student Research Training Program held by Zhejiang University and had two projects, participated in the Science and Technology Innovation Project for university students.

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## Yang Ning

**Major:** Agricultural Resource and Environmental Sciences

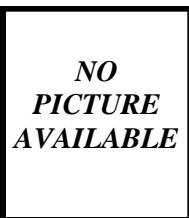
**GPA:** 3.9/4.0

**Rank:** 1/31

**Honors:** National Scholarship (2007-2008), First prize of Zhejiang University Scholarship (2008-2009), HSBC Scholarship

**Experiences:** Member of Prof. Ke Wang's GIS Lab at the Institute of Remote Sensing & Information System, Zhejiang University. Mainly focused on "Research based on GIS technology of tea plantation fertilization management system." New Shoot Talent Program, supported by the government of Zhejiang Province.

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## Yajun Zhang

**Major:** Horticulture

**Education:** College of Agriculture and Biotechnology, Zhejiang University

**GPA:** 4.3/5.0

**Rank:** 4/128

**Honors:** The Second-Class Scholarship of Outstanding Students at Zhejiang University

**Experiences:** School Innovation Competition – 'Challenge Cup' (09/2008-05/2009). Study of the classification of *Brassica alboglabra* Bailey. Student Research Training Program (05/2009-present).

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## Zhu Xinyu

**Major:** Agricultural Resources & Environment

**GPA:** 4.2/5.0

**Rank:** 2/31

**Honors:** ZJU Second-Class Scholarship for Outstanding Students (2008-2009), ZJU Second-Class Scholarship for Outstanding Merits

**Experiences:** Research Projects: The Research of Water Pollution Caused by Turtle Breeding and The Application of PLA Material in Slow-release Fertilizer



## Huiyuan Lou

**Major:** Applied Biological Science

**Minor:** Agribusiness Management Honors

**GPA:** 3.9/4.0

**Rank:** 1/128

**Honors:** National Scholarship (twice), Excellent Student, Zhejiang University (twice)

**Experiences:** Sept.2009 – presented “The Promotion of Lactoferrin Produced by Genetic Engineering.” Conducted this project in the seventh, "Dandelion" Student Business Plan Competition, Zhejiang University.

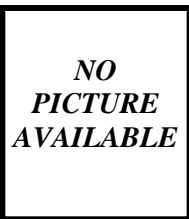


## Yingfang Du

**Major:** Animal Science

**Experiences:** May 2009 – September 2009: The expression differences of CPT-1 between native pigs and exotic breeds/ molecular biology lab of feed science institute of Zhejiang University

**Interests:** Molecular biology, animal nutrition and immunity, animal nutrition, and control of meat quality



## Yanqi Xu

**Major:** Animal Sciences, Veterinary Medicine

**GPA:** 3.8/4.0

**Education:** Zhejiang University, College Of Animal Science  
Zhejiang University, Chukechen Honors College

**Honors:** The “Three Goods” Student, Third-Class scholarship,  
Excellent Student scholarship

**Interests:** I love my major and hope to be an excellent specialist. So I want to go abroad and do postgraduate study to receive higher education after graduation. I want to do research on animal science.



## Lu Yu

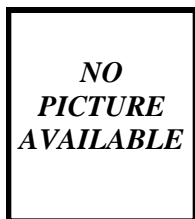
**Major:** Horticultural science

**Education:** ACES Department of Agriculture and Biotechnology  
Zhejiang University

**GPA:** 3.8/4.0

**Honors:** Awarded as an excellent student cadre (2008-2009),  
Receiver of the second-class peripheral scholarship of Northern City  
Daily (2008-2009)

**Experiences:** March 2009–May 2010: Phylogeographic Research  
on the Smilax Complex Based on cpDNA trnS-G sequence Function:  
Principal 2009 Practice in Institute of Genetics and Developmental  
Biology, Chinese Academy of Science, location: Beijing.



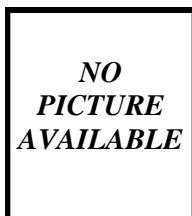
## Lin Xiaowen

**Education:** Zhejiang University (Undergraduate 2007–present)

**Major:** Environmental Engineering

**Minor:** MAM

**Interests:** Having participated in a research led by K. Yan with the  
national science fund about ESP on oxidation of concentrated  
ammonium sulfite with streamer plasma, I am now really intrigued by  
this area.



## Lu Xiao

**Major:** B.S. Agriculture and Biotechnology

**Education:** Zhejiang University

**GPA:** 3.8/4.0

**Rank:** 4/30

**Honors:** Second-Class Scholarship once and the Third twice; First-Class Scholarship twice and the Second Scholarship once

**Experience:** Took part in a plant field practice for a week in Mount Tianmu, Lin'an, China, recognizing and classifying the plant life (July 2009). Took part in the Students' Research Training Program in University. As an organizer, I worked on the breeding of genetically modified canola by the technology of gene gun (March 2009 to present).



## Xang Xuan

**Major:** Veterinary Medicine

**GPA:** 3.5

**Interests:** Animal nutrition and immunity as well as enzyme activation and inhibition. In the past year I have joined SRTP with the use of Soybean flavanoid.



## Chen Wenyuan

**Major:** Environmental Science

**GPA:** 3.7/4.0

**Rank:** 3/27

**Honors:** National Scholarship 2007-2008, Xin-Ping Scholarship 2008-2009

**Experiences:** Member of Prof. Baoliang Chen's Lab at the Institute of Environment Pollution Control Technology, Zhejiang University. Mainly focused on "Research on Adsorption Behavior of Organic Pollutants On Biochar" National Innovation Experiment Program for University Students, supported by Ministry of Education.

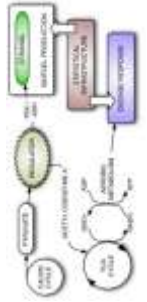
# Synthetic Circuit for Enzyme Production

Lu Yu Advisers: Sun Min Kim and Dr. Kaustubh Bhalerao

Department of Agricultural and Biological Engineering, College of Agricultural, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign

## Introduction

Pyruvate decarboxylase (PDC) and Alcohol dehydrogenases (ADH) are enzymes which play indispensable role in the ethanol fermentation industry. Consequently, producing large amounts of enzymes is of great significance.



In order to produce the larger yield of the enzymes, we engineered the fermentation pathways in E. coli and developed a modular positive feedback circuit that can function as a genetic signal amplifier, heightening the sensitivity to inducer signals as well as increasing maximum expression levels without the need for an external cofactor. The basic design for the amplifier consists of GFP and LuxRA can be simply explained as followed.



And we used gene of PDC and ADH to replace the gene of GFP so that we can figure out whether this amplifier can help increasing the output of the enzymes.

## Aim

Our experiment is one part of a large research program, which mainly aim at: Engineering E.coli for the optimal production of ethanol by modulating the biosynthesis of endogenous enzymes and introducing new enzymes into the targeted organisms.

There three aspects:

### Pathway engineering

Using different strategies to modulate the genes related to the enzymes producing and trying to increase the yield of the enzymes in order to raise the output of ethanol.

### Monitoring metabolic responses to engineered alterations

### System response through metabolic efficiency

Our experiment is a section of this part which is trying to figure out the system response through metabolic efficiency after developing a modular positive feedback circuit in E.coli.

## Method

### Culture of E. coli:

- We have four kind of E. coli named by the different plasmids inside, PDC68, PDC69, ADH68, ADH69.
- PDC68 and ADH68 are the plasmid with the a modular positive feedback circuit while PDC69 and ADH 69 without.
- Get a bit of E. coli freezer stock into 2mL Luria Broth(LB) which include 2µL chloramphenicol (cm34).
- Overnight culture for 12-16 hours at 37C with shaking.
- The overnight culture was diluted 1:100 into 50 ml of fresh LB and grown to an OD550 of 0.5.

### Extraction of PDC and ADH

- The E. coli cells in 50-ml liquid batch cultures were centrifuged (4,000, 20 min) and resuspended in 2 ml of PDC extraction buffer.
- Similarly, cells were resuspended in ADH extraction buffer.
- Sonicate 5-7times, 30s every time.
- Centrifugate the liquid (15,000, 20min) and get the supernatant liquid.

### Enzyme assay of PDC and ADH

Mix the supernatant liquid with the enzyme assay buffer and the rate of NADH + H<sup>+</sup> oxidation was measured at 340 nm.



I'm using the shaker to do the subculture.



E. coli subculture in the shaker for 12hours. Left side are ADH and right side is PDC.



The Absorbance Spectroscopy Used for measure the absorbance of 340nm which can reflect the concentration of NADH. We can figure out the amount of enzyme. For enzyme assay and kinetic measurement.



Ultracentrifuge 4 degrees centigrade, 4000rpm, 20min for first time. 4 degrees centigrade, 15,000rpm,20min for second time.

## Results

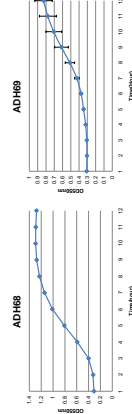
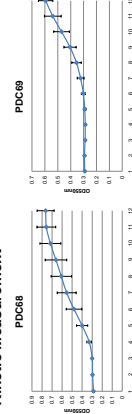
### Culture of E. coli

First time E.coli are subcultured for 6 hours and the OD value of each E.coli are as followed:

E. coli	OD	E.coli	OD
ADH 68	0.5501	ADH 68	0.7781
ADH 69	0.2136	ADH 69	0.2325
PDC 68	0.2651	PDC 68	0.2639
PDC 69	0.2196	PDC 69	0.1914

We can clearly see that the E.coli with the positive feed back grow more quicker than normal ones. And the E.coli with the ADH gene grow quicker than the PDC ones.

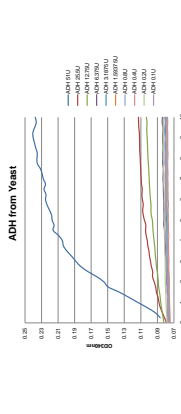
### Kinetic Measurement



From the diagrams we can see that PDC68 need nearly 6 hours to reach the OD 0.5; PDC 69 need nearly 10 hours to reach the OD 0.5; ADH 68 need nearly 4 hours to reach the OD 0.5; and ADH 69 need nearly 8 hours to reach OD 0.5. The results of kinetic measurement show that the time required for the subculture to reach OD 0.5.

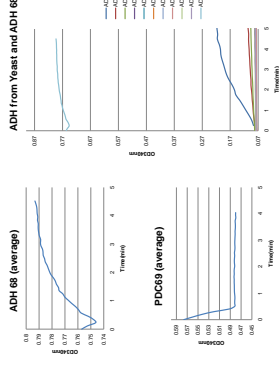
### Extraction and enzyme assay of PDC and ADH

1. The enzyme assay result of ADH from yeast



This diagram suggests that if the amount of ADH is larger than 6.375U, the curves of different amount of enzymes are in order. But if the enzyme is less than 6.375U, the curves are not in order as the amount. As the amount of enzymes added, the rate of NADH + H<sup>+</sup> oxidation increases.

2. The results of Enzyme assay for ADH and PDC in E.coli



(1) Enzyme assay results of ADH68, and PDC 69. The diagrams indicate that OD value of NADH in ADH enzyme assay is higher than PDC enzyme assay. Each ADH is higher than PDC. ADH for ADH68 E.coli cells increasing while yeast ADH is increasing from first. OD values of NADH in PDC69 enzyme assay decrease.

(2) Putting the results of ADH68 enzyme assay and yeast ADH enzyme assay together in a same diagram shows ADH for ADH68 E.coli cells increasing while yeast ADH is increasing from first. OD values of NADH in PDC69 enzyme assay decrease.

## Conclusions

- We have successfully extracted the PDC and ADH from the E. coli cells and got the results of enzyme assay for ADH 68 and PDC 69. However, we expected decreasing OD at first part of reaction which is not obvious from the enzyme assay of yeast ADH and E.coli ADH 68.
- One of our assumptions is that there may be decreasing part after mixing the buffer and the ADH, but the decreasing is too quick to be measured.
- We should find methods to short the time gap between mixing solutions and measurements.

## Acknowledgments

I really appreciate Professor Bhalerao's patient guidance and valuable advices. I'm grateful for the E.coli freezer stocks from Goutam Nistala and selfless help from Sun Min Kin. Thanks to Rekha Balachandran, Vaisak Parakkatt, Philip Poisson and all the members in Bhalerao's group.



# Preliminary Analysis of Western Corn Rootworm Rotation-Resistant Mechanism

Tao Hu, Yajun Zhang, Matias J. Curzi, Manfredo J. Seufferheld

Department of crop science, College of Agricultural, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign

## Introduction

The Western corn rootworm (WCR), *Diatraea virgifera virgifera* LeConte, brings about a huge annual yield losses and treatment costs of maize in North America. The larvae feed almost on the corn roots with destroying significant percentage of corn if left untreated. Since the farmers' laying of eggs as well as the larvae' development has strong fidelity to maize field, the annual crop rotation become an ideal approach to control the insect population. Considering the resistance and expense, crop rotation, especially the rotation with soybean, has more advantages than soil-applied or foliar insecticides application and the Bt technology. Soybean defenses against herbivory include protease inhibitors, which function in inhibiting the activity of coleopteran digestive proteases, decreasing insect survival.

However, a rotation-resistant variant of WCR (v-WCR) emerges in east-central Illinois after the selection for a WCR population with the large-scale adoption of crop rotation (80%) in the state from mid 1990s. The v-WCR demonstrates less fidelity to maize fields. As a result, oviposition of the v-WCR in non-maize field leads to the damage to maize field in the following year. Now the population keeps spreading in the American Corn Belt. We try to study the mechanism of this rotation-resistant system.

## Aim

It is v-WCR's greater tolerance of short-term dietary heterogeneity that makes it possible for females to lay eggs in the soybean fields. Combining the reported evidence with former experiment results suggests the hypothesis: there may be some changes in both insects' digestive protease activity and microbiota diversity. It can also help to explain the relationship between insect, bacterium, plant and environment.



We focus on:

- study different populations of the insects, compare the difference between v-WCR and wt-WCR
- reveal the diversity of bacteria from the insect guts.
- Evaluate the effect of environment, including the soil, humidity, on v-WCR and wt-WCR survival.

## Method

### 1. WCR Sampling

Collect three populations each of v-WCR and wild type WCR. The v-WCR is collected at: a) Champaign, IL, Minook, IL and Dakota, IL; all are locations where v-WCR presence is established. Samples of wt-WCR will be collected in: a) the Ames, Iowa area, b) northwestern Missouri, and c) near Lincoln, Nebraska. These regions have not yet experienced rotation resistance problems.



Figure 1. Locations for sampling v-WCR and wt-WCR

### 2. Gut microbiota diversity

The highly conserved 16S rRNA gene between different species of bacteria is used for bacterial identification studies.

Preliminary work:

- Isolation of Bacterial in the insect gut
- DNA extraction
- Current work:
  - PCR of 16S rRNA gene
  - Sequencing the products after purification
  - Blast on NCBI



### 3. Survival test

Survival test of different diet-soil-population treatment, will establish a functional correlation for the activity, feeding variety and bacterial community in soil.



This experiment was conducted in the growth chamber at 28°C, 14L:10D.

## Results

### 1. Bacterial identification

Insect population	Species
Brookings, non-dispersive	Staphylococcus aureus Enterobacter aerogenes Serratia marcescens Klebsiella pneumoniae
Champaign, Illinois	Acinetobacter calcoaceticus Staphylococcus aureus Pseudomonas fluorescens Serratia marcescens
Concord, Nebraska	Staphylococcus aureus Enterobacter aerogenes
Ames, Iowa	Staphylococcus aureus Acinetobacter calcoaceticus Serratia marcescens Klebsiella oxytoca

### 2. Survival test

Test I

WCR Survival Test



Figure 2. Percentage survival of insects with different 7 days maize diet reared on soybean diet for 7 days in which are non-transport corn, 10 transport corn and Roundup Ready transport corn.



Figure 3. The death situation after the diet change when maize diet.

Test II

WCR Survival Test

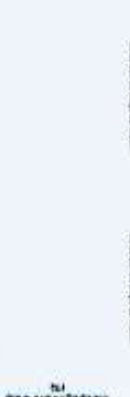


Figure 4. Percentage survival of insects with different 7 days maize diet reared on soybean diet for 7 days in which are non-transport corn, 10 transport corn and Roundup Ready transport corn.

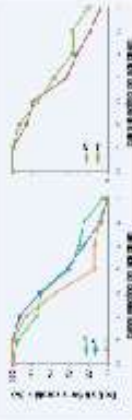


Figure 5. Percentage survival of 3 different v-WCR populations reared on soybean diet for 7 days, which are Champaign, Dakota and Ames. Each population has 5 treatments by adjusting the factors of humidity and soil beside the soybean plants. They are no soil (N), dry soil (D), humid soil (H), autoclaved dry soil (AD) and autoclaved humid soil (AH).

## Conclusions

Identification of some Bacteria species in WCR's guts of different populations has been accomplished. The work of 16S rRNA PCR still need to be continued in order to detect the difference of gut microbiota composition between v-WCR and wt-WCR.

The charts show that maize diet, humidity and bacteria play significant role in helping the insects' survival on soybean to some extent. However, the statistic data of survival tests do not reveal the significant difference between different treatments. It might be influenced by some other parts of the survival test itself, including the variable experiment conditions, improper method and objective flaws.

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## Acknowledgments



United States Department of Agriculture  
National Institute of Food and Agriculture



# Growing Microalgae in the Wastewater

Huiyuan Lou,

Department of Agricultural and Biological Engineering, College of Agricultural, Consumer, and Environmental Science, University of Illinois at Urbana-Champaign

## Introduction

### What is algae

Algae are recognized as one of the oldest life-forms. They are primitive plants. Algae structure are primarily for energy conversion without any development beyond cells, and their simple development allows them to adapt to prevailing environmental conditions and prosper in the long term.

### Potential roles of microalgae

- Microalgae is a way to produce biofuel, many species have oil content in the range of 20-50% dry weight of biomass. Microalgae-derived biofuel could progressively substitute a significant proportion of the fossil fuels required to meet the growing energy demand.
- Microalgae have a rapid growth potential and the exponential growth rates can double their biomass in periods as short as 3.5h.
- With respect to air quality maintenance and improvement, microalgae biomass production can effect bio-fixation of waste CO<sub>2</sub>.
- Nutrient for microalgae cultivation can be obtained from wastewater, so it provides a new way for wastewater treatment at the same time.
- Microalgae can also produce valuable co-products such as proteins and residual biomass after oil extraction, which may be used as feed and fertilizer.

The research on algae has become intensive due to its defined combination of potential biofuel production, CO<sub>2</sub> fixation, biohydrogen production, and bio-treatment of wastewater.

## Aim

In this project, we focus on :

- Separating microalgae from wastewater.
- Wastewater analysis, such as PH, salinity, the content of nitrogen, phosphorus, metal and so on.
- Studying the specific traits of the dominant microalgae species, such as species morphology, whether it is aerobic or anaerobic.
- Finding out which species of microalgae grow well in the wastewater which comes from Urbana & Champaign Sanitary District.
- Changing the growth condition to find out how to enhance the biomass production of microalgae.
- Selecting several microalgae species which perform well in wastewater treatment and biomass production improve their useful trait through some biological method such as mutation.

## Method

### Material

- Wastewater from Urbana & Champaign Sanitary District, in which various microalgae grow.
- Culture mediums such as f/2, BBM.

### Equipment

Microscope, test tube, centrifuge, filter, culture room with constant temperature and light, etc.

### Technology

- Utilize different kinds of culture medium (liquid, solid) to culture microalgae.
- Observe microalgae through microscope, to study the algae morphology.
- Use a spectrophotometer to determine OD value, to make records of its growing density, to draw the algae growth curve.
- Use the approach of automated rRNA intergenic spacer analysis (ARISA) to determine microbial diversity of the algae we have cultured (haven't done).



Fig.1 One of the sites of Champaign Sanitary District, to get several liters of wastewater.



Fig.2 One of the sites in which we do research.

## Preliminary Results

Several species of microalgae have been isolated. We got *Chlorella*, *Ulvaria*, *Chlorella*, *Polysiphonia*, *Scenedesmus* in the first round of cultivation in the liquid medium. Furthermore, we purified them and got a bigger amount in the solid medium. We got the pictures of the separated microalgae species.

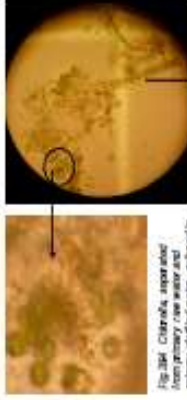


Fig.3a1 *Chlorella*, separated from primary raw water and primary clarified water, cultured in f/2 medium and BBM medium. Fig.3a is a larger one.

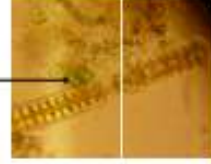


Fig.5 *Polysiphonia*, separated from primary raw water and primary clarified water, cultured in f/2 medium and BBM medium.



Fig. 67.3 *Chlorella* is separated from algae in the wastewater cultured in the f/2 medium. The black circle is an enlarged one.

## Discuss & Conclusions

We have successfully isolated the microalgae species that we expect to get like *Chlorella* and *Scenedesmus*, except the *Scenedesmus*.

We saw *Scenedesmus* through the microscope at the first time. However, when we cultured the algae in the specific medium, *Scenedesmus* could not be seen later on. Maybe it was caused by the following reasons:

- 1) It may be eaten by the plankton in the wastewater, we can see clearly that many planktons exist in the wastewater through microscope.
- 2) The medium is not suitable for *Scenedesmus* to grow.
- 3) Maybe *Scenedesmus* is not competitive enough compared to other species.

## Future work

After separating the useful microalgae species successfully, we will focus on:

- Make a big amount of every species through a period of cultivation;
- Finding out the better growth condition for the algae to play the potential roles as stated before;
- Finding out the specific trait that can be utilized by human;
- Changing some traits into better ones through biological methods;
- Designing several system in which algae grow well and do good wastewater treatment, biofuel production and other biomass production as a whole.

## Acknowledgments

- I really appreciate the help of Professor Schödlbauer, I really thank him for valuable comments.
- I would like to thank Professor Wang and C.T.Kuo for great guidance in the process of research.
- I also grateful to Professor Wang for giving me the chance to study in the ABE.

ILLINOIS





# Freshwater mussel Conservation and sampling adequacy assessment

Dai, Zhongmin & Yang, Ning

Department of Natural Resources and Environmental Sciences, ACES, University of Illinois at Urbana-Champaign

## Introduction

Freshwater mussels are long-lived sedentary, filter-feeding bivalves. Their jar-like shells normally host on fish for metamorphosis and dispersion. This group of animals performs important ecosystem functions, e.g., transferring nutrients and energy from the water column to the sediment, and linking plankton and other microorganisms to predators. Historically, they also provided human an important protein source. Because of their sensitive to sedimentation and other stresses, freshwater mussels are also used as biotic indicators in stream assessments. Approximately 1000 mussel species have been recorded in freshwaters across the world with about 300 living in North America. Once abundant, they have declined greatly, with 48% of species in US imported because of habitat and water quality degradation.



## Aim

Effective resource management and conservation require reliable sampling data. However, mussel sampling protocols have not been well developed and tested. In the present study, we aim at:

- 1) Understanding mussel distribution across the IL states.
- 2) Assessing the sampling adequacy
- 3) Estimating the detectability of rare species and endangered species for freshwater mussel conservation



## Method

- ◆ **Study Area**  
Eighteen sites that differed widely in watershed size, channel width, substrate composition, and historic richness, located in 6 major watersheds in Illinois were sampled in summer 2009 and 2010.



## ◆ Sites table

WATERSHED	LAND	LENGTH	WATERSHED	NEW_FUNC	COUNTY
18C3-01	6.400E	91.77E	Peoria/Champaign River	Forest/Urban/Champaign	Champaign
18E-01	6.440E	68.63E	Wabash River	Urban/Forest	Macon
18D1-01	6.420E	61.29E	Northwest River	Urban/Forest	Woodford

## ◆ Samplings

We sampled each of the 3 sites with the effort of 16 man-hours in a reach of around 200m. All five mussels found in hand search were identified to species. We also recorded stream characteristics, including substrate type, water depth/width, water temperature and clarity.



- Sampling:
1. 8 collectors
  2. 16 man-hours at each site
  3. Pile mussels for each man-hour
  4. 10-15 Measure individuals
  5. Record site specific variables

## ◆ Estimation of Richness

To account for possible missing species, we estimated the total richness using the Chao1 method

Calculations:  
 $S_{obs} = S_{obs} + C_1^2 / (2 * C_2)$   
 $= S_{obs} + C_1 * (C_1 - 1) / (2 * C_2 + 1)$  if  $C_2 = 0$   
 D1: No. of species that have one individual in the samples (singletons)  
 D2: No. of species that have two individuals in the samples (doubletons)

## Results

### 1) Mussel assemblage

- Richness (number of species)



- Abundance (number of individuals in every species)
- Length (shell length)

### 2) Sampling sufficiency

n4: Number of species found in the first four man-hours  
 $S_{obs}$ : Observed richness  
 $S_{est}$ : Chao 1 Estimated richness  
 m: Number of missing species  
 SS: Sampling sufficiency =  $n4 / S_{est}$

Site	n4	m	Species richness	Chao1-estimated richness	Sampling sufficiency
18C3-01	9	13	13	13.2	0.9
18E-01	9	18	18	18	0.9
18D1-01	7	7	7	7.4	0.9

### 3) Endanger species



#### Endanger species:

Potamiscus capax (Green, 1892)

- ✓ Other common names: Potters caper, grandmaw
- ✓ Key characters: A rounded, greatly inflated shell, thin to moderately thick, S-shaped hinge line, tan or light brown, rays/axes and shiny.

✓ Habitat: Large rivers in slow-flowing water in mud or sand

✓ Status: Federally Endangered

✓ Length: 4.0 inches

✓ Distribution:



## Conclusions

- In the different rivers and living environment, the species richness of Mussels varies greatly, which depends on the substrate composition, mobility, nutrients content and many other factors of the river.
- According to the data we got from sampling work, we find that the number of species found in the first 4 man-hours are more than half of that found in the whole 16 man-hours. As we spend more time in searching the mussels, the increase of species will become slower and the number of mussel species will be more stable. It shows the extent of increase.
- Although the whole field sampling group, including 8 collectors, spends 16 man-hours at each site, there are still some missing species. So we use the Chao1 method to account for possible missing species, and estimate the total richness with it. It's efficient and comparatively accurate.



## Acknowledgments

We would like to express our gratitude to Dr. Cao Yong, his research assistant Huang Jian and some other INHIS members, for providing us such a precious opportunity to experience the field sampling work and their research analysis. We really learn much from it and enjoy the work in natural environment.

A very special thanks goes out to Dr. Wang Xinhai and his assistant Lin Tao, for the preparation and arrangement they worked on of the whole Exchange Program and the various kinds of help they offered to us. We really enjoy the time in UIUC and have an unforgettable experience.



# Effects of Actigen on Gene Expression Profile in Pigs

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ILLINOIS

## Background

Different products extracted from yeast cell walls may have different proportions of carbohydrates which may affect the responses of immune cells differently. Actigen mainly contains mannan and  $\beta$ -glucan. Evaluation of the effects of Actigen on immune cells/system focuses on the following 3 important issues.

1. Interaction of constitutive carbohydrate components of Actigen with pattern recognition receptors (PRR) of immune cells
2. Immune responses induced by ligand-receptor binding
3. Actigen-mediated responses to different stimulants in vitro and in vivo

## Objective

To determine PRR gene expression of peripheral blood mononuclear cells (PBMC) and bronchoalveolar lavage cells (BALC) in response to different levels of Actigen in vitro and ex vivo

## Experiments

Exp. 1: PRR gene expression of PBMC and BALC in response to different levels of Actigen

Procedures:

1. Isolate PBMC and BALC from donor pigs (at about 5-6 weeks old).
2. Cells (seeded overnight in triplicate, in 24-well culture plates,  $1 \times 10^6$  cells/well) was washed and stimulated with 6 different levels of Actigen (from 0 to 5 mg/mL) and incubated for additional 24-h
3. Total RNA of cells was extracted by a commercial extraction kit. Total RNA was then converted to cDNA which was analyzed by qRT-PCR.

Table 1: Effects of different levels of Actigen on mRNA expression of receptor and transcriptional factor

	PBMC	Actigen level (mg/mL)					
	300ug/mL	0	1	2	3	4	5
MR							
TLR4							
Dectin-1							
NFKB							

Exp. 2: Effects of dietary Actigen on the expression of receptors in PBMC & BALC challenged in vitro with LPS or Poly I:C.

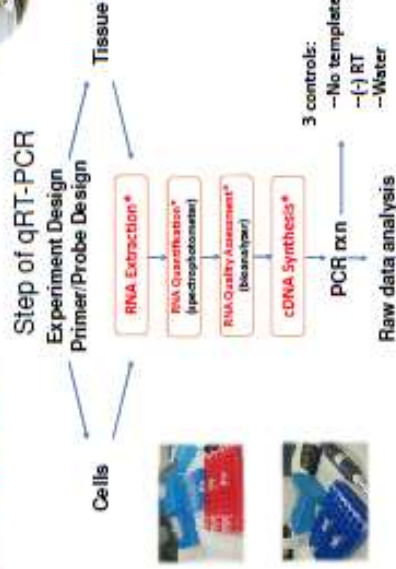
Procedures:

1. Isolation of PBMC and BALC.
2. Cells from control- or Actigen-fed pigs were seeded in triplicate in 24-well culture plates and allowed to adhere to the plates overnight. After that, cells were washed and stimulated with medium, LPS, or Poly I:C, followed by 24-h incubation.
3. Following supernatant collection total RNA was extracted by a commercial extraction kit. Total RNA was then converted to cDNA which was analyzed by qRT-PCR. Expression of MR, TLR3, TLR4, Dectin-1, MHCII, and NFKB genes was measured.

Table 2: Effects of dietary Actigen on gene expression of pattern recognition receptors, MHCII, and NFKB in response to different stimulants in vitro

	Undistimulated	LPS	Poly I:C	
	Control	Actigen	Control	Actigen
Receptor	MR, TLR3, TLR4, Dectin-1			
MHCII				
NFKB				

## Lab activities



\*The red words indicate the work that we have done in ASL

## RNA quality & quantity assessment

- Spectrophotometer using Nanodrop
- Unit: ng  $\mu$ L
- 260/230 ratio - Organic chemicals and solvent contamination
- Above 1.5
- 260/280 ratio - Protein contamination
- 1.8 to 2.1

Sample ID	ng $\mu$ L	260/280	260/230
1	153.58	2.07	1.85
2	148.81	2.02	2.08
3	188.73	2.04	2.19
4	193.69	2.05	1.67
5	285.12	2.04	2.22
6	96.19	2.07	1.90

-Bioanalyzer

- RNA integrity number 27.0



## Acknowledgments

We're greatly grateful to:

- Dr. Che for his thoughtful instruction and guidance to our lab work and preparation of this poster
- Jody Barnes for her supporting and teaching us laboratory skills
- Dr. Pettigrew for giving us an opportunity to learn new knowledge and strengthen our technical skills
- Other lab members for their helpfulness

# Chinese Agriculture and Conservation Policy

Presenter: Chao XU

Department of Agricultural and Consumer Economics, College of Agriculture, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign

## Introduction

My work with Prof. Kathy Baylis this summer started on July 19<sup>th</sup>. I concentrated on China's policies about many aspects of agriculture, peasants and the environment. The work can be divided into two parts.

The first policy I reviewed is China's SCLP. I researched the details of the SCLP and reviewed studies that analyzed the program. My primary task was collecting information on SCLP from different articles and websites.

### What is the Stopping Land Conversion Program (SLCP)?

The SLCP, also called "Grain for green program", is a huge program of the Chinese government and has been in place for more than 20 years. In recent years, especially after the Yangtze River's big flood in 1998, the government recognized the significance of conservation of soil, plants and the environment. Until the end of 2006, China has 24 million hectares assigned to the SLCP, in which 9 million hectares was for reforestation, 14 million hectares was for waste mountains and land suitable for tree planting and 1 million hectares was to facilitate afforestation. The total funding of this program was almost 130 billion yuan (RMB) so far.



This is a photo in Google from the Baylis

Here is a photo of photos from the Baylis



The other part of my work is a collection and review of China's agricultural policies, including land policies, food security and safety, urbanization, social security and so on. This may help Prof. Baylis in her courses to undergraduate students in UIUC. Most of my work was on current agricultural subsidies, both their details and issues. In researching the background of these policies, I utilized my notes from my agricultural policy course last term in Zhejiang University, along with sources from the UIUC library and websites.

## Aim

- To have a better understanding on China's SCLP, and find as much information as possible into a review.
- Collecting materials, discussions and suggestions of different scholars and articles, whatever they were talking about and the results, just make a collection on this topic.
- Learn how to utilize sources, a library and any other useful tools with my work in UIUC.
- Experience the research environment and atmosphere in UIUC, and equip myself with new abilities before I go back to Zhejiang University.

## Method

### Literature Review:

I read and summarized published articles in Chinese and English on Chinese agriculture and conservation policy. Tools and contents are as follows:

- E-mail: UIUC's email server ([expirites@uiuc.edu](mailto:expirites@uiuc.edu)).
- Library: ACES library and information center
- Search engine: Academic Search Premier, Web of Sciences, Google Scholar and so on.

### Where do I work and study?—My "lab"

The most constant places I went and study were Prof. Baylis's office in Mumford Building and the ACES library. I regarded them as my "lab" here. Generally, I would talk and discuss on my work and questions with Prof. Baylis every afternoon, and she would give me some comments or suggestions to make my work better.



This is in Prof. Baylis's office in Mumford Building. I'm really appreciated that I can work and study with professor in the summer of 2010.



This is the UIUC's e-library website, which is the most regular place I searched articles I need. It's really useful.

## Results

What have I done?—Two background papers and literature reviews.

During the 5 weeks in this summer, I have completed two reviews and several little summaries on different topics. Most of them are about the China's SCLP and Chinese agricultural policies in recent years.

### SLCP

One of the papers I wrote is "Information and background of SCLP in China". This is a 7-page review on one part of my work. I spent almost two weeks researching the background of this program and writing the summary document. The essay concentrates on the general background and details about SCLP in China, such as when it started, how much it cost, details of the policies along with the feeling of peasants in different places of China. I end with making some suitable suggestions for the future of the SCLP. This topic is very interesting. Other than some general ideas of SCLP, I was as well attracted into issues, or problems that appeared during the process of SCLP. I found that many peasants were not so satisfied with what governments had done to them. They want to be richer and live a happy life. However, if they plant trees like pine, they may not gain as many subsidies as they expected because of the many years the land remains out of agricultural production. Thus, peasants do not have sufficient incentives to participate, and maybe the government should endeavor more on this aspect in the following years.



A picture near Hangzhou from the Baylis

Here is information and the background of SCLP in China. The background and details about SCLP are in the following pages. I hope you can find some interesting information about SCLP.

The background of SCLP in China

(1/7)

The background of SCLP in China

Page	Content
1	Background of SCLP in China
2	Background of SCLP in China
3	Background of SCLP in China
4	Background of SCLP in China
5	Background of SCLP in China
6	Background of SCLP in China
7	Background of SCLP in China

From a library and Google scholar. You find many useful articles, both in Chinese and English. Finding English papers seems a challenge to me. But I enjoy the process, indeed.

## Chinese Agricultural Policies

Another review I wrote is "China's Agriculture Policies—Details and Issues". This is the other main topic I studied and worked in this summer. I used to deem it easy to understand, until I read several articles and realized its complication. So I had to dissect it into several topics and analyze each topic one by one. These topics include:

- Land policy
- Food safety and security
- Urbanization
- Social security
- Rural produce and market policy
- College graduate works as village officials



China's agricultural policies—some aspects in detail

## Conclusions

China invests a great deal of money and labor into the foundation and improvement of new agriculture.

### SLCP

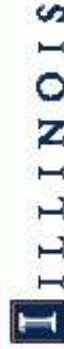
Farmers appear to be uncertain about whether this program truly helps them. First, farmers question whether the funding offsets their lost agricultural income, and second, the planting of a single tree species may make the new forest susceptible to pests or disease.

### Chinese Agricultural Policy

While on paper it appears as if there are many subsidies going to agriculture, it is not clear how much farmers are benefiting from these programs. Food safety and security, land policy, rural social security and other issues are still perplexing Chinese government.

## Acknowledgments

It's my great honor to study and work with Prof. Baylis in this hot summer. She helped me so much and taught me how to analyze and think in my own mind. Of course, I should appreciate Teresa Miller, Prof. Wang Xiaoli and Tao Lin, who helped me so much to come to UIUC and gave me a chance to study here. Thanks to UIUC. Thanks to Zhejiang University. Thanks to you all!



ILLINOIS

# Development of Procedure to Stain Boar Sperm with a Fluorescent Phospholipid Dye

Yangqi Xu

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## Introduction

A large number of assays have been developed and adopted for assessing semen quality. Invariably, at least three core parameters are evaluated:

- (1) Sperm concentration and total sperm in the ejaculate. Total sperm is determined by multiplying concentration by ejaculate volume.
- (2) Sperm motility is usually assumed to be the percentage of sperm that are progressively motile. A progressively motile sperm swims briskly forward in a relatively straight line, as opposed to moving in circles.
- (3) Sperm morphology. The best samples of semen invariably contain some sperm that have abnormal structure, such as bent tails or misshapen heads. To obtain a standard measure of sperm morphology, the percentage of sperm with normal shape and size is determined.

DiOC<sub>16</sub>(3) is a lipophilic cyanine dye with two C16 hydrocarbon chains. It can be optimally excited by the 488 nm argon laser line with green fluorescence emission (ex/em = 484/501 nm). The dye can be used to stain cytoplasmic membranes. The staining pattern may reflect sperm maturation status.

## Materials and Methods (cont.)

Check the sperm microscopically

- (1) estimate the motility using normal light
- (2) photograph the sperm using normal light
- (3) take a photo of the same field as #2, but in fluorescence optics
- (4) calculate the percentage of fluorescent sperm



The major common reason of deteriorating sperm concentration is to empty the sperm under a microscope with the aid of a hemacytometer. A hemacytometer is a glass slide with a grid structure and has been utilized.

The centrifuge is able to separate sperm from the sedimentation principle. It is used to separate sperm from the sedimentation principle. It is used to separate sperm from the sedimentation principle.



## Before staining the sperm

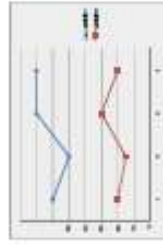


Figure 1. The live rate of sperm's motility is about 70% the next day is about 20%. Motility is almost equally motile. It seems to be dropping the second day. Maybe some backs in the same. Also some sperm will die normally the next day.



Figure 2. The concentration after staining is about 100-200 million. The concentration was adjusted so that the same for each experiment.

## After staining the sperm

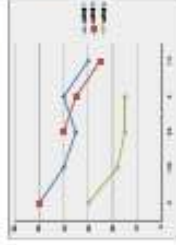


Figure 3. A concentration of DiOC16 (5ul) can wash a high percentage of the sperm without affecting motility. If the dye concentration is too high, motility decreases.

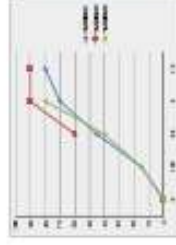


Figure 4. A higher percentage of sperm are stained by a higher concentration of dye. The concentration of dye (17.5ul) gives the highest percentage of fluorescent sperm. A lower concentration (5ul) was almost the same. But the higher concentration gave higher background staining.

## Results

### Sperm morphology

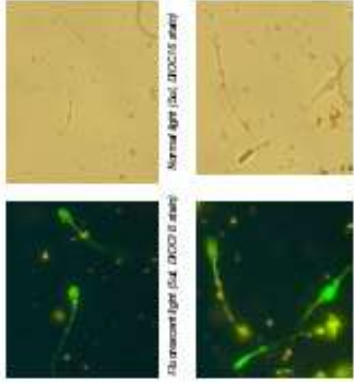


## Aim

To define conditions that are optimal for staining porcine sperm with the phospholipid analogue dye DiOC<sub>16</sub>.

## Methods

1. In a 15 ml conical tube mix: 0.6ml of 10 X HBS + 5.4ml Percoll + 4ml dmTALP
2. Add semen to the top of the mix
3. Spin (bench top centrifuge) for 10 min, speed 5
4. Aspirate supernatant and wash pellet
5. Spin for 5 min, speed 3. Aspirate supernatant
6. Add in 1 ml of dmTALP. Check motility under a microscope
7. Check sperm concentration by hemacytometer
8. Get 3 tubes. Add 5 million sperm in 0.2 ml TALP + either 2.5, 5 or 7.5 ul DiOC<sub>16</sub> (3)
9. Incubate for 1h at 39°C.
10. Observe under microscope.



Fluorescence light (7.5ul DiOC16 assay)

Normal light (7.5ul DiOC16 assay)

## Conclusions

1. 5ul of DiOC<sub>16</sub> is the optimal concentration (stains a high percentage of the sperm without affecting motility).
2. Concentrations higher than 5 ul give more background staining and reduce motility.

## Acknowledgments

Thank you to David Miller, Kadirvel Govindasamy, Sergio Machado and Syed Tahir Abbas Shah for help with the research project and to Zhaifang University and the University of Illinois College of ACES for their generous support of this opportunity.

ILLINOIS

# Grey water reuse system for the future

Xiaowen Lin, Solar Decathlon Team

Department of Agricultural and Biological Engineering, College of Agricultural, Consumer and Environmental Science, University of Illinois at Urbana-Champaign

## Introduction

**Definition:** Gray water is defined as the urban wastewater that includes water from baths, showers, hand basins, washing machines, dishwashers and kitchen sinks, but excludes streams from toilets and garbage disposal in our case.

Reasons for reuse: on-site

Big quantity:

Gray water constitutes 50-80% of the total household wastewater. And the typical gray water production is as high as 200 liters per person per day in USA, which is the highest figure in the world.

Useful & economic:

1. Unrestricted reuse: Ornamental fountains; recreational impoundments, lakes and ponds for swimming, toilet flushing; laundry, air conditioning, process water; **landscape irrigation**; fire protection.
2. Restricted reuse: Lakes and ponds for recreational without body contact, landscape irrigation, where public access is infrequent and controlled, subsurface irrigation.

**The price of water is increasing**-in some places dramatically-throughout the world. Over the past five years, municipal rates have risen by an average of 27% in the U.S., 32% in the United Kingdom, 45% in Australia, 50% in South Africa, and 58% in Canada. Treat on-site saves the cost in pipe system, and can be cost effective with proper operation presenting no hygienic risk or comfort loss for the consumer. Such a character fits the subject of Solar Decathlon Competition so well that adopting this system in it will be beneficial.

## Aim

**Regulations and guidelines:** It is limited to irrigation only, in this competition, which means the reclaimed water should fit the rules of unrestricted water or food crop irrigation.

**Federal:** No federal regulations directly governing water reuse practices in the U.S. They are developed by many individual states.

**Illinois:** In non-food crops, unrestricted urban reuse, there is no detailed pollutants limit in Illinois.

**What standard shall we take:** Given our system is for the future and maybe the prototype of water reuse system in Illinois, I prefer a relatively strict standard. But we can check the limit of the technology we adopt before we decide BOD < 10 mg/L, turbidity < 2 NTU and a non-detectable level of faecal coliforms, 100ml<sup>-1</sup>. It is a sensible conservative level and will be used as the main performance criteria throughout this report.

## Method

### Feed water quality & method

According to a WHO reuse guideline, the water load is medium strength. For this kind of water, there is an almost uniform opinion-MBR is the choice, which is also supported by many experiments.

### 1. MBR, the core process

What is MBR: Figure 2

Choose configurations  
Principal configurations of MBR technologies are shown in Figure 1. The first step to design an MBR is to settle these configurations.

### 1.1 Membrane process mode

There are three membrane process modes: conventional biomass rejection MBRs, extractive (eMBR) and diffusive (dMBR), which employ a membrane for a purpose other than to separate the biomass from the treated water. Conventional biomass rejection MBRs fit our condition.

### 1.2 Membrane configuration

A membrane as applied to water and wastewater treatment is simply a material that allows some physical or chemical components to pass more readily through it than others.

The configuration of the membrane, that is, its geometry and the way it is mounted and oriented in relation to the flow of water, is crucial in determining the overall process performance.

There are six principal configurations currently employed in membrane processes (Table 1), which all have various practical benefits and limitations. Flat-and-frame / flat-sheet (FS), hollow fibre (HF) and (multitubular (MT) are suited to MBR technologies. (Table 1)  
HF is capable to finish the work, reduce fouling well and be inexpensive.

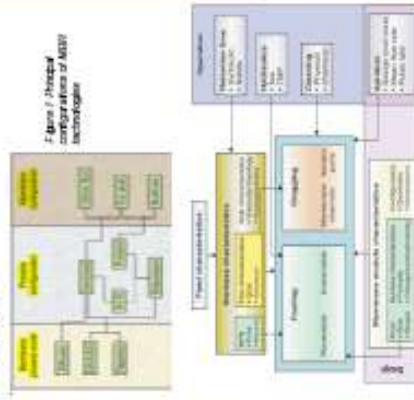


Figure 2 Composition and operation in an MBR

## Method

### 1.3 Process configuration

There are two kinds of process configurations: conventional pressure-driven membrane processes with liquid permeation can operate in one of two modes. If there is no retentate stream then operation is termed "dead-end" or "full-flow"; if retentate continuously flows from the module outlet then the operation is termed crossflow.

MBR are generally less energy-intensive and more compact than sMBR, which makes it suits our situation better.

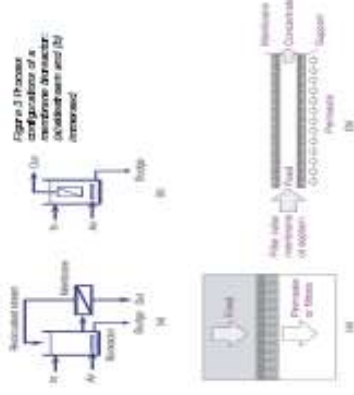
### 2. Scheme design (Figure 3)

**Pre-treatment:** It is generally recognized that the screening can **kill** the work. Whilst an MBR can effectively displace primary sedimentation, pretreatment and secondary solid-liquid separation, as well as tertiary effluent polishing, classical screens of around 6 mm rating are normally insufficient for an MBR. We choose 2mm screen.

**Disinfection:** The use of chemical disinfectants (e.g., chlorine compounds) in gray water systems should be avoided since treated gray water can be satisfactorily disinfected with a UV dose ranging between 200 and 400 J m<sup>-2</sup>.  
So the scheme is screening + MBR +UV

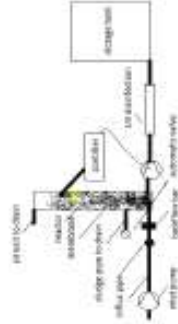
Table 1 There are six principal configurations currently employed in membrane processes, which all have various practical benefits and limitations. Flat-and-frame / flat-sheet (FS), hollow fibre (HF) and multitubular (MT) are suited to MBR technologies.

Configuration	Typical Applications	Advantages	Disadvantages
Flat-and-frame / flat-sheet (FS)	Wastewater treatment, drinking water production	Simple design, easy to install and maintain	High fouling rate, low fouling rate
Hollow fibre (HF)	Wastewater treatment, drinking water production	High fouling rate, low fouling rate	High fouling rate, low fouling rate
Multitubular (MT)	Wastewater treatment, drinking water production	High fouling rate, low fouling rate	High fouling rate, low fouling rate



## General procedure

1. Gray water goes through a dual pipe system and get the inlet pipe.
2. Inlet pump push the water through the screen, and small particle and hair are barred.
3. In the reactor, activated sludge absorb and digest the pollutants.
4. Clear water goes through the tiny hole in the membrane, and then disinfected by the UV.
5. Stored in the tank.



## Control & Maintain & Special

**Controller:** It handles the backwashing and water level.

### Maintain:

1. Air scour
2. backwashing: physical and chemical

### Detail & Cost

**Reactor:** Height=1.4m, diameter=0.45m  
**Membrane:** HCMICOM8 IF-82-95-PMC Hollow Fiber Cartridge, KOCH  
**Without OPEX and depreciation,** it takes 0.01\$ per cubic water, while tap water is 0.66\$ per cubic.

## Acknowledgments (alphabetical)

Huiyuan Lou, Lianco Schideman, Peng Li, Tao Lin, Theresa Miller, Xianlai Wang, Zhiping Wang

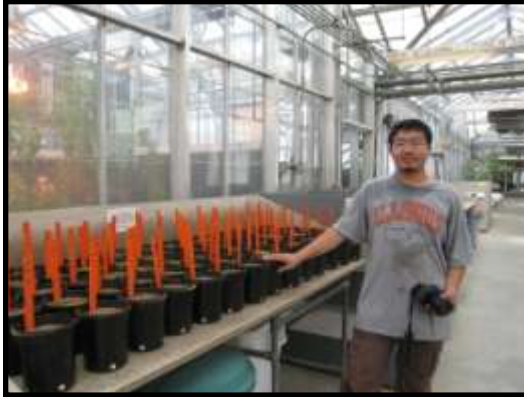


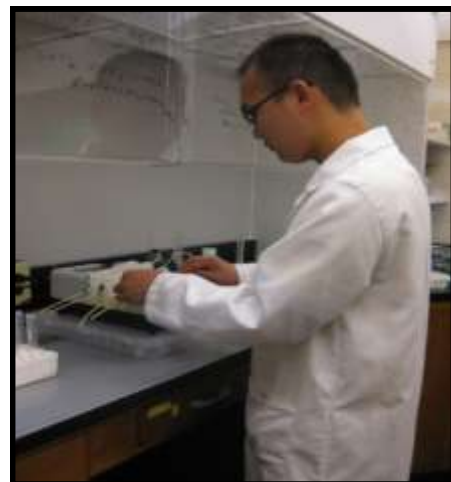
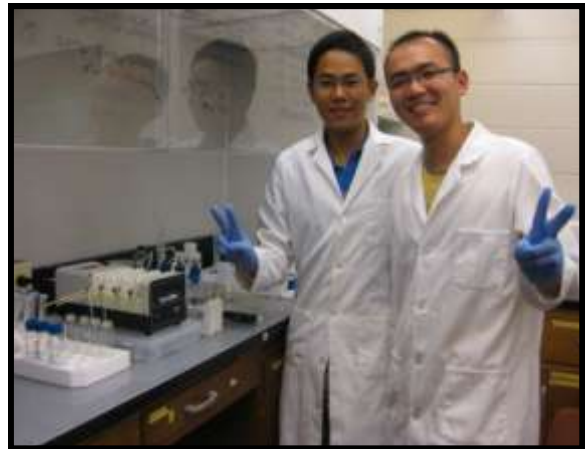
# Snapshots of Zhejiang Students at the University of Illinois, Summer 2010

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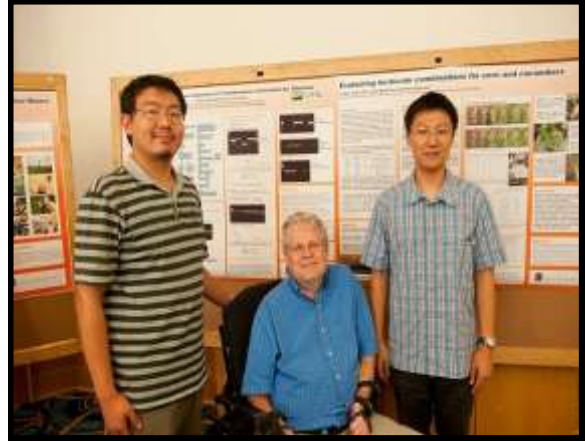












# July 23rd Chicago Field Trip

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- 7:00 a.m. Depart from Urbana
- 10:00 a.m. Chicago Board of Trade
- 11:30 a.m. Sky deck (Willis Tower) Tour
- 12:30 p.m. Lunch at the Illini Center  
Host and Speaker: Steve Lavin, Non  
Executive Vice Chair OSI Group
- 3:00 p.m. Tour Chicago Botanical Garden



# July 30th St. Louis Field Trip

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7:00 a.m. Depart from Urbana

10:15 a.m. Tour Monsanto Research Center with Jim Mieure

- Gene Discovery
- Gene Insertion
- Tissue Culture
- Greenhouses
- Growth Chambers
- Greenhouse Test Plants

12:00 p.m. Lunch

1:00 p.m. Bunge Corporation Tour

2:00 p.m. Bunge Overview from Deb Seidel,  
Director of Communications

2:45 p.m. Research Overview from Alex Goodson,  
Research Analyst



# Program Evaluations

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**1. What were your expectations of the study abroad program at the University of Illinois before you arrived?**

- Engage in American culture
- Learn and compare research skills in American lab setting
- Improve English
- Broaden horizons, learn about international agribusiness and trade

**2. Did this program provide opportunities to understand graduate research work at a U.S. university?**

- Yes, a lot – 88%

**3. How would you rate your communications and directions from the university professor or lab staff on your project? (On a scale of 1-5, with 1 being no direction and 5 being a good amount of direction).**

- 75% rated '5'

*“The lab staff was all patient and knowledgeable. We liked lab meetings. We not only talked about experiments, but also talked about American culture and their lives here.”*

*“Everyone was so warm and enthusiastic and always helped us in the lab.”*

- 20% rated '4'

*“At the beginning of the program, there were some difficulties in communication, but it got better.”*

**4. Could you estimate your weekly work time (in hours)?**

- 25-30 hours per week on average

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**5. Did you find the proposed project too difficult, just the right amount of difficulty, or not difficult enough? What could have made your project better?**

- 80% rated 'Just right'

- 20% rated 'Not difficult enough'

*"Maybe discussing our expectations with the professor before we come could help."*

*"If the project can fit our major, it will be perfect."*

**6. How would you rate the field trip to Chicago (CBOT, OSI Presentation, and Botanical Gardens)? On a scale of 1-5.**

- 30% rated '4'

- 25% rated '5'

CBOT was by far the favorite trip – liked learning about trades/futures.

- 25% rated '3'

- 20% rated '2' (no comments)

**7. How would you rate the field trip to St. Louis, (Monsanto, Bunge)? On a scale of 1-5.**

- 40% rated '5'

Monsanto was favorite trip here. *"We learned about the latest technology and see the huge gap in technology between two countries."*

- 25% rated '4'

- 25% rated '3'

- 10% rated '2'

**8. Did the graduate program information session help you to understand the graduate program and the application process?**

- 100% rated 'yes' – *"Learning more about the application would be helpful and also hearing from current graduate students in the program."*



# ILLINOIS

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