Academic Staff - Third Year Report
Neal M. Abrams
Faculty of Chemistry
August 1, 2009 – May 30, 2010

I. Instructional activities

Course no., Title, Semester, No. of Students

a. Undergraduate Course Offerings
   i. FCH 151, General Chemistry Lab I, Fall, 311
   ii. FCH 153, General Chemistry Lab II, Spring, 237
   iii. FCH 496, Special Problems in Chemistry, Fall, 1
b. Graduate Course Offerings
   i. None
c. CE Courses and Workshops
   i. EFB 796-02, Summer 2009
   ii. SPARE, 4-day solar power installer course, 11/2009, 2/2010, and 5/2010.
d. Guest Lecturer Activities
   i. Invited talk, STANYS annual meeting, 11/1/09
   ii. Guest speaker, ESF SURE, 11/4/09
   iii. Invited talk, Packer School, Brooklyn, NY, 11/17/09
   iv. ESC 335/535, 2 lectures, 2/2010

II. Student Advising and Counseling
a. James Soucy, junior transfer
b. Robert Miller, sophomore
c. Michael Kolis, freshman
d. Robert Amidon (withdrew), junior

III. Research and Other Scholarly Works
a. Departmental Research
   i. Educational: Development of alternative energy labs for general and/or upper level undergraduates.
   ii. Chemical
      1. Synthesis of oxynitride photocatalysts for water-splitting reactions.
      2. Biotemplating of cellulose with oxide and oxynitride photocatalysts.

b. Grant Supported Research – Funded proposals
   i. ACS-PRF New Doctoral Investigator grant
      Principal Investigator. Proposal for the low-temperature synthesis and testing of solid-state oxynitride compounds for water-splitting, "Synthesis of Novel Oxynitride Structures by Soft Chemical Routes". Duration: 9/08 – 8/10. Amount: $50,000. One supported undergraduate summer student supported 2009 and 2010.
   ii. NYSERDA PON 1184, School Power…Naturally Program Upgrade and Expansion.
      1. Principal Investigator. Development of a teacher workshop entitled "Advanced Training Workshops in Alternative Energy". Co-PI, R. Beal (Outreach). Amount: $223,205
   iii. Kaufman Foundation eNitiative grant
      1. Co-PI. Proposal to establish a "green cooperative" entrepreneurship program between ESF and Syracuse students, "Developing a ESF/SU

Student Green Energy Cooperative Project Initiative". Amount: $20,000

2. Co-PI. Proposal to establish a "green cooperative" entrepreneurship program between ESF and Syracuse students, "Business Development ESF/SU Green Energy Cooperative". Amount: $50,000.

iv. ESF Seed Proposal, Biomass Blueprints: Constructing Photocatalysts from Cellulosic Templates", S. Anagnost, co-PI. Amount: $7,747. One student supported summer 2010.

c. Grant Supported Research – Pending proposals
   i. Transforming Undergraduate Education in STEM (NSF), submitted 5/10
      1. Principal Investigator, Proposal for the creation of a synergistic General Chemistry and General Biology laboratory program. G. McGee, E. Hogan, V. Luzadis as co-PIs. Amount: $192,244.

d. Publications, License, Inventions, and Awards
   i. None.

IV. Public Service
   a. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.
      i. Ad-hoc reviewer for Advanced Functional Materials (2), ChemPhysChem (1), Journal of the Applied Materials and Interfaces (1), Journal of Chemical Education (1), Advanced Materials (2)
      ii. Reviewer for American Chemical Society Chemistry Club chapter reports (2)
   b. Funded Service Projects
      i. Government
         1. None.
      ii. Industrial and Commercial Groups
         1. Curriculum focus group, Vernier Inc.

V. Professional Development
   a. Professional Organization Activities
      i. Associate member, ACS Younger Chemists Committee (YCC), 2010
   b. Leaves, Additional Assignment, etc.
      i. None.
   c. Course work, Workshops, etc.
      i. None.

VI. Administrative and Governance Service
   a. Faculty
      i. Chemistry Curriculum Assessment team
      ii. ESF/SU chemistry education program faculty liaison
      iii. Graduate students steering committee (1, J. Feng), Candidacy exam examiner (1, N. Qin)
   b. College
      i. Member of the Learning Community
      ii. Search committee, Programmer Analyst
      iii. Search committee, Asst/Assoc Prof-Global Envir/Health/Sustainability
      iv. College Retention Committee
      v. Judicial Appeals Committee

vi. Middle States Assessment Committee
vii. Pre-Orientation instructor for EOP program
viii. Facilitated donation of a powder X-Ray diffractometer from SU Geology to ESF Chemistry.

c. University, including Research Foundation
i. None.

VII. Outreach
a. Advisor, Alchemist Club
b. Interview with WCNY "Central Issues" on electric batteries, 10/28/09
c. Judge Orientation leader and judge for ESF Environmental Challenge, 3/10
d. Judge for Manlius-Pebble Hill Science Fair, 5/10
e. Guest lecturer, *ESF in the High School*, Corcoran High School, 2/2010
f. Leader, Professional Development in Renewable Energy, Syracuse City School District, planning (3/10 -) and implementation (6/28/10)
g. YouTube videos (*various*)

VIII. Service learning
a. None.

IX. Retrospective

Teaching accomplishments

Overview

I continue to improve upon my teaching am very pleased with the outcome this third year. I would say my theme this year was "chemistry all around us". Knowing that the vast majority of students are not chemistry majors, I have focused on making my course more and more applicable to the general scientist rather than the chemist. I have continued to require the submission of formal, typed lab reports as a primary means of communicating science, but have made the transition increasingly gradual. This year we worked on submitting one section at a time (e.g. Abstract, Experimental, etc.) while keeping the rest of the report as worksheet-style. As I have learned that courses requiring a writing component (e.g. FCH151/153, EFB102/104, CLL190/290) all have differing requirements, students tend to get confused about styles for each course. Over the past two years, I have worked with Dr. Greg McGee, the EFB102/104 instructor to synchronize and complement our courses as much as possible, focusing the learning process on idea synthesis and intellect rather than pagination and spacing. We are also working with **Error! Reference source not found.**, CLL190/290 instructor to help uncomplicated the issue. This has culminated in a proposal submission and subsequent re-submission to the NSF-CCLI/TUES programs.

As a secondary use of materials purchased for my NYSERDA grant, I have outfitted our lab with numerous Vernier data acquisition devices, complete with temperature probes, voltage probes, and current probes. Academic Replacement funds were also able to fund the purchase of 10 diode array spectrometers, replacing Spec-20 units. This has increased experimental throughput and increase student motivation/attitude by using computer-based (digital) tools. We have also just outfitted the Jahn 130 teaching lab with stirrer/hotplates, permitting students to multitask during lab. During both fall and spring semesters, I was the in-lab instructor for one section of FCH 151 and 153, respectively. The section I taught was also the first one for the week, successfully allowing any issues/problems/insights to be dealt with quickly and efficiently.

New methods

Three new teaching tools were used this year, one of which was an optional in-lab practical during the fall semester. The other two were implemented in the spring semester. The first was the "Technique of the Week", a short prelab presentation highlighting chemical analysis methods that students might find in any modern science lab or literature reading. TAs were charged with developing 2-3 slides to present to students that described the purpose and operation of certain pieces of chemical instrumentation. Among these were NMR, FTIR, GC, pH probes, and AFM. Some topics were a bit difficult (e.g. NMR and IR), whereas others were very well received and understood (GC, AFM, pH). It was difficult for TAs to present some of the material as *they* were unfamiliar with the operation of some of these fundamental tools. Still, students appreciated learning about them and TAs reported that the segment should be continued, just improved upon by simplifying. The second teaching tool was the "Where are the Chemists" field trips. Throughout the Spring semester, I took small groups of students (15-20) to several facilities in Greater Syracuse that demonstrate the importance of chemistry in the workplace. Among them were Syracuse Metro Wastewater Treatment, OCRRA/Covanta Energy, Anheuser-Busch, and Upstate Freshwater. Students took tours of the facilities and upon returning, wrote an essay describing what they learned and how chemistry fills a pivotal role at the facility. The tours were very well received, with some students saying this was the best part of the semester (in total, not just FCH153)! Limited sites and availability prevented me from taking the entire class. I do not know if I will continue the tours during Spring 2011 because of the size constraints, but the overall program was a success. As a side benefit, many of the tour guides were ESF graduates or worked with ESF graduates, who all had great things to say about ESF and our programs.

A final two-week project was introduced during the spring semester, which allowed students to use modern chemical instrumentation, thus linking to the Technique of the Week. Approximately ¼ of the course was able to access the GC in A&TS and another ¼ used the FTIR with ATR stage to analyze their synthesized products.

Assessment

Fall grades for Chemistry majors averaged 82 (*n=6)* while excluding one F due to lack of attendance. Non-majors averaged 85 (*n=302)*, excluding Fs as those are typically earned due to lack of attendance. Spring grades for chemistry majors averaged 87 (*n=5)*, same as Spring 2009. Non-majors had an average score of 85 (*n=237*).

Table 1. FCH 151/153 assessment scores for AY09-10.

Semester	**Chemistry mean score**	***n***	**Total mean score**	***n***
Fall 09	82 (*excluding one failure)*	6	85 (excluding Fs), 82 w/F's	302
Spring 10	87	5	85	237

An optional fall lab practical resulted in 28% of the students taking the practical with an overall average of 4.8/5. The grades appear to be very high, but since the practical was optional, many of the participants were self-selecting higher-performing students (average of 85 on lab reports).

Teaching Assistants

Delivery of the labs and grading was accomplished by a group of motivated and outgoing teaching assistants (TAs): 15 graduate TAs and 3 undergraduates in the fall, 12 graduate and 2 undergraduates in the spring. I was very pleased with the abilities of the majority of the TAs, but there are still some communication and teaching issues among the foreign teaching assistants. In general, the TAs were engaged and took the role of teaching very seriously. Course surveys again reported that students were extremely pleased with their TAs, including approachability, ability to motivate, and general knowledge. To maintain consistency between TAs, I modified the grading rubrics to focus less on specific points in reports and more on the overall quality of

the reports. Final grades were consistent among TAs except for one high-grading outlier in both semesters. No TA was "harder" than others, although some TAs incorrectly perceived themselves to be "hard" on the students.

Evaluations (*SurveyMonkey*) were administered to TAs at the conclusion of the fall and spring semester with nearly 100% completion. TAs reported they believed students learned a great deal of chemistry and/or had the necessary materials to learn effectively. TAs also reported that they were given all of the background and materials necessary to be effective teachers. Last year, the TAs commented that they wished to improve their teaching and presentation skills, which I attempted to address in two ways: 1) A 5-minute presentation to their peers about any topic (fall) and 2) Producing a set of slides for prelab presentations (spring). Both were met with some dissatisfaction, but for different reasons. The 5-minute presentations were reported to be a bit too broad in subject area since any topic could be discussed. Evaluation rubrics were provided to the TAs, but only one TA came to review them with me. I am now confused by the reported interest in becoming better teachers but lack of interest in getting feedback. The TAs judged the prelab presentations as ineffective teaching tools and the subject matter was "above the students' heads'. TAs continue to report that weekly meetings are very beneficial as are the demos they perform one week prior to the lab delivery. TA office hours were well-attended and well-received, likely due to the overall "concerned" mindset of this year's freshmen class.

Videos and media

Online YouTube videos continued to be an integral part of prelab preparation. Apart from the ESF YouTube videos, the abridged video of how to construct a dye-sensitized solar cell (http://www.youtube.com/watch?v=rtHtJGjLyTk) has received over 24,000 hits and numerous comments/emails in two years. I also worked with ITS to update the video to match the other narrated ESF videos and be more informative to a worldwide audience. The Communications office (Mr. Dave White) recently videotaped a General Chemistry lab highlighting the dye solar cell lab, including interviews with a student and myself. The video has been published on YouTube, iTunesU, and Improve Your World. All of these video projects are freely available to the worldwide online community, thus enhancing ESF's global recognition. This year, the delivery of lab documentation was changed to a printed manual and was sold to students rather than relying on delivery via Blackboard. All lab experiments were still listed on Blackboard, as well as prelab assignments, instructor (and TA) information, general announcements, a variety of lab resources, and the series of above mentioned laboratory videos.

Lab Practical

Since teaching FCH151, I have struggled with students demonstrating poor lab skills as they continued on to FCH153 and have heard of similar issues as they progress to the Organic labs. This is problematic in an educational sense, but also an issue for the lab coordinator who works to maintain the equipment. To address this, I introduced an optional lab practical at the end of the Fall 2009 semester, requiring students to demonstrate skills such as proper balance and spectrometer use. As a trial run, this practical was offered as an extra-credit option for the students and ~⅓ of the enrolled students took the practical. Scores are listed in *Assessment* section above. By introducing a practical, TAs and I were able to offer one-on-one assistance to students as they used common lab equipment such as balances and spectrometers. Learning from this trial run, I will make this practical an FCH151 requirement at the end of the semester as well as less-formal assessments during the semester.

Research

Education

I am working on revisions for two manuscripts, one based on Cu_2O photoelectochemical cells and the other highlighting the role of chemistry in renewable energy outreach. Both are in draft form with at least one planned submission this summer.

Chemical
A successful ACS-PRF grant has allowed me to continue my solid-state research on oxynitride compounds. My 2009 summer research student, Alex Levine (Ithaca College, incoming 2010 ESF graduate student) made some progress during the summer, but also expanded the original scope of the project to include a new biotemplating component. By the end of the summer, Alex successfully produced an oxide template from cotton and filter paper and began attempts to template wood with oxide and oxynitride precursors. We also spent significant time getting a GC with TCD up and running. Little progress was made during the semester, but the new-to-me X-ray diffractometer was successfully delivered and installed. A new ESF Seed grant has also allowed me to hire an additional student to work on the project.

Outreach
The first Alternative Training Workshop in Alternative Energy took place on the ESF campus in late July 2009. There were 15 total attendees, including teachers, museum educators, and a preservice teacher. The workshop was well received by both the attendees and presenters and I look forward to the continuation of the project for the next two years of funding. This course has also extended into a professional development workshop for Syracuse City high school teachers, an ESF in the High School course, and a proposed course in renewable energy technology here at ESF (with possibility of Renewable Energy Science major). In addition, I have also been hired as co-instructor for the ESF SPARE (Solar Power as Renewable Energy) program, teaching the basics of solar power to solar installers nationwide. I also continue to serve as advisor of the ESF Alchemists.

X. Prospective

Teaching
The prior teaching year went relatively smoothly and I believe I can devote 1) more time to in-lab teaching and 2) development of additional courses. Along with Greg McGee in EFB, Betsy Hogan in EST (writing) and Valerie Luzadis (FNRM), we have submitted an NSF-TUES proposal to integrate the General Chemistry and General Biology laboratory courses guided around writing and communication. Dr. McGee and I have found that there are several parallel and complementary aspects of our two courses, most importantly, the students. We share such a large common student census, that it only makes sense to work on an integration scheme between our courses. If funded, we will be able to coordinate labs by sharing new instrumentation (e.g. Vernier instruments, polarizing microscopes) and a common TA, thus increasing course impact and decreasing costs. We (and pas reviewers) believe that this uniquely integrated approach could be used in colleges across the country.

I continue to examine the prospects of teaching an inorganic/physical chemistry laboratory. A clear advantage of offering this course would be the ability to bring our department closer to ACS certification, a desire of the President and Provost of this College. Although ACS certification has met some resistance within the department, I believe the lab coursework would cover material necessary and relevant to our undergraduate students with ACS certification provided as an added bonus.

Adding to my FCH151/153 teaching repertoire, I look forward to moving my various guest-lecture activities in solar/renewable energy into a self-standing course. This course would be introduced in the ESC program and would be in direct relation to the ESC335/535 policy and

economics-based course currently taught by Michael Kelleher. In collaboration with Tim Volk and Mike Kelleher, I plan to submit this to the CoI for Spring 2011 course listing. Requiring further interdepartmental collaborations, combining a science-based renewable-energies course with a policy/law-based course would also be an exciting opportunity. This would explore how laws that govern these new energy technologies effect development and vice-versa.

Research

Education

I will build off of ESF's strengths in collaboration and pursue further funding for my education research from the resubmission of an above-mentioned NSF-CCLI/TUES proposal. Funding this proposal will integrate the general chemistry and general biology laboratory courses a well as ESF writing courses.

Chemical

I am excited to continue working on my oxynitride project supported by an ACS-PRF grant. The project is in its infancy, but appears very promising. We have been able to generate some oxide and oxynitride compounds that will be tested for photocatalytic activity of water-splitting. The use of X-ray diffraction is essential to my research for phase identification and I look forward to using a newly acquired an X-ray powder diffractometer. ACS-PRF funding ends in summer 2010, so additional funding is needed to continue the project. I did not receive funding from the recent McIntire-Stennis 2009 RFP, but I plan to use the generally constructive comments to enhance the proposal for submission next year. I have also been awarded an ESF Seed grant to fund my project. Further support will be solicited from the NSF in both the Ceramics (CER) and Biomaterials (BMAT) RFPs. In collaboration with Dr. Susan Anagnost (CMWPE), we will develop a generalizable synthetic toolbox for the infiltration of woody biomass with a potential for extension to other forms of biomass. The project will focus on synthesizing compounds from hardwood templates for photocatalytic water-splitting and hydrogen generation. Results will be presented at the upcoming ACS national meeting in Boston.

Outreach

Current outreach programs will continue in the following year, including the SPARE program, my contributions to *ESF in the High School*, and the Advanced Training Workshop in Alternative Energy (NYSERDA). I am also working with Mike Kelleher to seek funding from National Grid to support a scholarship fund for bringing inner-city students to ESF for a summer renewable energy course.

Significant activities and accomplishments during this reporting period.

Teaching has focused on introducing students to the chemistry around us. By visiting some local industries "doing chemistry", I opened up students' eyes to the importance of chemistry in some unsuspecting places. Sites included Anheuser-Busch, Upstate Freshwater, and Covanta Energy. Based solely on student evaluations and essays, this successful endeavor taught our students about how much is out there. I am waiting to hear on an NSF-TUES proposal integrating chemistry and biology labs and writing. On the research front, I was awarded an ESF Seed grant along with my ACS PRF funding, thus allowing me to hire two undergraduate researchers this summer. My research has branched into two directions, one in traditional solid-state inorganic chemistry and the other into the field of biotemplating, allowing a new collaboration with the CMWPE department. At the University and outreach levels, my summer Energy workshop has extended the visibility of ESF as has my new appointment as SPARE instructor. Collaborations with ESF Outreach have included ESF SCIENCE, several professional development workshops, and the generation of a new *ESF in the High School* course.

ANNUAL REPORT June 1, 2009 - May 31, 2010

Gregory L. Boyer, Faculty of Chemistry

1. INSTRUCTIONAL ACTIVITIES

FCH 899/999 Graduate Research (summer 2009)……. 2 student
898/899 Professional Exp./Graduate Research ……. 1 student

FCH 495	Intro to Professional Chemistry (fall) ……	8 students
FCH 498	Introduction to Research (fall) ……	1 student
FCH 531	Biochemistry Lab (fall) ……..……..	8 students
FCH 899/999	Graduate Research (fall) .....…….	3 students
ENS 898/899	Professional Exp./Graduate Research (Fall) ...	2 student

ESF499	Honors Senior Research (Spring) .....….	1 student
FCH 899/999	Graduate Research (Spring) .....……...	3 students
ENS 898/	Professional Experience (Spring) ……..	1 student
ENS 899	Graduate Research (Spring) ……..	1 student

Service Learning Courses: none

1b. STUDENT ADVISING AND COUNSELING

Chemistry Undergraduate Students .....……. 3
Biochemistry Graduate Students .....…….. 1
Environmental Chemistry Graduate Students.. 1
Graduate Program in Environmental Sciences...3 (3 supported as GA)

2. RESEARCH ACTIVITIES

Graduate Research (**5** as Major Professor)

M. Pavlac (Ph.D.)	Lake Ontario Nearshore Nutrient Survey
J. Sullivan (Ph.D.)	Use of an Optical Phytoplankton Discriminator for algae
J. Schneider (MS)	Implementation of Ecosystem-based management in NY State (GPES)
S. Thomas (MS)	Thermal stratification of Oneida Lake by buoy based monitoring (GPES)
M. Cummings (MS)	Algal biomass as a source of biofuels (GPES)

Undergraduate Research (Paid and Senior Research)

Justine Schmidt	Metabolism of Cyanobacterial toxins (honors thesis)
Kimberly Hevers	Cyanobacteria toxins
Frank Cerio	Cyanobacteria toxins

Other:

J. Usher (PDF): Immunological methods for buoy deployment
M. Satchwell: (Research Technician): Cyanobacteria toxins in drinking water
G. Westby; (Research Technician): Great Lakes Observing System
Khris Dodson: Great lakes Research Consortium
Heather Carrington: Great Lakes Research Consortium

2B. Grant Supported Research

Current Research Support; Proposals Funded and Submitted: New proposals written during this period are marked with an "*"

New Funding:

*** Multiple Sponsors.**

Unrestricted Support for Biochemistry. *This includes funding for algal toxin determination for water reservoirs, etc.*

G.L. Boyer (1% AY); $219,710

Funded: 8/19/99 - 6/30/10 (*New Funding for reporting period: $47,374)*

NY DEC

Lake Ontario Nearshore Nutrient Survey -2

J. Makarewicz (PI) and G.L. Boyer co-PI), (1% AY) Funded: 8/19/08 – 4/30/10; $33,720;

*Phase 3; $50,714 approved and *waiting for contract*

****DOC- NOAA – MERHAB***

MERHAB 2008 Outreach efforts

GL Boyer (1%) Funded 7/01/08 – 6/30/10: $11,827

New Funding 7/01/09 – 6/30/11: $31,500; *Contract in process*

***DOC-IOOS –Great Lakes Observing System**

Implementation of the Great Lakes Observing System (GLOS), 2008-2011

G. L. Boyer (5% AY), Funded 10/1/08-9/30/11; $30,000 year 1, $58,000 year 2

*Year 3 (new funding); $360,000 (ESF share $253,331); *Contract in process*

***Environment Canada**

Analysis of Great Lakes Samples

G.L. Boyer (1%) Funded 2/18/10-3/31/12; $30,000

***Science Foundation of Ireland**

Biochemistry and Analytical Chemistry of Toxic Cyanobacteria Blooms

G.L. Boyer (50%), Funded 3/15/10 – 11/31/10; €61,830 (ca $83,470 and dropping fast)

***Environmental Protection Agency (to University of Michigan)**

GLOS Enhanced tributary Monitoring to Support AOCs and LaMPs

G.L. Boyer (5%) Funded 5/1/10-4/30/12; $267,000 (awarded and *contract in progress*)

***Environmental Protection Agency**

Source Tracking the Oswego River Phosphorus (Lake Ontario)

G.L. Boyer (5%) Funded 5/1/10-4/30/12; $289,552 (awarded and *contract in progress*)

New funding obtained or starting in this reporting period as described above: $1,030,947; however most (>$860,000) of that is tied up in contract and not available. Some of these contracts have been "approved" for more than a year. Additional funding specifically to the Great Lakes Research Consortium (PI-Boyer) and not listed above includes:

New York Department of State

Development of an Ecosystem based management Research and Monitoring agenda

G.L. Boyer (5% AY); Funded: 9/1/07 – 11/1/08 (Phase 1: $50,000)
Phase 2 (*new*): 5/1/10 – 6/31/11 ($45,000) in Contract

US Geological Survey
Internships for Research and Restoration of Great lake Fish Communities
G.L. Boyer (1% AY); $50,000 (to the Great Lakes Research Consortium)
Funded: 9/15/07 – 9/14/12 (New Funding for reporting period: $10,000)

Multiple Sponsors Great Lakes Research Consortium
Great Lakes Research Consortium Membership and conferences
G.L. Boyer (1% AY); (1/1/2003 – 6/30/2010) $110,289; New funding this period $37,000

***SUNY Conversations in the Disciplines**
Quantitation and Valuations of Ecosystem Services
V. Luzedis (PI), G.L. Boyer (co-PI) and others; $5,000 (new funding)
Funded 7/1/2009-6/30/2010

National Science Foundation
Environmental Scholars: A Scholarship Program in Environmental Chemistry, Biology and Engineering. Kelly Donaghy PI (G.L. Boyer as Senior Scientist, 1%)
Funded 3/15/09-2/28/13 $600,000

Continuing Funding

National Science Foundation / University of Tennessee
What makes MIcrocystis Bloom? Dissecting the physiological ecology of a toxic cyanobacterium with community level proteonomics
G.L. Boyer (0%); Funded 6/30/09-5/30/2011; $20,000

US-DOD
Acquisition of a Multiuser Benchtop MALDI TOF Mass Spectrometer
G.L. Boyer (1% AY); Funded 4/15/09-4/14/2010; $150,000

National Science Foundation to University of Tennessee
Investigating Chronic Toxicity and Bioaccumulation of Microcystins in Fish
Ted Henry (PI), G.L. Boyer (5%); Funded 10/1/2005 – 9/30/2009; (ESF share $35,000)

California Department of Water Resources
Health and Ecosystem impacts of Cyanobacteria in the San Joaquin Delta
P Lehman, GL Boyer and others; Funded July 1, 2007 – July 1 2009; (ESF Share $84,517)

Syracuse Center of Excellence in Energy and Environmental Systems
Development and deployment of a remote observing system for Determination of Taxon-specific Phytoplankton Abundance
G.L. Boyer (5%) and M.T. Twiss
Funded 9/1/2006 – 8/31/2009; $299,931(ESF share $184,813)

Boat Maintenance (*This is a multiple sponsor's account to support the chemistry boat*)
G.L. Boyer: (1% AY); $2,000 (*Funds came from other research PI and grants*)
Funded 6/01/02 – 12/31/07

Proposals submitted and still pending:

USDI Geological Survey
Phosphorus Dynamics and Noxious Algal Blooms in the Oswego River Outflow
G.L. Boyer (PI, 2% AY) and J. Atkinson (co-PI); $243,541 (proposed 8/1/10-7/31/12)

US Department of Commerce
Biofuels Development and Performance Testing Center
SUNY-ESF; $5,713,834 (proposed 1/1/11 – 12/31/11)

US Department of Commerce -NOAA
Role of the Oswego River as a Driver of Noxious Algal Blooms in Lake Ontario
G.L. Boyer (PI, 2% AY) and J. Atkinson (co-PI); $219,019 (proposed 2/2/11 – 1/31/13)

National Science Foundation (To University of Tennessee)
Dimensions: Collaborative Research: Linking Phylogenetic and Functional Diversity with Process: The Nitrogen Cycle of a Hypereutrophic Large Lake System
G.L. Boyer (Senior Scientist, 1% AY); $62,500; (proposed 2/2/11 – 1/31/16)

Proposals submitted and rejected:

US Department of Commerce
ECOHAB: The Role of Population Diversity, Growth and Transport in the Formation of Toxic Microcystis blooms in the Lower Great Lakes.
G.L. Boyer (PI) with 17 others; $4,998,670 (total for all 12 institutions)

National Science Foundation
Science and Technology Center, Integrative Partnerships
J. Atkinson (PI) with G.L. Boyer (Co-PI); $2,558,065 (ESF share)

AFRI / USDA
Assessment of Clostridium botulinum and anatoxin-a as causative agents of VTC outbreaks in channel catfish: verification and management options
P. Zimba (PI) and G.L. Boyer (Co-PI) with others (5%); $40,000 ESF subcontract

National Science Foundation
Collaborative Research: Molecular and Chemical Ecology of *Lyngbya* in the Eastern US
G. L. Boyer (5%) with 3 Co-PIs; proposed $797,724

National Science Foundation
PIRE- A US-China partnership in research and education on natural and human-induced causes of eutrophication, Syracuse University (PI) and G.L. Boyer (Co-PI); (proposed ESF Share $856,082)

USDA- DOE
Selection and Growth of Cold water algal species for Biomass Production
G.L. Boyer (10%) with O'Brien and Gere Engineering; proposed $1,950,898)

AES Corporation
Carbon Dioxide sequestration System using Algae
O'Brien and Gere Engineering (PI) with GL Boyer (Co-PI): proposed $795,000

Environmental Protection Agency (to SUNY Brockport)

Monitoring, Assessing and Predicting the Status and changes in the Coastal Zone of Lake Ontario (LONNS 4), G.L. Boyer (5%) Proposed $140,000 (ESF subcontract)

Environmental Protection Agency
Integrated Science Plan Development St. Lawrence River
G.L. Boyer (5%) Proposed $98,940

Environmental Protection Agency – to NYS DEC
GLECOS-Great Lakes Environmental Conditions Observing System
G.L. Boyer (5%) Proposed $112,323 subcontract to DEC

2C. PUBLICATIONS:

Papers and Technical Reports Published (Calendar 2009 to present):

Allender, C. J., G. R. LeCleir, J. M. Rinta-Kanto, R. L. Smith, M. F. Satchwell, G. L. Boyer, and S. W. Wilhelm (2009) Identifying the source of unknown microcystin genes and predicting microcystin variants by linking multiple genes within uncultured cyanobacterial cells. Appl. Environ. Microbiol. 75:3598-3604.

Boyer, G. L. (2009) Algal Toxins and their Detection. In: "Shellfish Safety" S. Shumway, and G.E. Rodrick, Eds., Woodhead, New York NY., p. 129-161.

Cusick, K. D., G. L. Boyer, S. W. Wilhelm, and G. S. Sayler (2009) Transcriptional profiling of *Saccharomyces cerevisiae* upon exposure to saxitoxin. Environ. Sci. Technol. 43:6039-6045.

Davis, T. W., D. L. Berry, G. L. Boyer, and C. J. Gobler (2009) The effects of temperature and nutrients on the growth and dynamics of toxic and non-toxic strains of *Microcystis* during cyanobacteria blooms. Harmful Algae. 8:715-725.

Lehman, P. W., S. J. Teh, G. L. Boyer, M. L. N0briga, E. Bass, and C. Hogle (2009) Initial impacts of *Microcystis aeruginosa* blooms on the aquatic food web in the San Francisco Estuary. Hydrobiologia. 637:229-248.

Makarewicz, J. C., G. L. Boyer, T. W. Lewis, W. Guenther, J. Atkinson, and M. Arnold (2009) Spatial and temporal distribution of the cyanotoxin microcystin-LR in Lake Ontario ecosystem: Coastal embayments, rivers, nearshore and offshore, and upland lakes. J. Great lakes Res. 35: 83-89.

Rinta-Kanto, J. M., M. A. Saxton, J. M. DeBruyn, J. L. Smith, C. H. Marvin, K. A. Krieger, G. S. Sayler, G. L. Boyer, and S. W. Wilhelm (2009) The diversity and distribution of toxigenic *Microcystis* spp. in present day and archived pelagic and sediment samples from Lake Erie. Harmful Algae. 8:385-394.

Rinta-Kanto, J. M., E. A. Konopko, J. M. DeBruyn, R. A. Bourbonniere, G. L. Boyer, and S. W. Wilhelm (2009) Lake Erie *Microcystis*: relationship between microcystin production, dynamics of genotypes and environmental parameters in a large lake. Harmful Algae. 8:665-673.

Smith, J. L., and G. L. Boyer (2009) Standardization of microcystin extraction from fish tissues: A novel internal standard as a surrogate for polar and non-polar variants. Toxicon. 53: 238-245.

Smith, J. L., K. L. Schulz, P. V. Zimba, and G. L. Boyer (2010) Possible mechanism for the foodweb transfer of covalently-bound microcystins. Ecotoxicology and Environm. Safety. accepted

Watson, S. B., R. Yang, G. Boyer, L. Forester, L. Molot, and M. Burley (2009) Taste-odour and Toxins in the Bay of Quinite; 2006-2007. Technical Report for the Bay of Quinte Area of

Concern. 15pages.

Watson, S., and G. L. Boyer (2009) Harmful algal blooms (HABs) in the Great Lakes" Current Status and Concerns. In: "Nearshore Areas of the Great Lakes, 2009" US EPA and, and Environment Canada, Eds., EPA 905-R-09-013, Ann Arbor, MI., pp. 78-91.

Smith, J. L., K. L. Schulz, P. V. Zimba, and G. L. Boyer (2010) Bioavailability and toxicity of covalently-bound microcystin-LR. Ecotoxicology and Environmental Safety, *in press*

Manuscripts Submitted:

Rogers, E. D., T. B. Henry, M. J. Twiner, J. S. Gouffon, J. T. McPherson, G. L. Boyer, G. S. Sayler, and S. W. Wilhelm (2010) Global gene expression profiling in larval zebrafish exposed to microcystin-LR and *Microcystis* reveals endocrine disrupting effects of cyanobacteria. Environ. Sci. Technol. *submitted*.

Wilhelm, S. W., S. E. Farnsley, G. R. LeCleir, A. C. Layton, M. F. Satchwell, J. M. DeBruyn, G. L. Boyer, G. Zhu, and H. W. Paerl (2010) The relationships between nutrients, cyanobacterial toxins and the microbial community in Lake Taihu, China. Microbial Ecology.

Abstracts Presented at Local, National, and International Meetings (June 2009 to present):

Boyer, G. L. (2009) Implementing Ecosystem based management in New York State. Healing our Waters Coalition, Annual Meeting. Buffalo NY, October 24th, 2009.

Boyer, G. L., A. H. Hotto, S. W. Wilhelm, J. M. Rinta-Kanto, and D. M. DeBruyn (2009) What large lake ecosystems can tell us about toxic cyanobacteria in small lakes and vice versa. Abstracts, North American Lake Management Society Annual Meeting. Hartford, CT, October 28th, 2009.

Boyer, G. L., and J. Smith (2009) Cyanobacteria toxins in Fish: Implications for Human Health and Safety. Abstracts, Gordon Research Conference on Mycotoxins and Phycotoxins. Colby-Sawyer College, June 2009.

Farnsley, S., G. R. LeCleir, J. M. DeBruyn, G. L. Boyer, G. Zhu, H. W. Paerl, and S. W. Wilhelm (2009) Spatial Distribution of toxic cyanobacteria and microbes in China's Lake Taihu. Abstracts, American Society for Microbiology Regional Meeting. xx-xx.

Thomas, S. P., M. M. Pavlac, R. L. Oakes, J. P. Hassett, J. M. Farrell, and G. L. Boyer (2009) Developing a Land-based monitoring station on the Saint Lawrence River. Abstracts. St Lawrence River Conference.

Boyer, G. L., and M. F. Satchwell (2010) Good news for Managers: The cyanobacteria neurotoxin Beta Methyl Amino Alanine (BMAA) does not appear to be a major new hazard in the Great Lakes. Abstracts, Intl Assoc Great Lakes Res. Toronto, ONT, May 2010,

Cummings, M. A., G. L. Boyer, D. Johnson, and S. Giarruso (2010) Determination and Comparison of lipid content in the Green Algae, Cladophora and Chlorella vulgaris. Abstracts, SUNY-ESF Graduate and Undergraduate Research Symposium. Syracuse NY, April 13th, 2010.

Schmidt, J. R., and G. L. Boyer (2010) Rate of conjugate formation of microcystin-LR in Animal liver tissue. Abstracts, SUNY ESF Graduate and Undergraduate Research Symposium. Syracuse, NY April 13th, 2010.

Sullivan, J. M., and G. L. Boyer (2010) Potential Discrimination of Phytoplankton on the basis of

the Pigment Signatures. Abstracts, SUNY-ESF Undergraduate and Graduate Research Symposium. Syracuse NY, April 2010.

Thomas, S. P., M. M. Pavlac, G. R. Westby, K. T. Holeck, L. F. Rudstam, E. L. Mills, and G. L. Boyer (2010) Monitoring thermal stratification in Oneida Lake. Abstracts, SUNY-ESF Undergraduate and Graduate Research Symposium. Syracuse NY, April 2010.

Pavlac, M. M., T. T. Smith, S. P. Thomas, G. L. Boyer, J. C. Makarewicz, T. W. Lewis, W. J. Edwards, C. M. Pennuto, C. P. Basiliko, and J. F. Atkinson (2010) Monitoring of the Lake Ontario Nearshore using real time fluorescence. Abstracts, SUNY-ESF Undergraduate and Graduate Research Symposium. Syracuse NY, April 2010.

Pavlac, M. M., T. T. Smith, S. P. Thomas, G. L. Boyer, J. C. Makarewicz, T. W. Lewis, W. J. Edwards, C. M. Pennuto, C. P. Basiliko, and J. F. Atkinson (2010) Monitoring of Lake Ontario Nearshore using real-time fluorescence. Abstracts, Intl Assoc. Great Lakes Res. Toronto, Ont. May 2010

Watson, S. B., G. L. Boyer, and T. Howell (2010) Long term patterns in taste-odour and toxins in inshore and offshore Lake Ontario. Abstracts, Intl Assoc. Great Lakes Res. Toronto, Ontario.

Wilhelm, S. W., S. E. Farnsley, J. M. DeBruyn, G. R. LeCleir, B. Qin, G. Zhu, Z. U. Xu, T. Otten, G. L. Boyer, and H. W. Paerl (2010) Harmful algal blooms in China's Lake Taihu: a looking glass for other large eutrophying waters. Abstracts, Intl Assoc. Great Lakes Res. Toronto, ONT, May 2010.

Invited Seminars and Workshop Presentations:

Boyer, G. L., A. M. Hotto, S. W. Wilhelm, J. M. Rinata-Kanto, J. M. DeBruyn, and S. B. Watson (2009) MERHAB-LGL: The role of embayments, nearshore nutrient shunts and offshore waters in the initiation and maintenance of Toxic algal Blooms in the Lower Great Lakes. Abstracts. 5th US Conference on Harmful Algal Blooms. Ocean Park, Washington.

Boyer (2009) Planning meeting for the St. Lawrence River water quality and Environmental Observatory. June 10, 2009. Clayton NY.

Boyer (2009) Coastal Connections -2. Conference on Lake Ontario. SUNY-Brockport, August 25, 2009.

Boyer, G. L. (2009) Harmful Algal Blooms: Sailing the blue-green waters of our Great Lakes. Exemplary Research Award Seminar, SUNY College of Environmental Science and Forestry. September, 2009.

Boyer, G. L. (2009) Algal Biofuels. Seminar, SUNY College of Environmental Science and Forestry. October 14th, 2009.

Boyer, G. L. (2009) Algal Biodiesel, Is it a solution to our current energy needs? Seminar,. SUNY Brockport, October 26th 2009.

Boyer, G. L. (2009) St Lawrence River; People and Partnerships. Workshop. Brockville ONT, Dec 4th, 2009.

Boyer, G. (2009) Toxic Cyanobacteria in the Great Lakes, Problems, issues and solutions. Seminar. Buffalo State College, December 7th, 2009.

Boyer, G. B. (2010) Toxic Cyanobacteria in the Great Lakes: Problems, Issues and Solutions. Seminar, Feb 1, 2010. University of Ottawa, Ottawa, CA.

Boyer, G. L. (2010) Development and deployment of a remote observing system for determination of Taxon-specific phytoplankton abundance. Syracuse Center for Excellence Annual Progress meeting; April 15, 2010

Completed Thesis:

Eckerlin, J. E. (2010) A Quantitative Comparison of Ecosystem-based Management Plans. MS Thesis, Graduate Program in Environmental Sciences. State University of New York, College of Environmental Science and Forestry. Syracuse NY, April 2010.

Awards and Honors

Recipient, E.T.S. Walton Visiting Professorship, Cork Institute of Technology, Ireland

(note: this is a turning out to be a very prestigious award – to the best of my knowledge, there was only one E.T.S. Walton Professorships awarded last year in all areas of science (defined broadly to include literary, social, and physical sciences) for the entire country of Ireland)

3. OUTREACH and PUBLIC SERVICE:

Outreach Activities

- Boyer, G. L. (2010) Threat Mapping Workshop. Meeting. Ann Arbor, MI March 2010.
- Boyer, G. L. (2010) Lake Erie Phosphorus taskforce. Workshop. Toledo OH, Feb 2010.
- Boyer, G. L. (2010) Lake Ontario Nearshore Nutrient Survey - workshop. Burlington ONT, January 2010.
- Boyer, G. L. (2010) Great Lakes Underwater. participant. Oswego NY, March
- Interim Director, Great Lakes Research Consortium.
- Organizing Committee, Secretary and Treasurer, Northeast Algal Society
- Board of Governors and Treasurer, Syracuse Swing Dance Society

Grant Panel Service

- Panel Member, NOAA's Monitoring and Event Response for HAB 2010 (21 proposals)
- Reviewer, Kuwait Foundation for the Advancement of Science
- Reviewer, USP Environmental Protection Agency
- Reviewer, SUNY-ESF McIntire Stennis Program

Editorial Board Service

- Member of the Editorial Board for Toxicon
- Reviewer, Hydrobiology, Journal of Phycology, Harmful Algae,

Other Service to Government Agencies included:

- Toxin Analysis for New York State and California Departments of Health.
- Co-Chair, Science Advisory Committee to the New York State Oceans and Great Lakes Ecosystem Conservation Council
- Member, International Joint Commissions Council on Great Lakes Research Managers
- Member, Great Lake Observing System Regional Association advisory committee
- Member, New York's Great Lakes Basin Advisory Committee
- Member, New York's Great Lakes Leaders Group
- Co-organizer, Great Lakes Day in Albany
- Co-coordinator (with DEC), New York's Response to the Great Lakes Research Initiative

Professional Societies

- American Society of Limnology and Oceanography
- Northeast Algal Society (Executive Committee and Treasurer for 2003 –2008)

- Phycological Society of America
- American Littoral Society
- International Society for the Study of Harmful Algal Blooms
- American Society of Microbiology

Awards:

- 2010 Recipient, Frank Shipley Collins Award for Meritorious Service to the North East Algal Society.

4. ADMINISTRATIVE DUTIES - DEPARTMENTAL AND COLLEGE-WIDE

Faculty Appointments

- Faculty of Chemistry
- GPES Water Quality Group
  - Chemical Ecology Group
  - SB3 Core Program
- ESF Biotechnology Core
- Director, Great Lakes Research Consortium

Departmental Committee Appointments

- Biochemistry Qualifying Examination Committee (Chair)
- Natural Products Qualifying Examination committee
- MPS coordinator for Department of Chemistry

College Committee Appointments

- Chair; College-wide Radiation Safety Committee

Retrospective Summary

Perhaps the most satisfying issues from this last year was the receipt of both the prestigious **E.T.S. Walton Visiting Professorship** from the Science Foundation of Ireland and receiving the **Frank Shipley Collins award** recognizing meritorious service to the North East Algal Society. This latter award was especially gratifying in that I am probably the first chemist ever to win the award, as it is traditionally given to algal taxonomists and marine phycologists. It came with a nice plaque and briefcase, but no money. Another major highlight was the successful completion of the process to obtain a **new MALDI-TOF mass spectrometer**. This instrument has rapidly blossomed from one where there was little support for the effort from others outside my own research group, to an instrument that now has more than 36 different users scattered across the University Hill. I was also invited to the editorial board of Toxicon, a step up from just being a reviewer for them and a nice recognition for our work internationally. Finally, I received a lot of nice comments regarding my **seminar presentation for the Exemplary Researcher award** given in September, including one that basically said that basically said that they thought chemistry seminars were boring but even they enjoyed this presentation. That was very high praise from a very difficult audience.

Research productivity was up and down this year. One the plus side – we had nearly a dozen research papers come out in 2009. On the negative, many of these were co-written by colleagues or graduate students at other institutions. I have had little luck in getting my own graduate students to publish their work and have not found the time to write the papers for them. It is discouraging to see graduate students leave ESF without submitting their work for publication but that has become the culture in our department. We need to seriously consider changing that culture if we are to advance as a research department.

It has been a crazy year for proposals and my sympathies go out to Theresa Baker in our research office. We were involved in 17 proposals this last year – many of them (ECOHAB, $5M, 17 collaborators, 11 institutions) had numerous collaborators and required a huge amount of effort on the part of myself and the Research Office. Our success rate was good (sometimes great as 3 out of 4 Observing system proposals were funded), but unusual in what was funded and what did not. When all was said and done, 7 new projects were funded totaling over $900,000 in funding. Unfortunately about half of that funding is allocated towards off campus subcontracts and, more importantly, much of that success was with either New York State, US EPA or DOC-IOOS proposals, all projects that have significant "pre-award" requirements. As a result, 90% of that funding is tied up in contract negotiations and it is uncertain when we will actually see any of that funding. Thus we continue to be paper-rich but cash poor. My biggest need right now is for a simple, single investigator project through NSF geared to basic research.

Great Lakes Research Consortium – We hired our new Assistant to the Director Heather Carrington and she has taken over many of the duties of the office. Her hiring puts additional stress on the need for us to establish a long term funding base for GLRC as I am currently supporting her on soft money. We had modest success in obtaining funding from Department of States via NYOGLECC and from Department of Environmental Conservation via GLBAC for her position, but those funds have yet to make it through the contract negotiation stage. This again has required a tremendous amount of effort for the gains received, including a number of trips to Albany to discuss the situation with DEC and DOS personnel.

Teaching: I continue to enjoy teaching professional chemistry (FCH495) as it provides me with an opportunity to meet all of the undergraduates that pass through our program. I would rate this year's class as average – some good students but many just putting in the required time. FCH-531 (Biochemistry lab) proceeded well under the able guidance of Jeremy Sullivan (TA) and I am confidence he will be able to handle the class next year in my absence.

Sabbatical: I was forced to delay my departure for Ireland to deal with the GLRI research proposal deadline but left in March for 1 week and May for the 8 months until December.

Prospective Summary

I hope to have a productive sabbatical leave in Ireland. I choose this institution (Cork Institute of Technology) because they have 5 LC-MS/MS instruments. Obtaining a similar instrument for ESF is my number one at ESF. A recent proposal reviewer highlighted the fact that our institution is behind the game in this regard and doubted we would be able to continue to publish without one. We already see that in contracts where we were not considered since we lack the

instrumentation. There are few funding agencies (NSF) that would consider such a request from ESF seriously. However the last two available calls, I have been denied permission by ESF to prepare a proposal since we were limited to one per institution. I think we could write a very competitive proposal for the instrument combining efforts across three campuses, and similar to the MALDI-TOF mass spectrometer, I think this instrumentation would have very broad appeal across the campus once people found out what you could do with it. However if I cannot apply for the instrument, that puts me in a very awkward position of not being able to continue my core research activities here at ESF.

A ONE PARAGRAPH SUMMARY OF SIGNIFICANT ACTIVITIES/ ACC0MPLISHMENTS

As with prior years, my efforts last year were split between the Great Lakes Research Consortium and our existing monitoring and response program for toxic cyanobacteria in the Lower Great Lakes. We have significantly increased our visibility in the Great Lakes Observing System efforts, and that work has translated into new funding totally nearly $1,000,000 obtained this past year. I was honored by the Northeast Algal Society when they awarded me their Frank Shipley Collins Award for 2010 in recognition of my service to the society. This is probably the first time n the history of the society that a chemist has won that award. I also received the E.T.S. Walton award from the Science Foundation of Ireland, a prestigious visiting professorship that will form the basis of my sabbatical leave to Ireland. Working with Dave Kiemle in A&TS, I also successful purchased our new MALDI-TOF mass spectrometer. This was a result of a two year effort to obtain funds from the Department of the Army, and required that we obtain more than $150,000 in matching funds. These funds came from over 20 different research groups, showing the broad appeal for that instrument. The MALDI-TOF now as a user base of more than 35 different users and in 6 short months has become the second most popular tool in the A&TS group of instruments. I published more than a dozen papers in calendar year 2009, was invited to present 11 seminars at local, national and international venues, and had one student complete her MS degree in the GPES. Equally important, I successfully got out of Syracuse for my sabbatical leave in Ireland and hope to have a fruitful sabbatical on the Emerald Isle.

Faculty of Chemistry

June 1, 2009 - May 31, 2010

I. *Instructional Activities*

A. *Graduate Course Offerings*

FCH-997 Graduate Seminar.
Fall Semester
Spring Semester

Guest Lecturer Activities

- 5/20/2009 DOE Annual merit review, Washington DC " ***Polymer-Based Activated Carbon Nanostructures for H2 Storage***"
- 7/27/2009 University of Krakow, Krakow Poland, "***Membrane for Fuel Cell***"
- 8/02/2009 University of Mine, Frankfurt German "***Membrane for fuel cell***"
- 8/22/2009 Weizmann Institute of Science, Rehovot, Israel ***"Electrosynthesis."***
- 4/25/2010 PoroGen, Boston, MA. ***"PEEK Hollow Fiber Membranes."***

II. *Advising and Counseling*

***Graduate Students* - Ph.D.**

1. Nan Qin RA + Summer Support
2. Anna Flach TA + Summer Support
3. MinYu Li TA +Summer Support
4. Sean Nicholson (Undergraduate student, part-time research support)

Research Assistants

1. Dr. Youxin Yuan - Senior Research Scientist (Research Full Salary)
2. Dr. Fred Johnson - Post-Doc (Research Full Salary)

3. Shirley Wilbur - Secretary (half time) the Polymer Research Institute (and Graduate Student Recruiting Efforts etc.)

III. *Research*

B. *Grant-Supported Research*

1. Department of Energy (DOE): "*Nano-Structured Activated Carbon for Hydrogen Storage",* (5/2/05 – 05/30/10), $1,530,000 as a part of Energy Storage).
   Grant allocation for 5/1/09 – 6/30/10. $200,000

2 United States D.O.E. & Giner, Inc. $210.000, 8/1/06 – 6/30/10.
Fuel Cell Membranes. (Approved for continuation allocation for 4/1/09-4/30/11).

3. Center for Membrane Engineering Science, $49,817.
   07/01/97 - 12/31/11.

Industrial Grants

1. Dow Corning Corp. – $35,917.05 - 12/31/11.
   Research Fellowship in the Field of Siloxane Polymers and Polymerizations.

2. Union Carbide Corporation (Praxair) - $57,174.39 - 12/31/11,
   Fellowship for Research in Polymer Membranes.

Others:

1. Campus Royalty Patent Income – from patent. $8,036.00.

2. Sponsored Program Individual Res. Incentive Allocations.
   For 2007-2008. $2100

Proposals

1. Proposal to United States D.O.E., for. ***"Grand Challenge for Basic and Applied Research." Hydrogen Storage: (Nano-Structured Activated Carbon for Hydrogen Storage).*** **Budget period: 6/30/10—12/30/10. Cont. extention, Funded in part.**

2 Pre-Proposal to United States ARPA D.O.E. (Feb. 2010): ***"PEEK Fibers for CO_2 Adsorption"*** (with PoroGen). Approved by ARPA-Energy (DOE) for

3. submission of **full proposal** which was submitted at **March/2010** for $1000K to ARPA-DOE. DE-PS36-05GO95020.

4. Proposal to NASA Research and Education Support for Graduate Student Researches Program “Synthesis and Characterization of Crosslinked PMDSF (Poly(perfluoro(4-Methyl-3,6-dioxaoct-7-ene) Sulfonyl Fluoride) Membrane for High Performance PEM Water Electrolyzer” by graduate student Anna Flach (May, 2010).

5. Proposal for Continuation of ***Fuel Cell Membranes Research*** by DOE via Giner Electro. (Feb/2010). Approved for funding $50K.
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Publications

1. Frederick Johnson, Israel Cabasso, “Synthesis and Mechanism of PBI Phosphonate, Poly[2,2’-(-m-phenylene)-5,5’-Bibenzimidazole Phosphonate Ester], and its Polyphosphonic Acid Derivatives” ***Macromolecules*** **Vol 43, P3634-3651 2010.**

2. Israel Cabasso and Youxin Yuan “Polymer Based Activated Carbon Nanostructure for H_2 Storage” ***DOE 2009 Annual Review***, Published June,2009.**http:/www.hydrogen.energy.gov/ http:/www1.eere.gov/vehiclesandfuels/**

3. Cortney K. Mittelsteadt*, William Braff , Shelly VanBlarcom, Han Liu, Israel Cabasso, Fred Johnson **“Dimensionally Stable Membranes™”** ***DOE 2009 Annual Review***, Published June,2009.**http:/www.hydrogen.energy.gov/ http:/www1.eere.gov/vehiclesandfuels/**

4. Anna Flach, Frederick Johnson, Courtney Mittelsteadt, Youxin Yuan, and Israel Cabasso ***“Synthesis and Sulfonamide Derivatization of Poly(perfluoro(4-methyl-3,6-dioxaoct-7-ene) Sulfonyl fluoride – Co- chlorotrifluoroethylene) Copolymer for Use as Fuel Cell Membrane”.*** Poster, International Symposium on Ionic Polymerization, 26-31 July, 2009 Krakow, Poland.

Submitted:

6. Israel Cabasso, Sounding Li, Xinwei Wang and Youxin Yuan ***"Synthesis of Polymer-Based Activated Carbons and Their Hydrogen Uptake"*** J. Mat. Sci. Submitted May, 2010.

7. Mingyu Li, Youxin Yuan, Stuart W. Tanenbaum, Israel Cabasso "Concurrent Production of Biofuels and Hydrogen by Electrochemical Reformation of Bio-derived Levulinic and Lower Fatty Acids". ***J. American Chem. Soc.,*** May 2010

IV. *Public Service*

1. ESF Search Committee for a candidate "Energy Renewable"

2. Organize the International Symposium on Ionic Polymerization of Dr. M. Szwarc at Krakow, Poland. for 100th memorial

3. Reviewer of 16 proposals (primarily for the DOE, NIH, NSF, U.S. Department of Commerce).

4. Reviewer of 17 papers for the following Journals: J. of Memb. Sci, J. of Polym. Sci. (Chemistry and Physics), J. of Appl. Polym. Sci., Macromolecule, J. of Ind. Chem Res., Separation Sci., Desalination, J. Chem. Eng., J. Electrochem, and Journal of Materials Science, J. of Polymer Sci...

5. Reviewer of Fuel Cells, for the State of Connecticut.

6. Collaboration on Molten Carbonate Fuel Cell, for ESF

7. On the USA Foreign Services board of reviewers, this year review 8 proposals on Desalination of sea water in South Arabia.

VI. *Administrative Service*

- Director, Polymer Research Institute
- Curriculum Director for Faculty of Chemistry (Graduate Students)
- Co-Director, Membrane Center, SU-ESF
- Examiner in Comprehensive and Thesis exams in ESF and S.U. students.
- Doctorate Defense Committee.
- Administered ACS Evaluation Exam for new incoming graduate students.

VII. *Miscellaneous (Scientific)*

-- Editorial Board of "*Membrane & Desalination" (The International Journal of Science Technology for Water Desalination and Purification).* Elsevier.

-- Review Board of National Institutes of Health.

-- Member of NSF-EPA Proposal Review Committee on Polymer Use for Env. Science.

-- On the Board of Directors of PoroGen Corp. (Boston, MA).

-- Member of the Board of "Fuel Cell Research" of the University of Rochester, Rochester, New York.

Industrial Consulting

- Dow Corning (Michigan)
- Praxair (Membrane Division) (Massachusetts)
- PoroGen LLC (Massachusetts)
- E.C.R. Electrochemistry (Israel).
- Giner, Inc. (Massachusetts)
- Biomedical Development Corporation (Texas)
- National Res. Sci (Canada)
- Shiva Technologies, Inc

VIII. Retrospective Summary:

Our research on high surface area carbon (for the absorption of hydrogen) has the continuing support from the DOE within the frame of the Grand Challenge for Basic and Applied Research in Hydrogen Storage (Nano-Structured Activated Carbon for Hydrogen Storage). The budget for the year 2009 – 2010 has been approved, including our share (note that this project has been funded after winning a highly competitive grant proposal submitted to the DOE). This past year, we continued to submit four (4) quarterly, and one annual report to the U.S. government on each of our projects. Fuel Cells and Hydrogen Storage and have to attend Annual DOE. Peer Review Conferences. The continuation of Hydrogen project this year is a direct result of the efforts of Drs. Youxin Yuan, and the graduate student, Nan Qin. It has to be **recognized** that the efforts of these individuals led to the most significant achievement of the DOE. Hydrogen Storage Program, where the activated carbon produced in our laboratory has been determined by five outside laboratories (including two National Laboratories) which have concluded that our carbon is the best ever product for gas adsorption and storage.

Our collaboration with DOE-Giner Inc. (Dr. Courtney Mittelsteadt) in "Developing High Temperature Low-Humidity PEM Membranes for Fuel Cells," continues, this also require 4 quart. and one annual reports submitted to the DOE, (a grant of approximately $70,000 annually (our share)), This has been supported by the DOE, and the continuation has been the result of the good work conducted by Dr. Fred Johnson and graduate student Anna Flach. The graduate student Ann Flach won ESF travel award $700 for present this work in the ISIP at Krakow, Poland.

Research on the development of fuel cell technology has continued in collaboration with the United States Department of Energy, Giner Inc. and with Lawrence Berkley National Laboratory and UC Berkley.

Our new project of "production of biofuels and hydrogen by electrochemical reformation of bio-derived levulinic and lower fatty acids" with the collaboration with Prof. Stuart Tanenbaum, whose novel ideas about the conversion of biomass into liquid fuels via electrosynthesis has significantly improved. This work conducted by Dr. Youxin Yuan and graduate student Mingyu Li proved very successful in producing high octane fuel and bio-diesel, and hydrogen. We submitted this work to JACS and presented in the ESF Spotlight on Student Research & Outreach 2010.

In addition, we had Mingyu present a Poster in the ESF Spotlight on Student Research & Outreach April 13, 2010 Syracuse, NY. MingYu Li, {Y.Yuan, S.Tanenbaum and I.Cabasso}***"Production of Biofuel and Hydrogen by Electrochemical Reformation of bio-derived levulilic Acid".***

Additional collaborations with Syracuse University, SU, Rochester University, PoroGen (Boston), National Laboratories and others continue.

During past year, Nan Qin successfully passed the Doctoral Candidacy Examine and Mingyu Li passed the physical chemistry and organic chemistry qualifying examine.

IX. 19th IUPAC INTERNATIONAL SYMPOSIUM on IONIC POLYMERIZATION 2009

For several months until the end of the summer 2009 we (PRI) were engaged in organizing the 19th IUPAC INTERNATIONAL SYMPOSIUM on IONIC POLYMERIZATION 2009; in honor of the 100th anniversary of the birthday of Michael Szwarc. The symposium was held in July/ 26 – 31, 2009, in Krakow, Poland. M. Szwarc had obtained the M.Sc. in Chemistry Warsaw Technical University1932, and *Doctor Honoris Causa*, Jagiellonian University Krakow, 2000 where the IUPAC symposium was held.

PRI (SUNY ESF) and the Center of Macromolecule of the Polish Academy of Science organized the one week conference under the auspices of the IUPAC and the support organizations logos of which are shown below. ESF's Research Office contributed modest funds for travel expenses (and $700 for Anna travel from the Grad. Office).

About 400 scientists and graduate students from **all over the world** attended the one week symposium, 60 oral presentations were given and 65 posters were shown (included one from ESF by Anna). IUPAC has published the whole symposium on series of 4 CDs. This international conference has been quite an impressive undertaking, which has spread the glory of SUNY ESF, its department of Chemistry and the PRI on five continents (ESF campus seems to care less.)

IUPAC's polymer sponsorship 2009

IP'09 is the 19th in the series of biannual symposia which began as the International Symposia on Cationic Polymerization, and which later merged with the Symposia on Anionic Polymerization and on Ring-Opening Polymerization.

IP'09 will address contemporary research, both fundamental and applied, in the areas of anionic, cationic, and ring opening polymerizations. Papers related to other techniques of living/controlled polymerization are welcome in so far as they broaden the scope of ionic polymerizations. The Symposium also incorporates a limited number of contributions on the properties and analysis of materials prepared by techniques of controlled polymerization. All of the oral presentations are planned to be 25-30 min. There also room for approx. 100 poster presentations.

The Symposium venue is Auditorium Maximum of the University, Krakow

The M. Szwarc Polymer Research Institute
State University of New York - esf

Centre of Molecular and Macromolecular Studies
Polish Academy of Sciences, Lodz, Poland

Jagiellonian University
Krakow, Poland

Under auspices of:

International Union of Pure and Applied Chemistry

European Polymer Federation

Polymer Section, Polish Chemical Society

,

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Statement of Accomplishments
Paul Caluwe
September 1, 2009 – May 31, 2010

Instruction

Fall

FCH 221 Organic Chemistry I, 3 credit hours, 83 students took at least one test in this class.

Spring

FCH 223 Organic Chemistry II, 3 credit hours, 60 students took at least one test in this class.

Assessment

This academic year's assessment is identical to the one reported last year.

Student Advising

Advisor to two undergraduate students.

Research

My collaboration with Steve Keller on polyfunctional carboxylic acids as crosslinking agent for cellulosic materials has apparently come to a standstill. I have not heard from Steve this past academic year.

Publications

None this year.

Proposal Submitted

None

Computer Software Development

Upgrading the graphic content, *i.e.* very detailed structural formulas of organic compounds, of my chemical database to modern computer graphic standards proved to be a very frustrating exercise in manipulating graphics standards. Although ChemDraw is the standard method to create organic structure structural formulas, it is mainly used for high-resolution printout on paper. It is far less accommodating in exporting structures for high quality display on computer screens, which is what is needed for my purpose of placing my chemical toxicity database on the web. After lots of trial and error I found a workable solution by first drawing the organic structure in ChemDraw (without the PostScript part of the program), then copying the sketch into Excel as a graphics file, and from there export it as a PNG graphics file. So far I have created more than 1700 formulas and linked them with the appropriate toxicity information in my database.

Administrative Service

- Chair Organic Preliminary Examination Committee, Department of Chemistry
- Chair candidacy examination committees at ESF

ACADEMIC STAFF -- ANNUAL REPORT

Avik P. Chatterjee
FACULTY OF CHEMISTRY

May 15, 2009 - May 14, 2010

I. **Instructional Activities:**

A. Undergraduate Course Offerings:
FCH 360: Physical Chemistry I: Fall, 2009: 42 students

The average score for the entire class of 42 students was 70.4 %. By way of comparison, the average score for the ten (10) Chemistry majors who were in this class was 67.3 %, slightly lower than the average score for the entire class.

Participated (along with Profs. Dibble and Kieber) in administering the graduate preliminary examination in the area of Physical Chemistry

B. Graduate Course Offerings:
None

C. Continuing Ed Courses and Workshops:
None

D. Guest Lecturer Activities:
None

E. Service Learning Courses/Activities:
None

II. **Student Advising and Counseling (Undergrad and Grad):**
Served as advisor (as best I could) to four undergraduate students, and to one graduate student

III. **Research and Other Scholarly Works:**

A. Departmental Research:
None

B. Grant-Supported Research (Existing grants plus grants pending):
None

C. Publications (including *only* published articles, for which volume and page numbers are available, Licenses, Inventions and Patents, Awards):
1. D.A. Prokhorova and A.P. Chatterjee, "Elastic moduli of cellulose-nanoparticle reinforced composites: A micromechanical model", *Biomacromolecules*, vol. **10**, 3259-3265, (2009).

IV. **Public Service and Outreach:**

A. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.:

Acted as a referee for manuscripts submitted for publication to the "Journal of Chemical Physics", and as a reviewer for proposals submitted to the National Science Foundation (NSF).

B. Funded Service Projects:
   1. Government Agencies
      None

   2. Industrial and Commercial Groups:
      None

V. **Professional Development:**

A. Professional Organization Activities:
   None

B. Leaves, Additional Assignment, etc.:
   None

C. Course Work, Workshops, etc.:
   None

VI. **Administrative and Faculty Governance Service:**

A. Faculty:
   None

B. College:
   Participated as the external Chair for one MS defense of thesis examination (for a student in the Env. Science program), and in one doctoral candidacy examination (Form 2), as the major professor of a doctoral student in the Department of Chemistry. It greatly saddened me that my doctoral student came to the decision to not seek a Ph.D and to pursue a MS degree instead.

C. University, including Research Foundation:
   None

Retrospective:

In work reported in: D.A. Prokhorova and A.P. Chatterjee, *Biomacromolecules*, vol. **10**, 3259-3265, (2009), it was shown that our microscopic model that combines percolation theory with the methods of continuum elasticity can quantitatively describe the linear elastic coefficients of cellulose-reinforced nanocomposites. Quantitative comparisons were made to several rather different systems, and the agreement between theory and experiment in each case was very satisfactory. I am very pleased with how successful this work has been, partly on account of the fact that the theory involves only a single adjustable fitting parameter, and also given the time and effort that was expended upon both developing our model to this point, as well as in acquiring and checking and verifying and collating a sizeable volume of experimental measurements, that had been published previously in separate, piecemeal fashion by a number of different groups of workers, each engaged in the study of their own systems.

The cohort of students who took Physical Chemistry I (FCH 360) in Fall, 2009, was almost certainly the largest that I have had thus far in this course. The sheer size of the class (42 students

at the end of the semester; perhaps as many as 47 or 48 at earlier points, prior to the deadline for dropping a course), and the wildly varying levels of prior preparation that the students had, made for a challenging and interesting semester. Each year, I find myself thinking that this time I really have "seen it all", and that the level of incivility, sheer lack of preparation for college/university-level academic work, and absence of basic decorum, not to mention functional literacy and numeracy, simply cannot sink any further. Each year, I am surprised and disappointed anew. During this term (Fall 2009), it came to my attention that copies of notes and of solutions to problems that I place on reserve at the library for the benefit of the class had been mutilated and defaced, and that entire sections of material had been removed. While I am perfectly well aware that this was almost certainly the act of a single, isolated, individual, it is also unfortunately the case that this experience is likely to alter what materials I place on reserve/make available to the class in future, and in what format.

In all fairness, however, I must also hasten to add that our finest and best-prepared students are indeed excellent, and a real joy and pleasure to work with. It disappoints me that the wide range of abilities and levels of preparation that are evident in the classroom makes it quite difficult to challenge and stimulate the brightest/most gifted minds in the room, whilst simultaneously attending to the needs and difficulties of the average person, as well as addressing a helping hand towards the complaints and laments of those who are truly struggling (or straggling).

In preparation for teaching both halves of Physical Chemistry, I and II (FCH 360 and 361), I also put a significant effort into generating a complete set of lecture notes for FCH 361, and am in the midst of constructing a set of example and homework problems/assignments to go along with this. My objective is to (insofar as feasible) construct a *de facto* "textbook" of my own for both FCH 360 and 361, one that can be made available readily to the students. Three of the most important factors that motivate me to proceed this way are: (i) in order to emancipate myself, and my class, from frequent revisions/alterations made to textbooks with each new edition; (ii) the burgeoning cost of textbooks, by no means an insignificant expense, and: (iii) the students seem to find it quite helpful, and almost universally, they seem to like the fact that I try to do this.

Prospective:

Over the course of the first months of 2010, a number of promising and fascinating ideas came to me regarding the area of percolation by fibers/nanoparticles characterized by a wide range of aspect ratios ("shape polydispersity"). I have been following up on these thoughts, and have reason to think that I may have stumbled upon a method to relate together: (i) the well-studied and quite well understood Bethe lattice model, (ii) certain mathematical results that are most widely used in the area of network science, particularly that of "scale-free networks", and (iii) continuum percolation by elongated particles in three dimensions. Such a synthesis could be of great value and utility, as it would make possible the application of very well understood lattice methods towards the more complex continuous space problem. Additionally, it will likely provide a simple and elegant pathway towards a rigorous description of effects due to polydispersity. It should be noted that, although polydispersity is ubiquitous in all real-life experimental systems, it has been the subject of a bare handful of careful theoretical studies. A preliminary account of my work in this area, providing an outline of this new approach that is based upon physical reasoning and mathematical analogy, has been submitted to the *Journal of Chemical Physics* and is under review by that journal at the present time. I also plan to pursue my efforts in the area of heterogeneous fiber networks and fiber-based composites, and the impact of non-uniformities in the dispersion of filler particles within the matrix. As it happens, this was the problem that I was working on when, completely unexpectedly and in serendipitous manner, the insight regarding a modified Bethe lattice approach occurred to me. I paused to complete work on the latter problem and submit a quickly written manuscript containing my

findings, given that this is topical and of timely interest. Now that that is well on its way to completion, I plan to return to the problem that had originally been the subject of my attention.

In terms of teaching, I have to admit that it is with some trepidation that I look forward to teaching both halves of Physical Chemistry (FCH 360 and 361) in alternate years. It has been a number of years since I have last worked with quantum mechanics or kinetics, and in some ways, I welcome the opportunity to re-learn these subjects that teaching this class will most assuredly provide. Progress is being made with regards to putting together what I hope will become a completely self-contained set of lecture notes/"reader" for both courses, one that the instructor for Physical Chemistry II (FCH 361) in alternate years, Prof. Ted Dibble, will of course be free to use/adopt for his use in case he feels that that would be of assistance to him.

Summary of activities and accomplishments during this reporting period, especially those most noteworthy and relevant to the College's and Department's mission:

To the extent that scholarly activity in the area of polymer science and polymer physics pertains to the broader mission of our Department and College (and I feel that this is indeed of central importance), the successful validation of our theory for the elastic properties of cellulose nanocrystal-based composites that came within this past year was of great personal satisfaction to me, and gave me a sense of true accomplishment. In a similar vein, I have high hopes that my most recent work in the area of relating percolation on a modified Bethe lattice to the formation of networks among polydisperse, elongated nanoparticles is likely to open a number of new, promising, avenues of investigation, and enable new lines of inquiry, on long-standing problems in the field of nanocomposites.

ACADEMIC STAFF -- ANNUAL REPORT

Theodore S. Dibble
FACULTY OF CHEMISTRY

May 15, 2009 - May 15, 2010

I. Instructional Activities

A.Undergraduate Course Offerings

FCH 511, Environmental Chemistry II (3 credits), Fall 2009, 1 undergraduate.
FCH 361, Physical Chemistry II (3 credits), Spring 2010, 14 undergraduates.

FCH 361- Physical Chemistry II

This was my eleventh time teaching FCH 361 (Physical Chemistry II). *Exercises* were assigned to prepare students for quizzes testing ability to use single equations. Following quizzes I presented in-depth discussions of the meaning of equations and relationships between quantities. Graded *Problems* were assigned to prepare students for exams. *Problems* required multiple calculations to arrive at an answer, and also tested conceptual understanding. One day of class time was spent doing a partial analysis of a published paper. This allowed the students to become aware of how much they could accomplish with the material they had learned.

I sketch out homework answers in class before collecting student answers for grading. I make it clear that students may make notes on my answers on their homework, but that they must do so in a way that distinguishes their work before class from my answers or notes made during my explanations. I encountered no cheating this year, as opposed two incidents last year.

Assessment of FCH 361

a. Data Collected - Average and median scores on the final exam and each of the three hour exams. The instructor's rating of the conceptual difficulty of the calculation questions and the difficulty of the conceptual questions.

b. Results and Conclusions

The final exam performance average (average 50%, median 50%) is far worse than the average on any of the three one-hour exams (averages of 69, 67, and 76%, and medians of 70, 70, and 82%) when the difficulty level of the questions are similar between the final and the one-hour exams. A similar effect on the average was observed in the past, except in two years when questions on the final exam are significantly more straightforward (plug and chug) than the questions on the three one-hour exams during the semester. In those two years, performance on the final exam was comparable to that on the one-hour exams.

I conclude that a significant amount of the knowledge, both conceptual and calculational, demonstrated on the one-hour exams is not retained by most students. It is also possible that the apparent ability displayed on the one-hour exams cannot readily be brought to bear on problems in the context of the larger body of knowledge needed for the (comprehensive) final exam. It has been repeatedly observed that a majority of students forget even the most basic knowledge of chemical equilibrium (taught in FCH 360: Physical Chemistry I) between the end of the Fall semester and the beginning of the Spring semester.

c. Actions taken in response to assessment results

In many chemistry courses, knowledge from early in the semester is needed later in the semester, so that old learning is continually reinforced. This is much less true in FCH 361, given the structure: five weeks on each of the following units: 1) electrochemistry and transport; 2) chemical kinetics; and 3) quantum mechanics

This structure limits the extent to which old information is *required* to be revisited; so more conscious efforts will be made to reinforce concepts across / within each of the three main units.

Also, since many students are visual learners, greater use will be made of graphs, diagrams, and animations to help reinforce key concepts.

d. Modifications of assessment plans

A survey will be administered after each one-hour exam to determine which teaching modalities and assignments the students found most useful for learning that material. The survey will also include questions on what the students think they could have done to better prepare for exams (to prompt them to do those things for the next exam). These surveys will be administered anonymously via Blackboard.

I also will have at least one colleague sit in on class and evaluate my in-class teaching.

Note that the curriculum of FCH 360 and 361 do not correspond terribly well with the material covered by the ACS standard exam on Physical Chemistry. If that exam is to be used as an assessment tool, our students will perform rather poorly unless the contents of both courses are significantly altered.

FCH 511- Atmospheric Chemistry

This was my twelfth time teaching FCH 511 (Atmospheric Chemistry). Two in-class exams and a take-home final exam determined 70 percent of grades, along with projects (10%) and homework (20%). Nine homework assignments prepared students for exams and projects. Homework was divided between ungraded *Exercises* and graded *Problems*. *Exercises* tested factual knowledge and basic skills. *Problems* required students to put together their knowledge by carrying out multiple calculations to arrive at an answer and also tested conceptual understanding. Projects demanding students exercise critical thinking skills regarding the construction of input to computer programs/spreadsheets and in the analysis of computed results. Many critical thinking activities were carried out in class.

Assessment of FCH 511

a. Data Collected

Scores on homework assignments, projects, two in-class exams and a take-home final.

b. Results and Conclusions

Students largely appeared to master the tools for gas phase kinetics calculations. They evidenced more difficulty in understanding connections between coupled chemical cycles in the stratosphere and troposphere. With only three students in the class, generalized conclusions are difficult to make.

c. Actions taken in response to assessment results

Additional time in class and homework assignments on linking coupled chemical cycles. More time in group work.

d. Modifications of assessment plans

I plan to have at least one colleague sit in on class and evaluate my in-class teaching.

B.Graduate Course Offerings

FCH 511 Environmental Chemistry II, Fall 2009, 2 graduate students. See above.

FCH 796 Theoretical Kinetics, Fall 2009, 3 graduate students.

FCH 899, M.S. research. 2 students in Fall 2009, 2 in Spring 2010

Karen Schmitt will defended her M.S. thesis in Summer 2010. She has made extensive progress on kinetic modeling of irradiation of humid air, and is also set to carry out experiments after having sorted through some unforeseen analytical difficulties. Her first paper on the kinetic modeling was published in *Plasma Chemistry and Plasma Processing*. Another modeling paper is being written, if we can get past gaps in the kinetic data needed for modeling.

Yue Zeng is in her second year; she succeeded in raising her GPA to a 3.0 after a disastrous first semester of her first year. She participated in research this year, partly working on rebuilding and testing the laser pulsed photolysis-laser induced fluorescence apparatus. She also coauthored a manuscript on the reaction products of the H + HOCO and N + HOCO reactions, which are important in electron beam processing in humid N_2.

FCH 999, Ph.D. research. 2 student in Fall 2009 and Spring 2010

Hongyi Hu has finished her coursework and passed both preliminary exams. In the Fall she focused on computations, but since January she worked at the National Center for Atmospheric Research, carrying out experiments on deuterium isotope effects in the atmospheric chemistry of methoxy radical. She will take her candidacy exam in Fall 2010.

Jiajue Chai passed the Preliminary Exam in Analytical Chemistry and will retake the P-Chem Exam in the Fall. He has encountered a lot of problems with rebuilding the LIF apparatus, but we have been making good progress lately.

C. CE Courses and Workshops -none

D. Guest Lecturer Activities - none

E. Service Learning - none

II.Student Advising and Counseling

I advised two (2) undergraduate students and four (4) graduate students.

III. Research and Other Scholarly Works

A.Departmental Research - none

B.Grant-Supported Research

1) NSF Chemical and Transport Systems "Fundamental Physical and Chemical Investigations of Electron-Beam Plasmas" ($340,562, 1/1/07 - 12/31/10). With Mark Driscoll of ESF and Chuji Wang of Mississippi State University (MSU). This proposal is in the sixth month of a 1-year no-cost extension. It now only supports the sub-contract with MSU.

2) DOE Chemical Physics "SISGR: Dynamics of Radical Reactions in Biodiesel Combustion" ($327,000, 9/15/09 - 9/14/12). This currently supports a postdoc.

3) NSF Atmospheric Sciences "Isotope Effects in Methoxy Radical Kinetics" ($468,932, 1/1/2010 - 12/31/2012). This currently supports two graduate students for the calendar year and one for the summer.

4) Pittsburgh Supercomputing Center, Developmental Allocation grant of 20,000 service units. 1/15/09 - 7/14/10. The new Linux server purchased with funds from the DOE grant means that a new Developmental Allocation is probably not needed.

Other Proposals

5) "Atmospheric Chemistry of Mercury" (277,168, 5/1/10 - 4/30/13), submitted to NSF Chemistry, declined.

I have three collaborations that does not involve joint funding:

- Terry A. Miller (Ohio State University): fluorescence spectroscopy of alkoxy radicals with intramolecular hydrogen bonds. This seems likely to be making progress soon.
- Vince DeTuri (Ithaca College): kinetics of the HO_2 self-reaction in aqueous solution
- Yi Luo (Royal Institute of Biotechnology, Stockholm, Sweden): gas phase chemistry of elemental mercury. Significant progress has been made by one of Dr. Luo's graduate students.

Publications

1) A study of OH radicals in an atmospheric AC discharge plasma using near infrared diode laser cavity ringdown spectroscopy combined with optical emission spectroscopy, C. Wang, N. Srivastava, and T. S. Dibble, *Eur. J. Phys. D*, **2009**, *54*, 77-86.

2) Towards a Consistent Chemical Kinetic Model of Electron Beam Irradiation of Humid Air. K. L. Schmitt, D. M. Murray, and T. S. Dibble. *Plasma Chem. Plasma Proc.*, **2009**, *29*, 347-362.

3) Observation of OH Radicals in the Far Downstream Part of an Atmospheric Microwave Plasma Jet Using Cavity Ringdown Spectroscopy. C. Wang, N. Srivastava, and T. S. Dibble, *Appl. Phys. Lett.*, **2009**, *95*, 051501.

In Press and Submitted

4) Atmospheric Chemistry of Isopropyl Formate and tert-Butyl Formate. A. S. Pimentel, G. S. Tyndall, J. J. Orlando, M. D. Hurley, and T. J. Wallington, M. P. Sulbaek Andersen, P. Marshall, and T. S. Dibble, *Int. J. Chem. Kinet.*, in press.

5) Potential Energy Profiles for the N + HOCO Reaction and Products of the Chemically Activated Reactions N + HOCO and H + HOCO. T. S. Dibble and Y. Zeng, *Chem. Phys. Lett.*, submitted.

Posters and Talks:

"Organic Chemistry in the Atmosphere." Talk presented at Juniata College, 9/23/2009.

"Some Aspects of Atmospheric Isoprene Chemistry." Talk presented at the NorthEast Regional ACS Meeting, October 2009, in Hartford, Connecticut.

"The Mechanism of Furan Formation From Atmospheric Oxidation of Butadiene." Poster presented by my student, Hongyi Hu, at the NorthEast Regional ACS Meeting, October 2009, in Hartford, Connecticut.

"Developing a Consistent Chemical Kinetic Model for Electron Beam Irradiation of Humid Air" Poster presented at 62nd Gaseous Electronics Conference in Saratoga Springs, NY, 10/23/2009.

"Computational Chemistry Investigations of Organic Radical Chemistry in the Atmosphere." Invited talk at the Royal Institute for Bioechnology, Stockholm, Sweden, March 4, 2010.

IV. Public Service

A. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.

Editorial Board: International Journal of Chemical Kinetics

Proposal Reviewer:

DOE Chemical Physics New Investigator Program (4 proposals)
NSF Chemistry (1)

Manuscript Reviewer (10 in total)

Recognized as being in the top 20% of reviewers for the *Journal of Physical Chemistry* for 2009

B. Funded Service Projects

1. Government Agencies -

Faculty mentor on the NSF STEM grant awarded to Dr. Donaghy.

2. Industrial and Commercial Groups

V. Professional Development

A. Professional Organization Activities

I co-organized Environmental Chemistry sessions at the NorthEast Regional ACS Meeting in October 2009 (NERM 2009). The 30 speakers and 13 posters represented about 12% of all technical presentations at NERM2009.

B. Leaves, Additional Assignment, etc. - none

C. Course Work, Workshops, Attended 31st Annual DOE Combustion Contractors Workshop.

VI. Administrative and Governance Service

A. Faculty

Member of the Preliminary Exam Committee in Analytical Chemistry, administered to 8 students.

Member of the Preliminary Exam Committee in Physical Chemistry, administered to 3 students.

Department Seminar Committee. I hosted two speakers and co-hosted another. As Chair of this committee, I encouraged colleagues to invite speakers, resulting in a total of 13 seminars for the academic year.

Graduate Recruiting and Publicity

1) Web pages - arranged fixes to many pages and links, as well as updates. This included e-mail addresses of faculty! Updated Environmental Chemistry Web pages (list of current/recent students) and reorganized description of research and coursework there.
2) Arranged offer of free talks to be sent twice to neighboring colleges and universities.
3) Organized mailing of graduate poster to about 570 schools.
4) I arranged a classified ad in *Eos*
5) Arranged for a brief note about our graduate program to be distributed to all upper division chemistry majors as well as to Chemistry advisors at The Ohio State University.
6) Administered survey of graduate students entering Fall 2008 (when our yield was high) to compare with Fall 2009, when our yield was low.

B. College

Empire Innovations Initiative. I was actively involved in creating evaluation criteria and evaluating candidates for the sub-panel on Quantitative Analysis. I invited several people to apply, including one of those eventually hired: Dr. Huiting Mao. I gave (with Chuck Kroll) the campus tour to three interviewees, and hosted one thematic group meeting and attended two others. I was actively involved in recruiting Dr. Mao during and after her second visit.

Steering Committee for Maria Cabaraban (ERFEG)

C. University, including Research Foundation - none

VII. Outreach - none

Retrospective

This is my fourteenth year at ESF; I was promoted to Professor three years ago. My goal has been to maintain research programs in both experimental and computational chemistry. The focus of my research has broadened from chemistry of the atmosphere to include remediation of polluted emissions and also the molecular mechanisms of biodiesel combustion. Since arriving at ESF, I have published 27 papers in peer-reviewed journals and my group has given about 60 talks and posters.

I have been continuously funded by the Atmospheric Sciences Division of NSF since 15 months after my arrival at ESF, with the exception of a 9-month gap in 2009; I started a new 3-year grant in January. A grant was awarded in Fall 2009 from DoE Chemical Physics for three years to do calculations on reactions of peroxy radicals in biodiesel combustion. I was sole PI on all these proposals, whose total value is $780,000.

I now have four (4) students in my research group, although one will leave by the end of summer after earning her M.S. Students in my courses have expressed appreciation for the depth of understanding they gain from my pedagogical approach.

My work as Graduate Recruiting Coordinator continued this year. I have organized a group of graduate students to suggest improvement to our web site. I have provided extensive service to the profession, both as a proposal and manuscript reviewer and a symposium organizer.

Prospective

The new funding allows be to support two (2) Ph.D. students on Research instead of as GAs., hire a postdoctoral research associate, and provide summer support for an M.S. student. The DOE grant on molecular mechanism of biodiesel combustion represents a new research direction and a new funding source. A proposal (on the atmospheric chemistry of gas-phase elemental mercury) to the Environmental Chemistry program of NSF's Chemistry Division was declined. I am actively seeking an experimental collaborator to get funding for a joint experimental-computational project. My publication rate continues to be strong, with three papers published, one in press, and one under review; scholarly productivity will be increasing as a result of this extensive funding. I plan to continued my high level of service to the department in the areas of graduate recruiting and seminars, and to the profession in organizing symposia and, next year, co-organizing the International Conference on Chemical Kinetics. I continue to refine my teaching approach in Atmospheric Chemistry (FCH 511) and Physical Chemistry II (FCH 361). I will start teaching a graduate-level kinetics course in the Spring of even years.

Annual Report Academic Year 2009/2010

Kelley J. Donaghy
FACULTY OF CHEMISTRY

June 1, 2009 - May 31, 2010

1. **TEACHING**

a. Workload Summary

Year/Semester	Course Number	Course Title	Credits	End of Semester Enrollment	Semester Enrollment Totals (FTE's)
Spring 2010	ESC 296	Environmental Scholars	1	15	
	FCH 152	General Chemistry II	3	116	
	FCH 152	General Chemistry II	3	126	
	FCH 411	Inorganic Chemistry	3	12	
	FCH 496	Service Learning Teaching Experience	1	8	
	FCH 498	Introduction to Research	5	2	
	FCH 796	Advanced Inorganic Chemistry	3	1	
	FCH 899	Masters Thesis Research	2	1	281 (800)
Fall 2009	ESC 296	Environmental Scholars	1	16	
	FCH 150	General Chemistry I	3	124	
	FCH 150	General Chemistry I	3	116	
	FCH 150	General Chemistry I	3	73	
	FCH 798	Research in Chemistry	9	1	330 (964)

b. Curriculum Changes - Introduced the art of chemistry in both Inorganic chemistry and general chemistry. These were developed as a result of the National Science Foundation professional development workshop I attended in June called “The Chemistry of Art”.

c. Awards - None

2. **RESEARCH**

a. Publications/Presentations

i. **Publications**

“Reflections on the Environmental Scholars Retreat”, Kelley Donaghy, *Spruce Moose*, Spring 2010, pg. 8-9.

“Service Learning in General Chemistry”, Kelley J. Donaghy, *Journal of Chemical Education*, *In Preparation*.

Tetrahedral Kites: Connecting Geometry and Chemistry, Kelley J. Donaghy and Anthony C. Fuoco, *Journal of Chemical Education*, Submitted.

ii. Presentations

"Progress toward the synthesis of macromolecules with pendant 1,2-dicarborane groups", Kathleen J. Dugan and Kelley J. Donaghy, INOR-589, Abstracts of Papers, 238th ACS National Meeting, Washington, DC, August 16-21, 2009.

"Pogil-IN: The inorganic chemistry POGIL project", Kelley J. Donaghy, David C. Finster, Susan C. Jackels and Dean H. Johnston and Kimberly A. Woznack, CHED-376, Abstracts of Papers, 238th ACS National Meeting, Washington, DC, August 16-21, 2009.

"Service learning: Good for the community, good for the teacher and great for the student", Kelley J. Donaghy, CHED-017, Abstracts of Papers, 238th ACS National Meeting, Washington, DC, August 16-21, 2009.

"POGIL in Inorganic chemistry courses" David C. Finster, Dean H. Johnston, Susan C. Jackels, Kelley J. Donaghy and Kimberly A. Woznack, CHED-1157, Abstracts of Papers, 237th ACS National Meeting, Salt Lake City, UT, March 22-26, 2009.

b. Grant-Supported Research (Existing grants plus grants pending)

i. Funded

"POGIL-IN: Inorganic POGIL Project." Co-Principal Investigator, $2691 POGIL SPUR Grant (5/15/2009-5/15/2010) Funded.

"Environmental Scholars: A Scholarship Program in Environmental Chemistry, Biology and Engineering." Principal Investigator. National Science Foundation, $600,000 (February 2009-January 2013). Funded.

ii. Pending

"Service Learning in General Chemistry." Principal Investigator. National Science Foundation, $199,858.

"Acquisition of single crystal X-ray diffraction equipment at Syracuse University" with Karin Ruhlandt-Senge, Syracuse University. National Science Foundation.

iii. Not Funded

"REU Site: Environmental Chemistry at SUNY-ESF." Principal Investigator. National Science Foundation, $341,354 (February 2009 – January 2012).

"Taking General Chemistry on the Road." Principal Investigator. National Science Foundation, $163,117 (January 2010 - January 2013).

"Making Inorganic Chemistry Fun: Development of a Studio Course." Principal Investigator, Camille and Henry Dreyfus Foundation, $42,761, (January 2010).

3. OUTREACH AND SERVICE

a. Outreach Activities.

- Member: Board of Directors, Project Watershed (a part of the Isaak Walton League of America).
- American Chemical Society Local Section - Education Chair, Newsletter Editor and Alternative Counselor.
- "Adopt-a-Stream", April 24, 2010.
- "Bring your kids to work day", April 29, 2010.
- "Messy Chemistry Days" at the Manlius Pebble Hill School and the Montessori School of Syracuse, February 16, April 6 and April 22, 2010
- Utica Science Fair, March 27, 2010 Judge.
- Junior Science Olympiad, March 6, 2010
- Science Olympiad Regional Section Division C – LeMoyne College - January 30, 2010 ran the Environmental Chemistry Event.
- National Chemistry Day at the Museum of Science and Technology (MOST), October 2010.
- Weekly Volunteer at Carpenter's Brook Fish Hatchery, February - May 2010.

b. Grant Panel Service

- National Science Foundation Panel Review for Scholarships in Science, Technology, Engineering and Mathematics, Washington, DC, November 4 - 6, 2009.

c. **Editorial Review** - Journal of Chemical Education

d. Other Service -

i. Departmental

Member of Undergraduate Curriculum Committee
Member of the Middle States Assessment Committee (2008-present)
Organized Chemistry Day at the NYS Fair (2009)

ii. College

Member of Learning Community (2006 – Present)
Member of the Committee on the First Year Reading (2006-present (chair 2009))
Faculty Governance – Executive Chair (2010-2012) and SUNY Senator (2008-2011)
Graduate Student Teaching Colloquium (2009)

iii. External

Project ChemLab Annotator
Syracuse Section of the American Chemical Society - Education Chair
Newsletter Editor American Chemical Society

4. SERVICE-LEARNING

a. General Chemistry II - FCH 152

b. The service activities in this course are varied. Each student who chooses to participate in the service track is required to participate in 20 hours of chemistry related community service. For 2010 this involved 118 students who performed 2714 hours of service in chemistry for the semester. Activites include, chemistry demo-days at local schools, presentations at the MOST in collaboration with their education staff, working at Carpenter's Brook Fish Hatchery, hosting an Adopt-a-Stream event for the entire ESF campus and

helping host and organize Science Olympiad. Students often find other events where chemistry is being promoted or directly incorporated in the community work.

c. Instructor input - 4.50 hours per week/semester. Volunteer hours from graduate TA (not a part of their teaching assignments) - 1 hour per week/semester.

5. STUDENT ADVISING AND COUNSELING (UGRAD AND GRAD)

Curriculum Advisor (5): Tyler Kight, Alexander Mottern, Melissa Santos, William Thornton

Undergraduate Researchers (0):

Graduate Students (1):
Kathleen Dugan (MS) - (supported on TA for academic year and by NSF grant for the summer)

Volunteer (1): Brendan F. Dutter (MS)

RETROSPECTIVE

Teaching: The past year was unusually teaching intensive for me. I had 1858 full time equivalents, two course preparations in the fall and four course preparations in the spring. Utilizing new knowledge gained from attending the NSF sponsored workshop "The Chemistry of Art", I was able to pique the interest of my general chemistry I students more and introduced art topics to supplement and teach traditional general chemistry topics. The Spring of 2010, was the second year for the service track in general chemistry II and it was another huge success. This year, just about half the class chose that option and as I get better at facilitating it, the course material overlaps improve and the rigor of the program increases. The amount of my time the service track consumed this year was significantly reduced as I had better undergraduate teaching assistants. Additionally, a new partner was added to the service projects, Carpenter's Brook Fish Hatchery and this significantly helped to shorten my time requirements. Inorganic Chemistry aslo ran significantly more smoothly this spring. I am in the process of developing a course workbook that will significantly improve the course organization and instruction. To date I have all of the handouts now, which was my goal for last year and will be able to publish the workbook for my students in 2012. Although this course continues to be a tough subject to teach effectively, this year was much better. The curriculum for the course was validated by the administration of the 2002 Inorganic Chemistry American Chemical Society Exam where the class averaged in the 70^{th} percentile. Five of the 13 students scored better than the 90^{th} percentile.

Research: This was a slow year for research but I do have several manuscripts in progress, one that was submitted to the *Journal of Chemical Education* this week. We continued our work on macromolecules with pendant carboranes and expanded our work to include polyborane clusters for feedstocks for biodegradable polymers. Our interest in the health of area streams continues and we are investigating a new method for passive sampling of endocrine disruptors using thin layer chromatography plates and high pressure liquid chromatography. New collaborations between Syracuse University and Ithaca College have lead to new project lines within the group such as metal organic frameworks and biologically inspired materials. Katie presented the results of her research at the National American Chemical Society Meeting in Washington, DC last August.

Outreach and Service: I continue to serve the American Chemical Society as their Newsletter Editor and Education Chair. On campus, I was the SUNY-Senator this year, I remain active in the learning community and participated in pre-orientation and graduate orientation events again this year. Within the department I am a part of the undergraduate curriculum committee. Much of my outreach work involves the State Fair and my American Chemical Society outreach activities, however the bulk of the outreach is accomplished with and through my students.

PROSPECTIVE

Teaching: I plan to continue to incorporate interesting and relevant topics into General Chemistry, increasing the "interest" while not sacrificing the content. Although Inorganic will not be taught again until 2012, I will continue to work to develop my workbook and to work with colleagues at other institutions to create peer reviewed materials for general use in this course. Although the studio course proposal was not funded, I will continue to think about how this may be accomplished through other agencies.

Research: This year I plan to focus on my chemistry research objectives. In collaboration with researchers at Ithaca College and Syracuse University I plan to work on two different projects, the first is the synthesis of metal-organic framework materials that mimic biomaterials for photovoltaic applications and the second is the synthesis of structurally novel metallapolyboranes for use as catalysts. I have several proposal submissions planned, NSF Synthesis Initiative, NSF-REU, NSF Transforming Undergraduate Education in STEM and

Education research through Environmental Scholars and general chemistry continues, but I am not a chemical educator by training and my interest is mostly in improving my course not pushing back the frontiers of understanding about how students learn. I am currently developing a best practices guide for Inclusive Excellence for the campus and will have some level of work accomplished on this for next fall.

Outreach and Service: 2010-2011 may well be the biggest test of my leadership abilities yet as I have been elected as Faculty Governance Executive Chair. This is daunting. My goal last year was not to take on any more leadership roles and yet, I have, **and I'm still teaching in Illick 5**. (Last year's goal not accomplished on either front!) With respect to other outreach and service activities, I have basically reached my limit and have leveled off and in some cases reduced my volunteer efforts, preferring to enlist students to take over my efforts.

SUMMARY OF SIGNIFICANT ACCOMPLISHMENTS FROM 2009-2010

- Completed Inaugural year of Environmental Scholars successfully - 14/16 students will make it through to next year
- Facilitated over 2600 student community service hours
- Wrote and Compiled all materials for Inorganic Chemistry workbook
- Had Inorganic Chemistry class score well above national averages on the Inorganic Chemistry American Chemical Society exams (class as a whole averaged in the 70^{th} percentile, 5/13 students were in the 90^{th} percentile)
- Wrote four proposals and submitted one paper with one paper in preparation
- Elected to Faculty Governance Chair
- Attended professional development workshop on the "Chemistry of Art"

2010 Annual Report

Dr. José-L. Giner
Dept. of Chemistry
SUNY-ESF
June, 2010

I. Instructional Activities

A. Undergraduate Course Offerings:

FCH 210 - Elements of Organic Chemistry, 4 credits, 2 sections, 48 students.

FCH 224 - Organic Laboratory II, 1 credit, 2 sections, 54 students.

FCH 524 – Topics in Natural Products Chemistry, 3 credits, 3 students

B. Graduate Course Offerings:

FCH 999 - Doctoral Thesis Research, Fall: 1 credits, 1 student; Spring: 1 credit, 1 student

C. CE Courses and Workshops: none

D. Guest Lecturer Activities:

II. Student Advising and Counseling:

•Doctoral students: Ju Feng

•Undergraduates: Zachary Stultz

III Research and Other Scholarly Works

A. Departmental Research:

B. Grant-Sponsored Research:

Rejected proposals:

National Science Foundation, Chemical Synthesis, “The Orthoester - Cyclic Ether Rearrangement: Investigations of a Biomimetic Reaction”, $400,316.

National Science Foundation, Biological Oceanography, “Effects of Marine Algal Sterols on Zooplankton Growth and Reproduction”, $369,940.

Preproposal to AFRI (Suborganismal Biology section in the Arthropod and Nematode Biology and Management Program) “The effects of unusual marine sterols on phytophagous insects”, $400,000.

C. Publications, Licenses, Inventions, Awards:

none

•Peer reviewed journals:

1. Puan, K. J.; Low, J. S. H.; Tan, T. W. K.; Wee, J. T. S.; Tan, E. H.; Fong, K. W.; Chua, E. T.; Jin, C.; Giner, J.-L.; Morita, C. T.; Goh, C. H. K.; Hui, K. M.,"Phenotypic and functional alterations of Vg2Vd2 T cell subsets in patients with active nasopharyngeal carcinoma", *Cancer Immunol. Immunother.* **2009**, *58*, 1095-1107.

2. Giner, J.-L.; Zhao, H.; Boyer, G.L., Satchwell, M.F., Andersen, R.A.,"Sterol Chemotaxonomy of Marine Pelagophyte Algae ", *Chem. Biodiversity* **2009**, 1111-1130.

D. Graduate students supported (name, semesters/summer):

none

iV. Public Service

A. Unfunded Service at Governmental Agencies, Public Interest Groups, etc.:

Reviewer for 12 journal manuscripts. (Bioorganic and Medicinal Chemistry Letters - 1, Organic Letters – 1, Steroids - 4, Lipids –2, Phytochemistry – 1, Journal of Food Biochemistry – 1, Journal of Natural Products – 1, Marine Drugs - 1)

Organized a session (The Chemistry of Natural Products) at the 37th Northeast Regional Meeting (NERM 2010) of the American Chemical Society (Potsdam, NY).

Was made a member of the Upstate Cancer Research Institute.

B. Funded Service Projects:

1. Governmental Agencies: None

2. Industrial and Commercial Groups: None

V. Professional Development

A. Professional Organization Activities: None

B. Leaves, Additional Assignments, etc.: None.

C. Course Work, Workshops, etc.:

•Conferences attended: 37th Northeast Regional Meeting (NERM 2010) of the American Chemical Society (Potsdam, NY)

D. Awards (include external awards to your students):

Awarded "Top Reviewer in 2009" by Steroids.

VI. **Administrative and Governance Service**

A. Faculty:

•Exam committees:

Doctoral Thesis (Nat. Prod. Chemistry – Ju Feng, December 2010.
Preliminary Exam (Organic chemistry) – September 2009, February 2010.
Candidacy Exam – none.

•Seminar committee, seminars hosted: none

•Open houses, poster sessions, etc.: none

B. College:

•Exam Committees:

Candidacy Exam – Corey Williams (FNRM, March 2010)
Doctoral Thesis – Lauren Johnson (Environmental Studies – April, 2010)

•Recruiting: - 2 seminars at undergraduate colleges (Nov. 2009, Jan. 2010)

C. University, including Research Foundation: None.

Retrospective

Teaching:

I continued teaching Elements of Organic (FCH 210). There were about as many students as last year, again there were 2 TA's instead of 3. This is my 8th year of teaching this course. The TA's were both very good. Accentuate the positive, eliminate the negative.

I continued teaching Org Lab II (FCH 224). The enrollment was significantly higher than last year. Despite starting early on my part, the lab manager had problems in finding time to troubleshoot the newer experiments in a timely way, which led to bad results in the last lab. The TA's were a mixed bag.

I taught Topics in Natural Products (FCH 524), as I have every other year since Bob LaLonde retired in 2000. Initially, there were a couple of underprepared environmental studies/paper science students enrolled. They dropped it, and then there were only 3 students (undergrads) in the class.

Ju Feng wrote his thesis, successfully defended it, and finished his revisions after a tremendous effort.

Josh Brooks, who successfully defended his master's thesis in November 2008 and is now a PhD student at the University of Rochester, finally submitted his revisions. Unfortunately, by the time I got it, I was so bogged down working on Ju Feng's thesis and teaching that I could not take care of the corrections in time for spring graduation.

Adam Stringer, who had begun as a PhD student with me in 2008, switched to Dr. Webster's group after making unsatisfactory progress in his research during his first year.

There was a general lack of applicants for the PhD program in Natural Products chemistry.

Research:

A paper was published in collaboration with immunologists concerning the immunostimulatory chemical HMBPP. Another was published on the sterols of algae related to the brown tide organism. Three other manuscripts have been written and are in the final stages before submission. There are several publications that have been on hold until a key synthetic method developed in my lab was better understood. This has been difficult, but the mechanism is now understood.

A proposal to study orthoesters was submitted to the NSF. Proposals to study marine sterols in insects and zooplankton were submitted to NSF and to AFRI. None were funded.

Prospective

Teaching

In the past several years I have become increasingly discouraged with my teaching duties. I find teaching "Elements of Organic" is somewhat unrewarding, although the EFB students who take it are no worse than our own. Since SU apparently does not allow their students to take our courses, and there are very few graduate students in organic chemistry here, my graduate level classes will continue to be taught to undergrads. The lack of any motion at all to find a replacement for Bob LaLonde after already 10 years clearly shows the misplaced priorities of the department and the college. The manager position for the teaching laboratory will be vacant soon. It will be interesting to see what happens if it is not filled.

Research

There continues to be much to be excited about on the research front. The unknown reaction mechanism that kept us from publishing a number of papers has now been solved. I am excited about potential collaborations with people at the new Upstate Cancer Research Institute. However, without funding or students, progress will continue to be very slow. Proposals will be submitted to try to secure funding for the future.

ACADEMIC STAFF -- ANNUAL REPORT

IVAN GITSOV

FACULTY OF CHEMISTRY

June 1, 2009 - May 31, 2010

I. Instructional Activities

A. Undergraduate Course Offerings

FCH 222 "Organic Laboratory I" - Fall 2009 70 students @ 1 cr. = 70 credits

FCH 550 "Polymer Science: Synthesis and Mechanisms" - Spring 2010, 4 students @ 3 cr. = 12 credits

B. Graduate Course Offerings

FCH 550 "Polymer Science: Synthesis and Mechanisms" - Spring 2010, 4 students @ 3 cr. = 12 credits

FCH 999 "Doctoral Thesis Research" - Fall 2009/Spring 2010, 2 students, 28 credits (total)

C. CE Courses and Workshops

none

D. Guest Lecturer Activities

Institute of Materials, Swiss Federal Institute of Technology (Zurich, Swtzerland), May 18, 2010

Department of Organic Chemistry, University of Santiago de Compostela (Santiago de Cmpostela, Spain), May 21, 2010

Department of Chemistry & Institute of Nanoscience, University of Zaragoza (Zaragoza, Spain), May 24, 2010

II. Student Advising and Counseling

Three undrgraduate students: Gregory Capozzi, Nathan P. Phillips and Erin B. Snyder

Three graduate students: Caiping Lin (successfully defended June 2009, formally graduated August 2009), Kristina Goranova and Lili Wang

III. Research and Other Scholarly Works

A. Departmental Research

"Novel Bone Cement Materials", with Kristina Goranova; TA for the academic year 2009/2010

B. Grant-Supported Research

1. "Novel Biocatalytic Structures for the Sustainable Synthesis of Fine Chemicals and Biologically Active Substances", 2009-2012, NSF, $ 307,289

2. "Water Resource Impacts of Flexi Pave - A porous Pavement", 2009-2010, Syracuse Center of Excellence in Environmental and Energy Systems (EPA), $17,139

C. Publications, Licenses, Inventions, Awards

1. Synthesis and Physical Properties of Reactive Amphiphilic Hydrogels Based on Poly(p-chloromethylstyrene) and Poly(ethylene glycol): Effects of Composition and Molecular Architecture, Macromolecules 43(7), 3256-3267 (2010); C. Lin, I. Gitsov
Journal Impact Factor: 4.539 (2009)
Times cited: 1

C. Schuerch Award, Department of Chemistry, SUNY ESF - Lily Wang

Named in the top 25 % reviewers of Macromolecules, the most cited journal in polymer science - Ivan Gitsov (see attachment in the hard copy).

Appointed as Guest Professor in Nanostructured Materials, Faculty of Science, University of Zaragoza, Spain - Ivan Gitsov (see attachment in the hard copy) .

IV. Public Service

A. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.

1. Proposal Panel Member of The Molecular Foundry, Lawrence Berkeley National Laboratory, DOE and UC -Berkeley (2 proposals)
2. NSF Panel review member for: 1. Division of Chemistry (March 2010) and 2. Catalysis and Biocatalysis, Chemical and Transport Systems Division (June 2009)
3. Reviewer for: The National Science Foundation, The Research Corporation and The Petroleum Research Fund (The American Chemical Society) (3 proposals)
4. Articles Reviewer for 21 journals in natural, supramolecular and polymer science, medicinal, biocatalytic and organic chemistry (19 reviews).
5. Faculty advisor of the Bulgarian students association at SU/SUNY ESF.

B. Funded Service Projects

1. Government Agencies
   none

2. Industrial and Commercial Groups
   none

V. Professional Development

A. Professional Organization Activities
Member of the Public Outreach Program of the American Chemical Society

B. Leaves, Additional Assignment, etc.
none

C. Course Work, Workshops, etc.
none

VI. Administrative and Governance Service

A. Faculty

1. Member of the Faculty Seminars Committee;

B. College
   1. Chairman of the defense committee of one Ph.D. student
   2. Steering Committee Member of two Ph.D. students

C. University, including Research Foundation
   none

Retroscpective

The research of my group continues to be focused on the synthesis and characterization of polymers with novel macromolecular architecture that have potential application in the biotechnology and biomedical fields both as drug-delivery vehicles and biocompatible templates. These materials contain poly(ethylene oxide), PEO and highly branched (dendritic) fragments as the key building blocks. The ultimate goal of these investigations is to design and produce systems that are capable of sustained drug delivery, surface nanosensing, non-covalent modification of glycoproteins and bio-catalysis through immobilization. During this period we started exploring a new synthetic strategy for the construction of new poly(ether)/poly(ester) dendrimers and the mechanism of action of enzymes by fluorescent spectroscopy.

For the period of this report 233 citations of our papers have been noted.

Lily Wang received a notable honor - The Schuerch Award of the Department of Chemistry at SUNY ESF.

My exceptional service as reviewer for Macromolecules was acknowledged with personal letter by the Editor-in-Chief of the Journal.

I was also appointed as Guest Professor in the Masters Degree Program in Nanostructured Materials for Nanotechnology Applications (NANOMAT) at the Faculty of Science of the University of Zaragoza in Spain. The affiliations of the other guest professors in this program are worth mentioning: Princeton University and Stanford University (USA), Swiss Federal Institute of Technology, Kembridge University (UK) and Technical University of Denmark.

During this period I taught one course at 500 level: FCH 550 "Polymer Science: Synthesis and Mechanisms". I also continue teaching FCH 222 "Organic Laboratory I" as a substitute until the eventual hire of a new faculty. The interest to all lectures was satisfactory with student responses being both favorable and encouraging.

The achivements of the group could be summarized as follows:
1. One research paper was published in a peer-reviewed journal with high impact factor.
2. One graduate student received one of the major Departamental awards in the respective category.
3. Three invited lectures were delivered at prestigeous universities in Swtzerland and Spain.
4. One preliminary proposal for the total amount of $484,078 has been submitted to DOE to further boost the support the research activities of my group, currently funded at $ 324,428.

Prospective

My extended plans for the academic year 2010 and beyond envision the continuation of the research activities in my traditional study areas.

1. Dendritic and Hyperbranched Polymers and their Hybrids - Synthesis, Properties and Applications
Several topics will be explored:
a) Synthesis of novel hybrid macromolecules and networks based on poly(ethylene glycol), PEG, as the water-soluble/water-swellable component for green chemistry applications (catalysis of organic reactions in water) and templates for biological nanosensors. Currently one graduate student is working in this area (Lily Wang). She already made notable progress in the formation of amphiphilic dendrimers and hybrids with entirely new building design and is the coauthor of one paper currently submitted. The uniqueness of these materials is in the density gradient, which can be deliberately incorporated in different areas of the macromolecules and tuned to every different application the particulate material is evaluated for. I plan to use the resources of the newly NSF funded grant to broaden the area towards biocatalysis in highly organized media. We have very encouraging results in the sustainable enzymatic synthesis of poly (amino acid)s with zwitterionic character and unusually high moecular weights. I will actively explore options to pursue this research through additional private, local and federal funding.
b) Evaluation of the hybrid linear-dendritic copolymers and nano-grafts as potential materials for enzyme enhancement and biodetection. Currently we are still waiting for the patent evaluation process to increase speed and enable the more active investigation of the unique cell-labelling potential observed with some of the nano-assemblies.
Both topics are of prime interest to several research groups in Europe and we started working together on two joint proposals for international collaboration through NSF and its partners in Spain.
2. Novel nanomaterials for bone repair
This project was funded by NASA through the SUNY Biotechnology Center and currently one graduate student (Kristina Goranova) is exploring the possibility to form reactive crosslinkable hydroxyapatite nanoparticles as additives to the existing formulations. The studies will be continued during the summer with a SBI-REU student in my group (Henry Durnwald) and this Fall in collaboration with with Prof. Keneth Mann from the Institute for Human Performance at SUNY Upstate Medical University. I am very enthusiastic to join forces in this area also with Prof. P. Mather at Syracuse University, who is working in the same area, but from a completely different side. The fact that we both serve in the newly established Syracuse Biomaterials Institute opens broad avenues for collaborative research. We are in a rather advanced development stage for this project and several others where we can take full advantage of the

synthetic capabilities of our group and the advanced engineering expertise of our partners.

3. Environmental Impact of Polymers

The small research project with Prof. T. Endreny, which is recently being funded by the Syracuse Center of Excellence (EPA), has the potential to grow beyond the local studies. Polymer recycling through secondary use for materials with improved properties and novel applications has been rather neglected (and almost totally ignored!) by all major funding institutions. Studies in this area, however, have high social value and increasing iconomic importance and I am fully committed to continue and expand our research in this direction. In parallel with the plastic paving studies we plan to start research on interior and exterior building insulation. Our extensive envestigations on the potential bisphenol A leakage from FlexiPave has revealed that this potential toxic substance is not released upon exposure to environments, close to Syracuse climate conditions. This is a very important result, which will facilitate the expansive use of this recycled material.

My teaching plans for the 2010 are associated with two courses as outlined below:

1. FCH 550 "Polymer Science: Synthesis and Mechanisms". The content of this course is well suited to provide sufficient information both at graduate and senior undergraduate level. The textbook that was tested - "Polymer Chemistry: An Introduction", 3-rd edition by Malcolm P. Stevens (Oxford University Press, 1999) will remain as the basic reference. This year, however, I will start to modify and addapt the content for the incorporation of this course into the joint curricullum of the Syracuse Biomaterials Institute. I was aked by the Director of the Institute, Prof. P. Mather, to spearhead the effort in creating an unified polymer education program, which will serve the needs not only of SUNY ESF or Syracuse University, but be a fundamental part in the education of the future biomaterials professionals. I already started working on this curriculum and will intensify my efforts in the summer.

2. FCH 222 "Organic Chemistry Laboratory I". Due to the retirement of Prof. R. Lalonde and college-wide budgetary restrictions I will be teaching this course again until a new faculty could be hired. This is a very useful course that traditionally attracts students from several departments. In the past semester I evaluated the incorporation of "visual modules" for the course, where the students were sent detailed visual instructions for the assembly of the glassware and the sequence of procedures for each experiment. The positive response is encouraging and during the summer of 2009 I will continue the work with Mr. Guy Pyrolla towards full completion of these modules. We hope that IDEAS will assist us with the visualization and with the development of a special Web-site for the class. We will move to the new edition of the course textbook (K.L. Williamson, "Macroscale and Microscale Organic Experiments" Houghton Mifflin Co., Boston-New York) since the previous one is long out-of-print. I also plan to actively assist the Administration in the search for a new person, who will replace Mr. Pyrolla after January 1, 2011.

ACADEMIC STAFF -- ANNUAL REPORT

John P. Hassett
CHEMISTRY DEPARTMENT

June 1, 2009 - May 31, 2010

I. Instructional Activities

A. Undergraduate Course Offerings
FCH 497 - Undergraduate Seminar. Spring, 7 students (1 cr.)

B. Graduate Course Offerings
FCH 515 - Methods of Environmental Chemical Analysis. Fall, 11 students (3 cr.)
FCH 796 (Sect. 5) - Organic Chemicals in Natural Waters. Spring, 4 students (3 cr.)
FCH 798 - Research in Chemistry. Spring, 1 student (1 cr.)

C. Continuing Ed Courses and Workshops
none

D. Guest Lecturer Activities
none

II. Student Advising and Counseling (Grad and Grad)

4 undergraduate Chemistry advisees
2 Chemistry MS advisees
1 EFB MS advisee (joint w/ Nakatsugawa)
5 Chemistry PhD advisees
1 student successfully defended PhD thesis (Rebecca Jarrell)
1 student completed Ph. D. (Raphael Klake)
1 MS thesis defense (not including my own students)
1 PhD Candidacy exam (not including my own students)
1 PhD thesis defense (not including my own students)

III. Research and Other Scholarly Works

A. Departmental Research
Advised and assisted FNRM MS student April McEwen with sampling and analysis for gasoline components in Adirondack lakes.

B. Grant-Supported Research (Existing grants plus grants pending)

Near-Real-Time Monitoring Platform for Detection of Drinking Water Contaminants. $182,790. US Army Research Development & Engineering Command. (9/22/05 to 10/15/09).

Trackdown of Sewage Sources to Onondaga Creek. $4500. Onondaga County *via* Onondaga Environmental Institute. (9/1/08-10/30/09).

Real-Time Sensing and Time-Resolved Sampling of Organic Chemicals in Onondaga Lake. $298,890. US-EPA *via* Syracuse University CARTI (6/1/09-5/31/11).

none pending at this time.

C. Publications (include “in press” but not “in preparation”), Licenses, Inventions and Patents, Awards

Oakes, R. L.; Croskrey, J. M.; Hassett, J. P. and Effler< S. J. "Real-Time Sensing and Time-Resolved Sampling of Organic Chemicals in Onondaga Lake" Upstate Freshwater Institute Onondaga Lake meeting, November, 2009.

Hassett, J. P.; Oakes, R. L.; Croskrey, J. M. and Effler, S. J. "Real-Time Sensing and Time-Resolved Sampling of Organic Chemicals in Onondaga Lake" Syracuse Center of Excellence meeting, April, 2010.

Hassett, J. P.; Cabasso, I.; Jarrell, R. A.; Flach, A.; Cole, K. "A Real-time Self-contained Buoy Detection System for Water-Borne Trace Organic Pollutants" Syracuse Center of Excellence meeting, April, 2010.

Oakes, R. L.; Croskrey, J. M.; Hassett, J. P. and Effler, S. J. "Real-Time Sensing and Time-Resolved Sampling of Organic Chemicals in Onondaga Lake" Northeast Regional Meeting-American Chemical Society, May, 2010.

IV. Public Service and Outreach

A. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.

Member of Committee on Access to Pesticide Registry and Pesticide Application Information of the Health Research Science Board, NYS Department of Health. Prescreen proposals for rest of the committee. Participate in panel reviews.

Member of New York State Task Force on Flame Retardant Safety. Principal author of environmental chemistry section of report.

manuscript reviewer for:
Environmental Science and Technology (1)
Environmental Toxicology and Chemistry (1)

proposal reviewer for:
Graduate Women in Science fellowship

Consulted with Allen Silverstone (UMU) on Onondaga Lake cleanup plans related to contaminated sediment treatment and disposal in Camillus.

B. Funded Service Projects

1. Government Agencies
none

2. Industrial and Commercial Groups
Faraci and Lange - review data, model exposure concentrations and provide testimony at trial regarding a worker exposed to chlorine gas.

V. Professional Development

A. Professional Organization Activities
none

B. Leaves, Additional Assignment, etc.
none

C. Course Work, Workshops, etc.
none

VI. Administrative and Faculty Governance Service

A. Faculty
Member, Analytical Chemistry PhD qualifying exam committee

Acting Department Chair - various times

B. College
Campus Representative to Great Lakes Research Consortium

Radiation Safety Committee

Ad hoc committee to review and recommend action on establishment of Environmental Health program at ESF

Advisory committee for Empire Innovations faculty search - helped to successfully recruit Huiting Mao.

C. University, including Research Foundation
none

Retrospective

I taught my usual 3-credit lecture/lab course on water analysis (FCH 515) this fall, for the 29th time, with the course focusing on Meadow Brook. Enrollment in this class was 10, which is ideal for the capacity of the lab. Enrollment would have been very low if not for several undergraduate Environmental Science majors. While engaged and interested in the class, these students were not well-prepared for an upper division/graduate level chemistry course. I have advised the administrator of the undergraduate Environmental Science program that students will have to meet the minimum prerequisite of FCH 380 (Analytical Chemistry I) if they wish to enroll in the future. As usual, my primary mechanisms for assessment of the course were grades on exams and laboratory assignments, and course evaluations. The student average was "B-" (range: C- to A) which was lower than usual for this class. Overall average course evaluation was 4.4/5.0, which was also lower than usual.

I taught my usual 1-credit senior seminar course (FCH 497) in the spring, for the 30th time. All students in this class are chemistry undergraduates. Enrollment was 7 students. Average grade was "A-" (B+ to A). On-line course evaluation for this course failed, in that only one student appears to have completed it. In the past, essentially all students completed the paper version.

I taught a variation of Aquatic Organic Chemistry this year, a graduate-level special topics course that I teach every other year. I spent considerable time in revising it this year. I feel much more comfortable with it now. Total enrollment was 4, all chemistry

grad students. I took a different approach to evaluating students this year. No in-class exams were used. Instead, students were assigned several group and individual projects during the semester, an approach that worked well for an advanced chemistry course requiring integration of many environmental variables. The average was "A" (A- to A). On-line course evaluation failed for this class as well.

I had three funded research projects this year. One was to develop an on-line analytical system for odorants and other trace contaminants in drinking water. Another was to develop a generic analytical system for optical detection of hydrophobic organic compounds in alcohol extracts. Funding for both of these projects ended in the fall. I have a new, 2-year research grant for almost $300K starting June 1, 2009. The objective of this project is to construct two buoy-borne systems to extract, concentrate and detect trace organic chemicals in water and deploy the buoys in Onondaga Lake. This project is the culmination of research going back to Caryl Fish's work with me in the early 1990's, with further contributions by past students Shawn Hubbard, Don Hughes, Kaycee Cole and Rebecca Jarrell. The schedule is very ambitious and will consume much of my time this summer and next. However, we expect the outcome to be new insight into the behavior of organic chemicals in water on short time scales, as well as opening the way for application of this technology in other systems. Happily, it will also keep a couple of graduate students fed for a couple of years. Alas, it is not ready to deploy in the Gulf of Mexico.

I had one graduate student successfully defend her thesis this year. Rebecca Jarrell defended her Ph. D. thesis in May, 2010. She has taken a position as Visiting Assistant Professor at SUNY-Plattsburgh. Raphael Klake completed revisions to his thesis and graduated in December, 2009. He has just left for his home country where he will be a Professor in the Chemistry Department at the University of Ghana.

In 2008, I was appointed by Governor Patterson to the New York State Task Force on Flame Retardant Safety. The task force is charged with reviewing studies on decabromodiphenyl ether and evaluating alternatives. Intensive work continued this year, with regular phone conferences as well with time needed to prepare and review materials for a final report. I have taken the responsibility of reviewing the literature and preparing the section of the report dealing with the environmental chemistry of this chemical. This has been very time-consuming, but a near-final draft is now complete.

Prospective

I plan to teach Methods (FCH 515), senior seminar (FCH 497), and Chromatography (FCH 560) next year. Some students are lobbying me to teach an Electronic for Chemists course. Although I do not know how I will fit this in, I am getting closer to giving it a try. It will cost the department a modest amount of money to buy parts for experiment kits.

I expect that State Task Force on Flame Retardant Safety will wrap up its work in 2010 or possibly early 2011.

I expect that Debra Joseph, an EFB MS student whom I advise jointly with Tsutomu Nakatsugawa will finish this academic year. Lindsay Harrington, PhD student in Chemistry will probably finish in the fall. Mellony Manning, Ph. D. student in Chemistry, will probably also finish this year. I two continuing MS students, Jennifer Croskrey and Michelle Giardono, who may finish this year. I have one continuing Ph. D. student, Robyn Oakes, who will take her Candidacy exam this fall. I also have a new MS student starting in the fall.

SIGNIFICANT ACTIVITIES AND ACC0MPLISHMENTS DURING THIS REPORTING PERIOD, ESPECIALLY THOSE MOST NOTEWORTHY AND RELATIVE TO THE COLLEGE'S AND DEPARTMENT'S MISSION.

Supervised research of 8 graduate students, one of the largest groups in the department

Saw 1 graduate student complete her studies and defend her theses.

Represented the college to the Great Lakes Research Consortium

Continued to serve on the NYS Task Force on Flame Retardant Safety

Continued to serve on the Committee on Access to Pesticide Registry and Pesticide Application Information of the Health Research Science Board, NYS Department of Health.

Secured significant new research funding, of which 45% goes directly to the college, 55% goes directly to accomplishing the research.

Academic Staff – Annual Report

David L. Johnson
Faculty of Chemistry

June 1, 2009 – May 31, 2010

I. Instructional Activities

a. Undergraduate Course Offerings

- FCH 380 Analytical Chemistry I (Quantitative Analysis), fall semester, 17 students
- FCH 498 Senior Research, 1 students
- ENS 797 Environmental Science Seminar
- FCH 899 MS Thesis Research, Bonomo
- ENS 999 PhD Thesis Research, Crawford, Wang

d. Guest Lecturer Activities

- EFB 220 Urban Ecology, fall 2009

II. Student Advising and Counseling

- 3 Chemistry (UGrad)
- 5 Environmental Science (UGrad)
- 2 Chemistry (Grad)
- 4 GPES (Grad)

III. Research and other Scholarly Works

a. Departmental Research

- Anaerobic digestion of food waste with Village of Minoa
- With ESF faculty/staff members and an employee of the Minoa WWTF, filed two New Technology Disclosure documents with SUNY RF TTO.

b. Grant Supported Research

- Onondaga County Health Department 9/09-9/10, **Analysis of results from EPA funded dust intervention study, $5000-FUNDED**
- NASA Global Climate Change Education David Johnson, Chemistry, Principal Investigator Co-PI's: Dr. Richard Beal, ESF Outreach, Dr. Robert Malmsheimer, FNRM, Dr. Lindi Quackenbush, ERFEG, Dr. Charles Spuches, Associate Dean, ESF Outreach--**SUNY Sustainability: A Climate Changes Solutions Course, $179,400 (7/01/09 – 0/30/11)—FUNDED**
- NYSERDA response to PON 1276, D.L.Johnson, PI: Co-PI's Emanuel Carter, Stewart Diemont, Ken Tiss, Terry Ettinger, Rod Tyler (Filtrexx International)-- **Urban renewal through energy capture: Turning solid waste into a resource using distributed agriculture ecological systems (DAES)--$455,936 (not funded)**

c. Publications
- Hui Lin, Stewart A.W. Diemont, Wendong Tao, David L. Johnson, Douglas Daley, and Timothy Toland (2010). An Ecological Treatment System for the Re-use of Biodigested Food Waste. Submitted to Ecological Engineering.
- Andrew Hunt and D.L. Johnson (2010). Differential individual particle analysis (DIPA): applications in particulate matter speciation research. Submitted to Environmental Geochemistry and Health

IV. Public Service and Outreach

a. Unfunded Service to Governmental Agencies
- Proposal review panel member, NSF Science Masters Program, January 2010

V. Professional Development

a. Professional Organization Activities
- Reviewed manuscripts Environ. Geochem. Health (1)
- Member external review team for University of Texas, Arlington, Department of Earth and Environmental Sciences self study, March 2010

b. Additional Assignments
- Member: Urban Env. Sci. steering group
- Member: Campus Climate Change Committee

c. Course Work, Workshops, etc.
- Advisor to SU Whitman School student organization (SIFE) in their development of a proposal to repurpose SU dining hall food waste as a biodigester resource for renewable energy
- Developed proposal for use of the SU Zero-Credit course for ESF students…Validating a Climate Literacy Survey for knowledge, attitudes and behavior (with Susan Powers, Clarkson)

VI. Administrative and Faculty Governance

b. College
- Director: Graduate Program in Environmental Science
- Chair, Thesis/Comprehensive Exams (2)

Retrospective

Most of my research energies have been devoted to what we call the Minoa Enterprise; what follows below is a summary of that activity:

Repurposing waste materials as resources for on site renewable energy recovery.
Anaerobic digestion (AD) is an energy producing process that may offer an economic alternative to the disposal of institutional food waste. This approach to industrial ecology, or sustainability, is well advanced in Europe where large-scale biogas plants have been constructed to extract energy from residential, agricultural and industrial organic wastes[1]. While anaerobic digesters have been key components in the treatment of municipal wastewater streams for more than a century, their application to other organic waste feed stocks in the United States has not been widespread. For instance, according to EPA estimates[2], about 25% of all food prepared in the US is wasted. This amounts to some 50 million tons, or about 12.5% of the municipal solid waste generated each year; most of it is diverted to landfills.

Using the study of Griffin et al[3], we estimate that about 1750 pounds of food waste are available daily from the ESM school system and the Village residents. We have designed a unit operation using 1500 pounds (fresh weight) of excess food biomass to be processed in a co-digestion bioreactor with WWTF biosolids. If the food waste composition approximates that of Zhang et al[4], about 180 – 200 gallons of biosolids will be used daily to dilute this feedstock to 12-13% TS with a daily processing volume of 350 gallons with a VS content of ~11%. For a two-phase system, the hydrolysis/acidification reactor (3d HRT) requires a liquid volume of 1050 gallons, and the methane reactor (20d HRT) a liquid volume of 7000 gallons. The latter could easily be fabricated from double wall HDPE culvert of 5' diameter 60' long.

An experimental 300-liter, two-phase anaerobic digestion reactor has been in operation at ESF since 15th March 2010. It is constructed from 18" diameter double wall culvert, and is stirred by recirculating biogas through a manifold inserted longitudinally in the bottom of the methane reactor. The feedstock is a 1:1 mixture of biosolids and post-consumer food waste. Present CH_4 production is 0.44 $m3\ KgVS^{-1}\ d^{-1}$ with an organic loading rate of 2.9 g VS $L^{-1}d^{-1}$. The system presently achieves 81% destruction of volatile solids (VS). Both methane production rate and VS destruction have yet to be optimized, we anticipate increasing the methane production rate by 50%, but these results form the basis for reasonable engineering estimates of scale up. Using the experimental reactor methane production rate above, this recipe will produce about 2300 cubic feet of CH_4 each day. With an average electricity generation efficiency, this will provide ~5000 kWh of electricity each month—about 25% of the Minoa WWTF demand. Since the Village of Minoa will shortly have a CNG refuse collection vehicle, it may be more cost effective to plan for biogas upgrading to transportation standards, using the methane as a vehicle fuel.

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[1] http://www.iea-biogas.net/
[2] http://www.epa.gov/epawaste/conserve/materials/organics/food/fd-basic.htm
[3] M. Griffin et al (2009). An analysis of a community food waste system. Agric. Hum Values **26:** 67-81.
[4] R. Zhang et al (2007). Characterization of food waste as feedstock for anaerobic digestion. Bioresource Technology **98:** 929-935.

Prospective

The next year or two will focus on establishing a Sustainable Water Quality Technology Development and Transfer Center in the Village of Minoa. Research and educational initiatives associated with that project are outlined in the section below:

Optimizing sustainable technology development, integration and transfer.

With a history of wastewater treatment process innovations and the apparent support of Village residents for their implementation as a sustainability measure, reducing the municipal carbon footprint, Minoa is ideally suited for technology transfer activities. The presence of the constructed wetlands allows the development of full-scale, integrative technologies that could be exported to other public and private institutional venues.

The shared ESF/Minoa vision is one of more efficient use of waste biomass materials with an infrastructure that combines anaerobic digestion with compost reactors, constructed wetlands, and controlled environment agriculture. The process converts a variety of organic waste materials into value added products. Nutrients in the waste biomass are recycled, and energy is extracted to power the process. Algae and food crop production serve as nutrient removal mechanisms for treatment of the input waters. Agricultural fertilizer from the process can be custom formulated for specific N, P, and K content and nutrient release rate. The diversion of biomass from landfill disposal and the manufacture of agricultural fertilizers with decreased runoff potential are the ultimate goals of these water quality improvement thrusts. Several elements of the larger sustainability processes could be developed and tested at full-scale size in Minoa. These include:

- The physical footprint of the constructed wetlands is being redesigned for small-scale integration with Biodigesters. Advanced designs will feature phosphorus removal along with BOD, N and pharmaceutical attenuation. These implementations could be mobile, giving them potential for temporary deployment in a variety of situations, or targeted to distributed urban agriculture developments
- Compost reactors are being designed that will capture the heat energy produced and direct it to the thermophilic first stage of the anaerobic digester, thus saving the energy ordinarily required for such a process.
- The Class A digester solids produced in thermophilic systems will be removed by filtration through sawdust for direct introduction into the compost reactor feedstock.
- The nuisance algae, *Cladophora* will be cultivated and harvested to enhance the nitrogen and phosphorus removal potential of the process. Algal biomass can then: 1) enhance biogas production, 2) be incorporated in the compost fertilizer, or 3) be directed to biodiesel production.
- Short rotation willow growth will be added to the constructed wetland design as an additional source of renewable energy.
- Gasification of recalcitrant digester solids, algae and woody biomass will be investigated as an alternative Bioenergy production pathway.
- Greenhouse operation heated by excess heat from the compost, fermentation and energy production systems, incorporating the Class A bio solids produced, for fruit and vegetable growth.

Retrospective – D.L. Johnson

Most of my research energies have been devoted to what we call the Minoa Enterprise; what follows below is a summary of that activity: We estimate that about 1750 pounds of food waste are available daily from the ESM school system and the Village residents. We have designed a unit operation using 1500 pounds (fresh weight) of excess food biomass to be processed in a co-digestion bioreactor with WWTF biosolids. The methane reactor would have a liquid volume of 7000 gallons and could easily be fabricated from double wall HDPE culvert of 5' diameter 60' long. A pilot scale 300-liter, two-phase anaerobic digestion reactor has been in operation at ESF since 15th March 2010. While both methane production rate and VS destruction have yet to be optimized, the performance results form the basis for reasonable engineering estimates of scale up. Using the experimental reactor methane production rate above, this recipe will produce about 2300 cubic feet of CH_4 each day. With an average electricity generation efficiency, this will provide ~5000 kWh of electricity each month. We developed a process structure for integration of the biodigester with compost fertilizer production at Minoa and proposed to the NYS Environmental Facilities Corporation a sustainability/education project that would bring the entire enterprise to life at Minoa.

ACADEMIC STAFF - ANNUAL REPORT

DAVID J. KIEBER
FACULTY OF CHEMISTRY
June 1, 2009 – May 31, 2010

ACADEMIC YEAR RETROSPECTIVE

In the past year, I was involved in departmental, professional and public service activities. Some of my salient accomplishments over the past year were: **1)** I taught Environmental Chemistry (FCH 510) and Oceanography (FCH 496 and 796). **2**) I made several oral presentations of my research both locally (e.g., SUNY-ESF, U. Georgia) and nationally/internationally at the Surface Ocean Lower Atmosphere (SOLAS) meeting in Barcelona Spain and the Goldschmidt Conference in Knoxville, TN where I gave one of the keynote presentations. I also attended the SOLAS Steering Committee meeting in Luneburg, Germany. **3)** I advised 9 Environmental Science and 3 Chemistry undergraduates, and 3 graduate students, sponsored one visiting scientist from The Ocean University in China, and advised three undergraduates for their senior research. **4)** I reviewed several journal manuscripts/NSF proposals, a Canadian NSERC proposal, as well as McIntire Stennis proposals. **5)** I submitted five manuscripts for publications, with one published and four in review. **6)** I submitted five NSF proposals, three that were funded, one that was not funded and one that is under review. **7**) I co-organized and participated in the "Chemistry Day" at the New York State Fair.

Significant Activities and Accomplishments

- Five manuscripts submitted; one paper published.
- One of my Ph.D. students defended.
- Taught undergraduate and graduate-level Oceanography and Environmental Chemistry I.
- Co-organized and participated in Chemistry Day at State Fair.
- Advised 9 Environmental Science and 3 Chemistry undergraduates, and 3 graduate students.
- Hosted a visiting scientist from the Ocean University of China.
- Member International SOLAS Steering Committee (SSC). Attended SSC meeting in Luneburg, Germany.
- Chair Analytical Chemistry and member Physical Chemistry Comprehensive Exam Committees.
- Curriculum Group Leader for the Earth and Atmospheric System Science option in the Environmental Science program
- Guest Editor, Special Issue on *Marine Aerosol-Cloud-Climate Interaction* in the journal Advances in Meteorology
- Curriculum Group Leader for the Earth and Atmospheric System Science option in the Environmental Science program
- Five NSF grants submitted; three NSF grants funded.
- Part of organizing committee for the SOLAS Open Science meeting in Barcelona, Spain. Gave a keynote address at the Goldschmidt Conference in Knoxville, TN.
- Wrote a mid term strategy plan for marine aerosol studies as part of SOLAS (http://www.solas-int.org/aboutsolas/organisationaandstructure/midtermstrategy/midtermstrategy.html)

I. Instructional Activities

A. Undergraduate Activities

FCH 510 Environmental Chemistry I, 3 credits, 4 students

FCH 496 Oceanography, 3 credits, 4 students
FCH 498 Senior research, 5 credits, 3 students
Review FCH 495 proposals, 2 students

B. Graduate Activities
FCH 510 Environmental Chemistry I, 3 credits, 7 students
FCH 796 Oceanography, 3 credits, 2 students

C. CE Courses and Workshops

D. Guest Lecturer Activities
ESC 132 Orientation: Environmental Science, 1 lecture
FCH 132 Orientation: Chemistry, 1 lecture

II. Student Advising and Counseling

A. Undergraduate Students
12 students (9 Environmental Science and 3 Chemistry)

B. Graduate Students
Advisor: **Christopher Spiese** (Ph.D.) (Funded as an RA on a fellowship for 12 months); **Joanna Kinsey** (Ph.D.) (Funded as a TA during the AY and as an RA during the summer); **Inger Tyssebotn** (Ph.D.) (Funded as a TA during the AY and as an RA during the summer).

Steering Committee/Examination Committee: Lindsay Harrington, David Kalenak, Mellony Manning, Margaret Pavlac, Casey Smith (University of South Alabama), Nan Qin, Frank DeSantis

III. Research and Other Scholarly Works

A. Departmental Research
Visiting Scientist: Dr. Chunying Liu, College of Chemistry and Chemical Engineering, Ocean University of China
Senior Research: Sarah Button, Casey Cornelia-Galletto, Meahgan Burke

B. Grant-Supported Research

Current Research Support:
Environmental Protection Agency. Greater Research Opportunities (GRO). The effect of atrazine on dimethyl sulfur in marine phytoplankton. Duration: 8/17/07 - 8/16/10. Amount: $76,000.
National Science Foundation. EAGER. Principal Investigator. Collaborative Research: Design, fabrication, and performance evaluation of a marine aerosol generator for shipboard deployment. Duration: 9/1/09 - 3/31/11. Amount: $7,070.
National Science Foundation. Principal Investigator. Production and fate of acrylate in seawater. Duration: 5/1/10 - 4/30/13. Amount: $448,000.
SUNY ESF Outstanding Research Award. Duration: open. Amount: ~$21,000.
National Science Foundation. Principal Investigator. Collaborative Research: Ecophysiology of DMSP and related compounds and their contributions to carbon and

sulfur dynamics in *Phaeocystis antarctica*. Duration: 6/1/10 – 5/31/13. Amount: $360,347.00.

Pending Proposal(s):

National Science Foundation. Principal Investigator. Collaborative Research: Activity and abundance of photoheterotrophs fueled by photochemically-produced substrates. Duration: 1/1/11 – 12/31/13. Amount: $389,540.

Decline Proposal(s):

National Science Foundation. Principal Investigator. Preproposal: CCI Phase 1: Center for the Fate and Reactivity of Organic Matter in the Environment. Duration: 1/1/11 – 12/31/13. Amount: $1.

National science Foundation. Co-Principal Investigator. REU Site: Environmental Chemistry at the SUNY-College of Environmental Science and Forestry. Duration: 2/1/10 – 1/31/13. Amount: $343,291.

C. Publications and Awards

Awards:

Awards for my graduate students:

C.E. Spiese

Selected to participate in the 4th International SOLAS Summer School 2009, 3-15 August 2009, Cargèse, Corsica, France (~80 applicants accepted out of over 300 total).

J. Kinsey (1 internal award)

SUNY-ESF Faculty of Chemistry Graduate Teaching Assistant, honorable mention

I**. Tyssebotn (1 internal award)**

SUNY-ESF Faculty of Chemistry Graduate Teaching Assistant, honorable mention

Refereed Publications: (published between June 2009 and May 2010)

White, E.M., D.J. Kieber, J Sharrard, W.L. Miller and k. Mopper. 2010. Carbon dioxide and carbon monoxide photoproduction quantum yields in the Delaware Estuary. Mar. Chem. 118: 11-21.

D. Presentations

Keene, W.C., M.S. Long, R. Sander, D.J. Kieber, H. Maring and A.A.P. Pzsenney. 2009. Marine aerosol production, chemical evolution, and feedbacks over the open ocean. Goldschmidt Conference, June 22-26, Davos, Switzerland.

Kieber, D.J. 2009. Sulfur transformations in marine algae. October 28. University of Georgia, Athens, GA.

Kieber, D.J., C.E. Spiese and R.P. Kiene. 2009. Cellular dimethylsulfide concentrations in marine algae. Surface Ocean Lower Atmosphere Open Science Conference, November 16-19, Barcelona, Spain.

Kiene, R.P., D.A. del Valle and D.K. Kieber. 2009. Biological DMS consumption in diverse ocean waters. Surface Ocean Lower Atmosphere Open Science Conference, November 16-19, Barcelona, Spain.

Long, M.S., W.C. Keene, D.J. Kieber, D.J. Erickson and H.B. Maring. 2009. Size-resolved parameterization of Primary Organic Carbon in Fresh Marine Aerosols. American Geophysical Union, December 14-18, San Francisco, CA.

Kieber, D.J., 2010. Aquatic photochemistry. April 6, Cross-Disciplinary Seminar in Hydrological and Biogeochemical Processes, SUNY-ESF.

Kieber, D.J., 2010. Aerosols midterm strategy. Surface Ocean Lower Atmosphere (SOLAS) steering committee meeting, Aril 26-28, Luneburg, Germany.

Kieber, D.J., 2010. Keynote address, Oceanic production of organic-enriched marine aerosols: Uncertainties and impacts. Goldschmidt Conference, June 13-18, Knoxville, Tennessee.

IV. Public Service

A. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.

Proposal reviewer for McIntire Stennis, National Science Foundation, and the National Environment Research Council, UK. Manuscript reviewer for Advances in Meteorology, Atmospheric Chemistry and Physics, Limnology and Oceanography, Limnology and Oceanography Methods, Marine Chemistry, Deep Sea Research, Aquatic Sciences, and Marine Ecology and Progress Series

Guest Editor, Special Issue on *Marine Aerosol-Cloud-Climate Interaction* in the journal Advances in Meteorology

Faculty mentor for Kelley Donaghy

Co-organized and participated in the Chemistry Day at the 2009 NYS Fair

Wrote a session summary for a discussion session (Ocean-derived aerosols: Production, evolution and impacts) at the SOLAS Open Science Conference and written up in the January 2010 SOLAS Newsletter (http://www.solas-int.org/news/newsletter/newsletter.html)

Participated and gave a presentation in a second discussion session (Towards a better representation of ocean DMS emissions in global climate models -status of measurement issues and model parameterizations) at the SOLAS Open Science Conference and written up in the January 2010 SOLAS Newsletter (http://www.solas-int.org/news/newsletter/newsletter. html)

V. Professional Development

A. Professional Organization Activities

American Chemical Society, Environmental Chemistry Division
American Geophysical Union
American Society for Limnology and Oceanography
Oceanography Society

B. Leaves, Additional Assignments, etc

Symposium Organizer/Session Chair:

Member of the SOLAS Scientific Organizing Committee for the 2009 Surface Ocean Lower Atmosphere Open Science Conference, November 16-19, Barcelona, Spain. 2009

Discussion Chairperson, Ocean-derived aerosols: Production, evolution and impacts. Surface Ocean Lower Atmosphere Open Science Conference, November 16-19, 2009, Barcelona, Spain.

Discussion Co-Chairperson, Sea ice biogeochemistry and exchange with the atmosphere. Surface Ocean Lower Atmosphere Open Science Conference, November 16-19, 2009, Barcelona, Spain.

Committees:

Committee Member, International SOLAS Implementation group I. 2004-present. http://www.uea.ac.uk/env/solas/org/imps.html

Committee member, International SOLAS Scientific Steering Committee, 2006-present. http://www.uea.ac.uk/env/solas/org/ssc.html

C. Course Work, Workshops, etc.

VI. Administrative and Governance Service

A. Faculty

Member, Physical Chemistry Comprehensive Exam Committee
Chair, Analytical Chemistry Comprehensive Exam Committee
Member, Environmental Science Faculty

B. College

Member, Ad hoc committee for Water Program(s) in Environmental Science at ESF

Member, Ad hoc Committee on Promotion and Tenure

Panel member (Maximum Impact via Teaching, Research or Services), ESF Faculty Mentoring Colloquium, January 6, 2010

Judge for graduate student posters at the 2010 ESF Spotlight on Undergraduate and Graduate Research

Curriculum Group Leader for the Earth and Atmospheric System Science option in the Environmental Science program

Committee Member for the Climate Change Drivers and Responses of Natural and Urban Systems subcommittee as part of the ESF college-wide Empire Innovation faculty search.

ACADEMIC YEAR PROSPECTIVE

Salient tasks that I plan to undertake over the next year are: **1)** I will help organize and participate the Chemistry Department's State Fair exhibit. **2)** I will teach Environmental Chemistry I and Oceanography in the spring, 2011. **3)** I will attend the International SOLAS (**S**urface **O**cean **L**ower **A**tmosphere **S**tudy program) Science Steering Committee meeting in the spring 2011 (site to be determined), the 5th International Symposium on Biological and Environmental Chemistry of DMS(P) and Related Compounds in Goa, India in October, 2010, and the ACS Pacifichem meeting in Honolulu, HI in December 2011, and possibly the American Geophysical Union Ocean Sciences meeting in Portland, Oregon in February 2010. I

expect to give other presentations as well, but the location and sponsors are unknown at this time. **4)** I will submit from 2 to 3 proposals for funding. I have several manuscripts in review and expect to submit from 4-6 additional manuscripts next year. **5)** I will continue to serve as a committee member in the international SOLAS Implementation group I (http://www.solas-int.org/aboutsolas/organisationaandstructure/impgroups/IMP1.html) whose charge is to support the goals of SOLAS related to its first science foci: Biogeochemical Interactions and Feedbacks Between the Ocean and Atmosphere. I will also continue to serve on the International SOLAS steering committee, which oversees the entire international SOLAS program. **6**) I will continue to serve on the ad hoc Committee on Promotion and Tenure, chair of the Analytical Chemistry Comprehensive Exam Committee and member of the Physical Chemistry Comprehensive Exam Committee. **7)** I will continue to serve as a member of the Environmental Science program, which is a huge commitment because of the number of students that need to be advised and the open-ended nature of the curriculum. **8)** I will continue to host a visiting scholar, Dr. Chunying Liu, from the College of Chemistry and Chemical Engineering, Ocean University of China. **9)** I will serve on the NSF Chemical Oceanography proposal review panel in November, 2010. **10)** My lab and I will participate in a month-long research cruise next summer; site and ship TBD.

Annual Report June 1, 2009 – May 31, 2010
Christopher T. Nomura Department of Chemistry

1. Instructional Activities

Course ID	Section	Course Title	Professor	No. of students
Fall				
BPE498	02	Resrch Prob/Biotechnology	NOMURA	1
ERE501	01	Microbiology for Bioprocessing	NOMURA	12
FCH530	01	Biochemistry I	NOMURA	38
FCH797	01	Graduate Seminar Environmental Chemistry	NOMURA	11
FCH797	02	Grad Sem: Bioplastic Metabolism	NOMURA	5
FCH798	10	Research in Chemistry	NOMURA	1
FCH999	10	Doctoral Thesis Research	NOMURA	2
Spring				
FCH496	10	Special Problems In Chem	NOMURA	2
FCH498	10	Introduction To Research	NOMURA	4
FCH532	01	Biochemistry II	NOMURA	27
FCH999	10	Doctoral Thesis Research	NOMURA	2
Guest lectures				
BTC132		Biotechnology Orientation Seminar	Fernando	
FCH132		Chemistry Orientation Seminar	Webster	
ENS797		Graduate Seminar: Algal biodiesel production	Johnson	
FCH152		General Chemistry II: PHA production from biodiesel waste glycerol	Donaghy	

2. Advising and Counseling

Chemistry Undergraduate Students	4
Graduate Students	4
Postdoctoral Fellows	1
Visiting Scientists/Professors	1

3A. Research Activities

Postdotoral Research

Dr. Ben Lundgren	Metabolic engineering for biopolymer production.

Graduate Research

Ms. Qin Wang	Effect of N-limitation on polyhydroxyalkanoate (PHA) production in *Pseudomonas putida*, transcriptome of *P. putida* under various PHA producing conditions
Mr. Ryan Tappel	Cloning of *phaG* and *alkK* genes from *Pseudomonas* strains
Mr. Chengjun Zhu	GC analysis of PHA from *Burkholderia cepacia*, GPC analysis of PHA polymers, Production of PHA from glycerol for medical devices
Mr. Wenyang Pan	GC analysis of PHA from *Burkholderia cepacia.* Use of recombinant *E. coli* for the production of PHA polymers from cheese whey waste/Production of lactobionic acid from lactose
Mr. Alex Mueller	Engineering of GlpF and GlpK for glycerol utilization
Mr. Som Mukerjee	Optimization of *P. putida* for the production of PHA polymers with unsaturated side-chains; xylanase and cellulases from *S. coelicolor*
Ms. Xian Wang	Fermentation studies for PHA production
Ms. Lucia Salamonca-Cardona	Cloning and characterization of *Streptomyces coelicolor* cellulase and xylanse enzymes

Undergraduate Research

Ms. L. Izquierdo	Carbon metabolism in *P. putida*
Mr. B. Murphy	Production of PHA polymers in *E. coli*
Ms. D. Klein	Purification of DNA from *Streptomyces coelicolor*
Mr. A. Mottern	Analysis of pharmaceutical compounds in waste water
Mr. J. Gredder	Cloning of *S. coelicolor* xylanases and cellulases
Mr. M. Nonaka	Growth and production of PHAs from various carbon sources
Ms. G. Schlegel	Purification of PHB-*co*-HV polymers from *B. cepacia*
Mr. J. McEnaney	Purification of 3-OH PAME from *R. solanacerum*
Mr. J. Richardson	Molecular biochemistry for acetyl-CoA metabolism
Ms. D. Dunn	Molecular biochemistry for acetyl-CoA metabolism
Mr. M. Cook	Molecular biochemistry for acetyl-CoA metabolism
Ms. L. Mateya	Purification of PHA polymers
Mr. S. Kogon	Purification of PHA polymers
Mr. M. Clere	Purification of PHA polymers
Mr. Z. Powers	Purification of PHA polymers

Ms. G. Schlegel (Syracuse University)	Purification of PHA polymers
Mr. J. Gerchman	Wood hydrolysate analysis and production of PHA
Mr. W. Thornton	Molecular biology of PHA production
Ms. J. Quinn (Clarkson University)	Metabolic engineering for enhanced monomer supply in *E. coli*
Ms. F. Wang (SUNY-Oswego)	Gene expression from RpoN promoter sites

Other

Anthony Terrinoni	Antek, Inc.	Microbial fuel cell development, waste water treatment analysis
Steve Giarusso	Minoa Sewage Treatment	Analysis of waste water influent and effluent for pharmaceutical compounds and degradation of pharmaceutical compounds
Kazuki Ishida, Pat Mather	Syracuse University	Production of PHAs with unsaturated side chains for shape-memory foams
Khalil Howard, Liviu Movileanu	Syracuse University	Overproduction of a novel membrane protein in recombinant *E. coli*.
Jesse Brunner	SUNY-ESF	Use of QRT-PCR machine
Keith DeRuisseau	Syracuse University	Use of QRT-PCR machine
Zaara Sarwar, Anthony Garza	Syracuse University	Use of AKTA FPLC for protein purification.

3B. Grant Supported Research

Current

NYSERDA PON 1073

Production of value-added biodegradable plastics from NY State low-value biodiesel process-glycerin
PI: **C.T. Nomura**
Co-PI: J. Nakas
Total Award: $74,983
Award Period Covered: 07/25/07 – 6/31/10

US Department of Energy

Hot water extraction of hardwood chips and utilization of the residual chips and wood II
PI: T. Amidon
Co-PIs: J. Nakas, B. Ramarao, G. Scott, R. Franics, S. Liu, and **C.T. Nomura**
Total Award: $738,000
Nomura share: $35,559
Award Period Covered: 10/01/08 – 10/31/09

NYSERDA PON 1195/Blue Highway LLC

Biodegradable Plastics from Renewable Sources for Manufacturing Medical Products in Central New York
PI: A. J. Di Rienzo
Co-PIs: D. Dana, A. Drauter, J. Nakas, **C.T. Nomura**, J. Fieschko
Total Award: $350,000
Nomura share: ~$175,000
Award Period Covered: 01/01/09 – 12/31/11

Syracuse Campus-Community Entrepreneurship Initiative
Business Development ESF/SU Green Energy Cooperative
PI: M. Kelleher
Co-PIs: S. Lloyd, F. Carranti, N. Abrams, C. Watters, **C.T. Nomura**
Total Award: $50,000
Award Period Covered: 07/01/09-06/30/11

National Science Foundation
Protein and metabolic engineering for biodegradable plastic production
PI: **C.T. Nomura**
Total Award: $378,000
Award Period Covered: 07/01/09 – 06/31/12

McIntire-Stennis
Biochemical conversion of forestry-derived feedstocks to biodiesel
PI: **C.T. Nomura**
Total Award: $52,000
Award Period Covered: 08/01/10-07/31/12

Pending
USDA-AFRI
Production of novel PHA co-products from regional wood based feedstocks
PI: **C.T. Nomura**
Co-PI: R. Ashby, USDA-ARS
Total Award: $1,000,000
Award Period Covered: 01/01/11-12/31/16

National Science Foundation
CAREER AWARD: Microbial transformation of renewable carbon feedstocks to biodiesel
PI: **C.T. Nomura**
Total Award: $400,000
Award Period Covered: 01/01/11 – 01/31/16

Proposals submitted, funding declined
National Science Foundation
REU Site: Environmental Chemistry at SUNY ESF
PI: K. Donaghy

Co-PIs: D. Kieber, **C.T. Nomura**, T. Dibble, G.L. Boyer, M.A. Teece, N. Abrams, J. Hassett, A. Stipanovic, W.T. Winter, F.X. Webster, I. Cabasso, I. Gitsov.
Total Award: $341,354
Award Period Covered: 02/01/09 – 01/31/12

National Science Foundation
Metabolic engineering of algae to increase oil production for biodiesel
PI: **C.T. Nomura**
Total Award: $352,733
Award Period Covered: 05/01/10-06-01/13

National Science Foundation
MRI-R2: Acquisition of Essential Instrumentation for Determining Plant Cell Wall Structure and Changes During Sequential Deconstruction
PI: W.T. Winter
Co-PIs: T. Amidon, A. Stipanovic, K. Doelle, S. Liu, **C.T. Nomura**, B. Ramarao, T. Volk.
Total Award: $3,334,000

National Science Foundation
Engineering the next generation of microbial fuel cells
PI: **C.T. Nomura**
Total Award: $299,927
Award Period Covered: 05/01/09-06-01/12

Targeted Growth, Inc.
Genetic engineering of cyanobacteria for PHA production
PI: **C.T. Nomura**
Total Award: $304,200
Award Period Covered: 01/01/09 – 12/31/09

National Science Foundation
REU Site: Environmental Chemistry at SUNY ESF
PI: K. Donaghy
Co-PIs: **C.T. Nomura**, T. Dibble, D. Kieber, G.L. Boyer, M.A. Teece, N. Abrams, J. Hassett, A. Stipanovic, W.T. Winter, F.X. Webster, I. Cabasso, I. Gitsov.
Total Award: $341,354
Award Period Covered: 02/01/09 – 01/31/12

EPA SBIR/Antek, Inc.
Diversification of the carbon fuel source available to electrogenic bacteria for implementation in a microbial fuel cell
PI: **C.T. Nomura**
Total Award: $20,000
Award Period Covered: 01/01/09 – 12/31/09

NYSERDA/Antek, Inc.
Second generation microbial fuel cell
PI: **C.T. Nomura**
Total Award: $24,000
Award Period Covered: 1/1/09-12/31/09

NSF SBIR/Antek, Inc.
Second generation eletrogenic bacteria
Co-PI: **C.T. Nomura**
Nomura share: $29,911
Award Period Covered: 01/01/09 – 12/31/09

Dreyfus Postdoctoral Program in Environmental Chemistry
Genetic engineering for biomaterials from renewable resources
PI: **C.T. Nomura**
Total Award: $120,000
Award Period Covered: 01/01/10 – 12/31/12

3C. Publications and Patents

Papers submitted or published (2009 to present):

Nomura, C.T. and B.R. Lundgren**.** (**2010**). Repressors of RpoN promoters. *New Technology Disclosure.* The Research Foundation. Technology Transfer Office. Filed on March 6, 2010.

Wang, Q., Mueller, A.P., Ring, C.-L., Matsumoto, K., Taguchi, S., and **C.T. Nomura**. (**2010**). Quick and efficient method for genetic transformation of biopolymer producing bacteria. *J Chem Technol Biotechnol.* 85. 775-778.

Wang, Q. and **C.T. Nomura** (**2010**). A survey of biodegradable plastics in the U.S. *BioPla Journal. Japan Biodegradable Plastics Association.* 36. 18-23.

Zhu, C., **Nomura, C.T.**, Perrota, J.**,** Stipanovic, A.J., and J.P. Nakas. (**2010**). Production and characterization of poly-3-hydroxybutyrate from biodiesel-glycerol by *Burkholderia cepacia* ATCC17759. *Biotechnol Prog* 2. 424-430.

Nakas, J.P., Zhu, C., Perotta, J.A., and **C.T. Nomura.** (**2009**). Production of biodegradable co-polymers from biodiesel glycerol and levulinic acid. *New Technology Disclosure.* The Research Foundation. Technology Transfer Office. Filed on Dec. 12, 2009.

Lu, J., Tappel, R.C., and **C.T. Nomura**. (**2009**). Mini-Review: Biosynthesis of poly(hydroxyalkanoates). *Polym Rev*. 49(3). 226-248.

Nomura, C.T. and J. Lu. (**2009**). Hydrophobic compound capture-apparatus made from biodegradable polymers and methods based thereon. Filed July 15, 2009. *U.S. Patent Application No. 12/503,719*. File No. 1279-012NP. Ref. R1602

Matsumoto, K., Murata, T., Nagao, R., **Nomura, C.T.**, Arai, S., Arai, Y., Takase, K., Nakashita, H., Taguchi, S., and H. Shimada (**2009**). Production of short-chain-length/medium-chain-length polyhydroxyalkanoate (PHA) copolymer in the plastid of *Arabidopsis thaliana* using an engineered 3-ketoacyl-acyl carrier protein synthase III. *Biomacromolecules.* 10(4), 686-690.

Spiese, C. E., Kieber, D.J., **Nomura, C.T.**, and R. P. Keane. (**2009**). Reduction of dimethyl sulfoxide by marine phytoplankton. *Limnol Oceanog.* 54(2), 560-570.

Manuscripts submitted or in preparation:

Wang, Q. and **C.T. Nomura**. (**2010**). Identification of key genes involved in carbon metabolism in the polyhydroxyalkanoate (PHA)-producing strain *Pseudomonas putida* KT2440. (submitted to *Appl Environ Microbiol*)

Wang, Q., Martino, M.R., Boyd, G.D., and **C.T. Nomura.** (**2010**). Polyhydroxyalkanoate production from biodiesel glycerin in *Pseudomonas putida* KT2440. (in preparation).

Randall, R., Martino, M.R., Boyd, G.D., **Nomura, C.T.**, and T.M. Keenan. (**2010**). Media optimization for polyhydroxyalkanoate production in *Burkholderia cepacia* from xylose (in preparation).

Abstracts and presentations at local, national, and international meetings (2009 – present):

Wang, Q. and **C.T. Nomura (2010).** Defining the pathway for polyhydroxyalkanoate (PHA) production from unrelated carbon sources in *Pseudomonas putida* KT2440 using quantitative real time PCR**.** *110th General Meeting of the American Society for Microbiology.* May 23-27. San Diego, CA, USA.

Zhu, C., **Nomura, C.T.**, Perrotta, J.A., Stipanovic, A.J., and J.P. Nakas **(2010).** Production and characterization of poly-3-hydroxybutyrate from biodiesel-derived glycerol by *Burkholderia cepacia* ATCC 17759**.** *110th General Meeting of the American Society for Microbiology.* May 23-27. San Diego, CA, USA.

Izquierdo, L., Lundgren, B., and **C.T. Nomura (2010).** Quantification of the strength of *lac, trc, tac,* and *pBAD* promoters on the broad host range plasmid pBBR1MCS2 under different bacterial strains. *SUNY-ESF Spotlight on Research.* April 13. Syracuse, NY, USA.

Gredder, J., Lundgren, B, and **C.T. Nomura. (2010).** Increasing acetyl-CoA levels in polyhydroxyalkannoate producing bacteria through metabolic engineering. *SUNY-ESF Spotlight on Research.* April 13. Syracuse, NY, USA.

Nomura, C.T. (**2010**) Advances in *in vivo* polyhydroxyalkanoate production via molecular methods. *239th ACS National Meeting & Exposition.* March 21-25. San Francisco, CA, USA.

Nomura, C.T. (**2010**) Protein engineering for polyhydroxyalkanoate production. *239th ACS National Meeting & Exposition.* March 21-25. San Francisco, CA, USA.

Mueller, A.P. and **C.T. Nomura**. (**2009**). Metabolic engineering for enhanced biodiesel waste glycerol conversion to polyhydroxyalkanoate polymers. *Syracuse Biomaterials Institute (SBI) 2nd Annual Offsite Meeting.* August 28. Syracuse, NY, USA.

Wang, Q. and **C.T. Nomura.** (**2009**). Monitoring differences in gene expression levels of *Pseudomonas putida* KT2440 grown on different carbon sources. *Syracuse Biomaterials Institute (SBI) 2nd Annual Offsite Meeting.* August 28. Syracuse, NY, USA.

Tappel, R.C. and **C.T. Nomura**. (**2009**). Production of novel biodegradable polymers from fatty acid biosynthesis intermediates. *Syracuse Biomaterials Institute (SBI) 2nd Annual Offsite Meeting.* August 28. Syracuse, NY, USA.

Invited presentations:

Nomura, C.T. (2010). Protein and metabolic engineering for the production of polyhydroxyalkanoate (PHA) biodegradable plastics. *USDA-Arid Land Agricultural Research Center*. May 24. Maricopa, AZ, USA.

Nomura, C.T. (2010). Polyhydroxyalkanoate (PHA) biodegradable plastics: Production and novel applications. *SUNY-Oswego*. May 7. Oswego, NY, USA.

Nomura, C.T. (**2010**) Advances in *in vivo* polyhydroxyalkanoate production via molecular methods. *239th ACS National Meeting & Exposition.* March 21-

25. San Francisco, CA, USA.

Nomura, C.T. (**2010**) Protein engineering for polyhydroxyalkanoate production. *239th ACS National Meeting & Exposition.* March 21-25. San Francisco, CA, USA.

Nomura, C.T. (**2010**). Production of biodegradable plastics from biodiesel process waste glycerol. *Villanova University.* February 2. Philadelphia, PA, USA.

Nomura, C.T. (**2009**). Polyhydroxyalkanoates production and potential applications. *Cornell University.* Ithaca, NY, USA.

Nomura, C.T. (**2009**). Advances in *in vivo* polyhydroxyalkanoate production via molecular methods. *Nazareth College.* Rochester, NY, USA.

Nomura, C.T. (**2009**). Biological production of biodegradable plastics. *Cornell University Geneva Agricultural Station.* Geneva, NY, USA.

4. Public service

- Hosting student from Clarkson University for SU REU program for summer 2010.
- Use of real time PCR instrument by Prof. Jesse Brunner (ESF Biology).
- Interview for Ms. Christine Tachibana for an article to appear in *Science* tentatively titled **Postdocs and Sabbaticals Abroad**.
- Use of instrument and consulting to Ms. Zaara Sarwar (SU Biology) for AKTA FPLC protein chromatography.
- Use of instrument and consulting for Chris Boddy (U Ottawa) for fermentation studies.
- Use of instrument and Real Time PCR consulting for Prof. Keith DeRuisseau (SU Dept. of Exercise Science).
- Co-organizing a symposium for the 2010 Pacifichem conference (to be held in December 2010).
- Attended meeting with SU ODS (3/30/10)
- Interview/article for New York state Science and Technology Law Center at Syracuse University College of Law **http://nysstlc.syr.edu/Newsletter/researchspotlight/ESF_Biodiesel/default.aspx**
- Meetings for Syracuse COE space utilization
- SUNY-ESF Biomolecular Engineering Search Committee
- Search Committee for Syracuse University Plant Molecular Biologist
- Attended Honor Students Mixer as a Chemistry Faculty representative (11/17/09)
- Assisted with Chemistry Day NY State Fair (09/03/09).

- Ceremony to reveal the NY State Fair Butter Sculpture-Broadcast on Channels 9 and 10. Also radio interviews about Butter to Biodiesel process.
- 7/24/09 Meeting with Ed Reinfurt from NYSTAR to discuss new technologies for the college.
- 7/2/09 meeting with Syracuse University Mickey Lord for Bioprocess recruitment.
- Recruiting sessions with BMS, NYBA, Syracuse Tech Garden, etc. for the Certificate in Bioprocessing program.
- Meeting with EFB Biotechnology committee members, Provost Bongarten, and Dean Shannon for possible Dubai extension program. Development of Chemistry Assessment plan.

5. Professional development

Affiliations

American Chemical Society
ACS-Biotechnology Division
ACS-Syracuse
American Society for Microbiology
Cellulose Research Institute – SUNY-ESF
Michael M. Szwarzc Polymer Research Institute – SUNY-ESF
Center for Applied Microbiology – SUNY-ESF
ESF SCIENCE Corps/SOS – SUNY-ESF
Structural Biology, Biochemistry, Biophysics (SB^3) – Syracuse University, SUNY-Upstate, SUNY-ESF
Syracuse Biomaterials Institute (SBI)- Syracuse University, SUNY-Upstate, SUNY-ESF

Ad Hoc Reviewer and Referee Activities

Journal of Bacteriology
Macromolecules
Journal of Applied Polymer Science
New Biotechnology
Encyclopedia of Industrial Biotechnology
Journal of Chemical Technology and Biotechnology
Biochemistry
Journal of Biobased Materials and Bioenergy
Journal of Polymers and the Environment
The Journal of Biomolecular Screening
Archives of Microbiology
Biomacromolecules
Applied and Environmental Microbiology
Journal of Biotechnology
Polymer Degradation and Stability

FEMS Microbiology Letters
International Journal of Biological Macromolecules
Malaysian Journal of Microbiology
Canadian Journal of Chemistry
ESF Seed Proposals
USDA CSREES McIntire-Stennis Proposals
USDA CSREES SBIR Proposals

Meetings and workshops attended

239th ACS National Meeting & Exposition. March 21-25, 2010. San Francisco, CA, USA.

Syracuse Biomaterials Institute (SBI) 2nd Annual Offsite Meeting. August 28, 2009. Syracuse, NY, USA.

6. Departmental and College Duties

Faculty appointments

Department of Chemistry
SB3
ESF SCIENCE
Syracuse Biomaterials Institute (SBI)

Committee appointments

Biochemistry Qualifying Exam Committee
Chemistry Seminar Committee
SU Plant Molecular Biology Search Committee (SUNY-ESF representative)
Biomolecular Engineering Search Committee (Empire Innovation)
Plant Molecular Biology Search Committee Alternate (SUNY-ESF)

Other College Duties

Ph.D. candidacy exams	4
Ph.D. dissertation exams	2
MS dissertation exams	3

Seminars hosted

J.J. Hull (2010). Love potion #9 for insects: The molecular events underlyingthe initiation of sex pheromone production. USDA-ARS Arid Land Agricultural Research Center. Maricopa, AZ.

R. Ashby (2009). Biocatalytic Strategies to Produce Polyhydroxyalkanoates, Sophorolipids and Various Fatty Acid Derivatives from Agricultural Lipid-based Feedstocks. Eastern Regional Research Center-ARS. USDA, Wyndmoor, PA. (co-hosted with Bill Winter).

B.C. Tripp (2009). Bioengineering of bacterial flagellin: A self-assembling protein nanotube toolkit. Western Michigan University. Kalamazoo, MI.

M. Haas (2009). The development of novel approaches for the use of low quality feedstocks in biodiesel production. Eastern Regional Research Center-ARS. USDA, Wyndmoor, PA.

7. Retrospective Summary

Teaching:

My teaching load has been very heavy this year. In the Fall semester, in addition to the biochemistry lecture class (FCH530) that I teach, I had three additional assignments this year. FCH797 section 1 (Environmental Chemistry Seminar) and section 2 (Bioplastic Metabolism Seminar) and ERE/EFB 501 (Microbiology for Bioprocessing). In the Spring semester I taught FCH532.

The assessment for FCH530 is as follows:
Course average: 65.71%
Course median: 68.71%
% of Chem majors with C+ or better: 57%
% of Chem majors with B or better: 57%

For FCH532
Course average: 58.11%
Course median: 54.86%
% of Chem majors with C+ or better: 87.5%
% of Chem majors with B or better: 77.8%

Assessment for FCH530/532:

In the biochemistry course, we have been administering the ACS biochemistry exam in the spring semester. Students' scores are compared to the national average for the exam. The exam scores for this year's class were again slightly higher than the national mean but lower than the previous year. The average for the class in the previous year was a score of 43.3 with a standard deviation of 7.8. This year it was 42.3 with a standard deviation of 5.8. The national mean was 36.6 and median was 36.2 with a standard deviation of 8.4. This has been the worst class that I have had as an instructor at ESF. Only 4 of the students performed at an excellent level but overall the class was very poor. Although the students claim to like the homework assignments as a guide for the class, not everyone turns them in. Having a grader for the large number of assignments in the class was again helpful.

This is the first year that I taught the Environmental Chemistry Seminar course and we covered the construction of Gantt Charts and the standard 20 min American Chemical Society Meeting talk. Talks were videotaped so that

students could review their speaking skills. I believe this was a successful course4.

I taught ERE/EFB 501: Microbiology for Bioprocessing for the Advanced Certification for the second year and the course continues to evolve. The class make-up was largely members coming to school part time. The lab course was more intense this time due to increased contact hours, but I believe the students really get a lot out of this class. Again, I need to have some financial support to continue teaching the lab at the current level (we are currently using my research lab space as lab space) and would like a TA for this section.

Guest lectures for other classes on research performed in my lab continued to be very popular and have inspired the largest group of undergraduates to come forward to do research with my group. **We had 20 undegraduate students working with us this year!!**

Research:

Research continues to be a strong. For 2009-2010, we have 7 papers that have been published, 2 New Technology disclosures, and another paper submitted. There are several other manuscripts in preparation as well. Research from my group has also been presented at international, national, and local conferences by myself, graduate students, and undergraduates. I have received several invitations to speak at international conferences and colleges and universities worldwide as well as the USDA regional laboratories.

11 grant proposals were submitted during this time period. 1 (NSF) was funded and 10 were declined.

Other:

As a faculty member for the ESF SCIENCE Corps and SOS, I have given talks on biodegradable plastics and liquid nitrogen use. In addition we initiated inquiry based learning assignments to teach the scientific method to SOS students. These seminars were well received, and remain popular. I was able to use the relationships developed as a participant with this group to formulate a simple experiment for the kids and to write a strong section for broader impacts for my NSF proposal.

Postdoctoral Fellows

Dr. Benjamin Lundgren joined our group in Jan. 2010. He obtained his Ph.D. from the SB3/Syracuse University Chemistry Program. He will be working on metabolic and protein engineering for bioplastic production.

Graduate students

Ms. Qin Wang, a fourth year graduate student in my lab has co-authored 2 papers and recently submitted another. She was recipient of the Eastman

Award. She also received a 2010 ESF Graduate Travel Grant Award to attend the ASM meeting in San Diego.

Mr. Ryan Tappel, passed preliminary qualifying exams in Organic and Biochemistry.

Mr. Alex Mueller received an EAPSI NSF Fellowship to travel to do research with my collaborators at Hokkaido University, Sapporo, Japan.

Ms. Lucia Salamonca-Cardona joined the lab in Spring 2010. She will work on a joint project with my lab and Prof. Stipanovic's group.

Undergraduate students

Ms. Leticia Izquierdo has been accepted to a summer REU program at University of Oregon.

Mr. Alex Mottern will be doing a summer internship at Oak Ridge National Research Institute developing high strain piezoelectric multilayer actuators.

Mr. Joe Gredder has been accepted to graduate program in Biomedical Engineering at Tufts University.

Ms. Diana Dunn has received an internship with Antek, Inc. and Syracuse COE to work as an intern on wastewater treatment in my lab this summer (2010).

Ms. Jennifer Quinn (Clarkson University) will participate in the lab this summer through the Syracuse Biomaterials Institute (SBI) REU program.

Ms. Fengrong Wang (SUNY-Oswego) will join the lab this summer to participate in summer research in the laboratory.

Alumni

Mr. Greg Boyd is an assistant scientist with the SEA Ocean Science and Sailing Program.

Mr. Matt Martino is an assistant scientist at Metabolix, Inc.

Ms. Erica Hansen is currently working as a lab technician in Dr. Frederick Alt's lab at the Immune Disease Institute, Harvard University.

Ms. Hoa Nguyen is enrolled in Pharmacy school at Texas Southern University.

Ms. Jackie Mueller is enrolled in a doctoral program at University of Hawaii.

Mr. David Sgroi is employed as a lab technician at Covidien Pharmaceuticals. He has been accepted to a graduate program in Forensic Biology at SUNY Albany.

Ms. Jingnan Lu was the recipient of the SUNY Chancellor Award and Faculty of Chemistry Award. She is enrolled in a doctoral program at M.I.T.

Mr. Benjamin Murphy has been accepted to Officer Candidacy School.

8. Prospective Summary

Teaching:
I will again teach the biochemistry core courses this year. In addition, I will again be teaching the Microbiology for Bioprocessing course and the Bioplastic Metabolism seminar course. A grader for the biochemistry course has been absolutely necessary for the course due to the high assignment load. The Microbiology for Bioprocessing course again, will require an influx of support funds for upkeep costs of materials for the lab. It is hoped that I can get support for this both financially (for equipment upkeep for lab demonstrations and projects) as well as TA assistance.

Research:
My teaching load this last year was very heavy and I was not able to write up as many new submissions for grants as I would have liked. I am working on 3 submissions now with due dates over June and July.

I have been asked to co-organize a symposium on biodegradable polymers at Pacifichem 2010 along with Professor Uyama from Osaka University and Professor T. Iwata from Tokyo University. I have also been asked to be an outside examiner at Queens College, Ontario on a Ph.D. defense for one of Bruce Ramsay's students. Bruce is well known in the PHA field and his request indicates that the reputation of our lab is expanding

With the NSF grant we just received, our lab has expanded very rapidly. We currently have 1 postdoc, 3 full time supported graduate students, 5 other summer supported graduate students, and 4 summer supported undergradute students. We will be getting 2 new graduate students in the fall. It is clear that we need more space for the lab. We are also expecting a visiting Ph.D. student from Japan in 2011.

We are also looking into putting a white paper to Matt Driscoll on our work for the breakdown of pharmaceutical compounds. We believe this has some very interesting potential.

A ONE PARAGRAPH SUMMARY OF SIGNIFICANT ACTIVITIES AND ACCOMPLISHMENTS DURING THIS REPORTING PERIOD, ESPECIALLY THOSE MOST NOTEWORTHY AND RELATIVE TO THE COLLEGE'S AND DEPARTMENT'S MISSION.

The Nomura Research Group continues to meet the goals of SUNY-ESF and the Department of Chemistry. Our research has been published in peer-reviewed journals and we have greatly increased the global visibility of SUNY-ESF. Talks and poster presentations by members of the Nomura Research Group have resulted in excellent opportunities for both graduate and undergraduate students, as well as collaborative opportunities with SUNY-ESF and the Department of Chemistry. Presentations at conferences and universities will continue to expand the recruiting base for the graduate program in Chemistry. Presentations and collaborations with ESF SCIENCE and the SOS programs will continue to bring science to the fore for a number of at-risk youth and minority students from Syracuse during the summers. These contributions have significant, impacts for science, society, the Department of Chemistry and SUNY-ESF.

ANNUAL REPORT

Arthur J. Stipanovic

Professor and Chair - Faculty of Chemistry (70%)
Director, Analytical and Technical Services (30%)
June 1, 2009 - May 31, 2010

I. **Teaching and Instructional Activities:**

A., B. Undergraduate / Graduate Course Offerings: No courses taught in 09-10 except FCH 999 (Jessica Hatch).

C. Continuing Education (CE) Courses and Workshops: Participated in the Fall 2009 Graduate Colloquium on Teaching and Learning – Facilitated the session on "Teaching Strategies for Lab and Field Experiences" offered through the Instructional Support and Outreach Office.

D. Guest Lecturer: Presented lectures on "The Wood-Based Biorefinery" to the EFB 132 orientation sub-group for "Biotechnology" majors (November 2009) and to FCH 496-Biomass Chemistry. Also gave lectures on "Polymer Chemistry" to FCH 152 (Sections 1,2). Facilitated a session on Job Interviewing (plus mock interviews) in Greg Boyer's FCH 495 – Introduction to Professional Chemistry course.

Presented seminars on the "Wood-Based Biorefinery" to the chemistry / biology departments at Houghton College in October 2009 and to the NYS Ag Experimental Station (Cornell University) in Geneva, NY in March 2010. Participated in the Fall 2009 ESF Learning Community Retreat in Marcellus, NY. Served as a panelist at the GSA Symposium on "Defending Your Thesis".

II. **Student Advising and Counseling**: Served as the curriculum advisor to four undergraduate chemistry majors and research advisor to the following graduate students: Michelle Serapiglia (Ph.D., joint with Dr. Smart of EFB), Jessica Hatch (Ph.D., SB3 program; joint with Dr. Winter), Kun Cheng (Co-Advisor with Dr. Winter), Mellony Manning (Co-advisor with Drs. John Hassett and Mark Driscoll). Also, during the summer of 2009, I hosted one undergrad assistant in my lab (Nick Stam, LeMoyne College).

III. **Research and Other Scholarly Works:**

A. Departmental Research: My research programs focus on four broad objectives:

(1) The isolation of hemicellulose from biodelignified hardwoods and the fabrication / characterization of biodegradable polymer composites and blends from this renewable material, (2) The use of NMR, thermogravimetric analysis and Near IR in the high-throughput compositional analysis of renewable lignocellulosic biomass, (3) Reducing the recalcitrance of biomass using electron beams, microwaves and biological treatments including the influence of cellulase enzymes on the solid state structure of cellulose and, (4) Fabrication and evaluation of controlled-release devices for insect pheromones based on micron-sized, nanoporous polymer

particles. An additional program focused on the development and characterization of "Stimuli Responsive Materials" based on cellulose derivatives, including electro- and magnetically-activated fluids and elastomers is still awaiting future funding.

B. Grant-Supported Research: Current externally-funded research programs are highlighted below. Since 1998, I have generated over $2.98 million in external support for research and related equipment.

- PI for a DOE Energy Biosciences grant (co-PI's: Dr. W.T. Winter and Dr. David Wilson, Cornell University) entitled "The Effect of Cellulose Crystal Structure and Solid-State Morphology on the Activity of Cellulase Enzymes" (Total = $785,000, ended Sept. 2009).

- NYSERDA #1: "Microwave assisted extraction of hemicellulose from woody biomass", $87,000. Ended late 2009).

- NYSERDA #2: Electron beam irradiation of biomass to reduce recalcitrance", $110,000 / 2 years (joint with Dr. Driscoll; continuing into 2010).

- Xerox Foundation: "Biodegradable polymer blends and composites based on the hemicellulose fraction of woody biomass" $20,000 / year for 3 years through September 2010.

- USDA-NRI - "Electron Beam and X-Ray Irradiation of Cellulosic Biomass - Synergies with Biodelignification and Hemicellulose Removal in Reducing Recalcitrance", $500,000 / 3 years (1 year extension ends Sept. 2011)

- NE Sun Grant Initiative – "Influence of Varietal Difference Shrub Willow Crop Biomass Composition on Biochemical Conversion Yield", $16,235 / 2 years. (Joint with L. Smart, Cornell).

Pending Proposals:

- NSF: "Upgrade to 300 MHZ and 600 MHZ NMR Spectrometers at SUNY-ESF", $500,000 NSF; $625,000 total (AJS, PI).

- US DoC-NIST: "Biofuels Development and Performance Testing Center", $5,714,000; Addition to CNY Biotech Center (AJS, PI)

- USDA-NIFA-AFRI: Hemicellulose Extraction and Conversion To Polymer Co-Products: Synergies Between E-Beam Radiation, Biodelignification, and Aqueous Extraction; $588,474 (AJS, PI).

- USDA / DOE "Fermentable Sugars and Chemicals from Willow Biomass and Conversion to Value-Added Products"; Stipanovic, Amidon, Volk, Abrahamson, Nomura co-PI's. $7,090,000 / 3 years.

Unfunded Proposals: None currently

C. Peer-Reviewed Publications: 2009-10.

"Production and Characterization of Poly-3-hydroxybutyrate From Biodiesel-Glycerol by *Burkholderia cepacia* ATCC 17759", C. Zhu, C.T. Nomura, J.A. Perrotta, A.J. Stipanovic, and J. P. Nakas, *Biotechnol. Prog*., 26 (2), 424-430 (2010).

"Quantitative Analysis of Sugars in Wood Hydrolyzates with 1H-NMR During the Autohydrolysis of Hardwoods", A. Mittal, G.M. Scott, T.E. Amidon, D.J. Kiemle and A.J. Stipanovic, *Bioresource Technology*, 100, 2398-2406 (2009).

"An Improved Method for the Hydrolysis of Hardwood Carbohydrates to Monomers", Samar K. Bose, Vincent A. Barber, Ericka F. Alves, David J. Kiemle, Arthur J. Stipanovic and Raymond C. Francis, *Carbohydrate Polymers*, 78, 396-401 (2009).

"Electron Beam Irradiation of Cellulose", M. Driscoll, A. Stipanovic, W. Winter, K. Cheng, M. Manning, J. Spiese, R.A. Galloway, M.R. Cleland, *Radiation Physics and Chemistry*, 78, 539-542 (2009). *

"Analysis of Biomass Composition Using High-Resolution Thermogravimetric Analysis and Percent Bark Content for the Selection of Shrub Willow Bioenergy Crop Varieties", M.J. Serapiglia, K.D. Cameron, A.J. Stipanovic, and L.B. Smart, *Bioenergy Research*, 2, 1-9 (2009). *

* Included in 2008-09 Annual Report

Presentations at Technical Societies: Non-presenting co-author on the following:

"Investigation of irradiated wood dissolution in DMSO/TBAF using NMR and GPC". Cheng, Kun; Barber, Vincent A.; Stipanovic, Arthur J.; Winter, William T.; Driscoll, Mark. Department of Chemistry, Cellulose Research Institute, SUNY-ESF, Syracuse, NY, USA. Abstracts of Papers, 239th ACS National Meeting, San Francisco, CA, United States, March 21-25, 2010 (2010).

Poster: "Self-association, conformational ordering and gelation of pustulan ((1-6) beta-D-glucan)", N.J. Stam. A.J. Stipanovic. and D.J. Kiemle, 239th ACS National Meeting, San Francisco, CA, United States, March 21-25, 2010 (2010).

Awards: None in 2008-09 .

IV. **Outreach and Public Service**: **A**. *Unfunded Service*: At the request of President Murphy, I have been working with Bell IPC, a small company actively developing wood gasification technology (Rochester, NY) to provide compositional analysis and heat of combustion determination for woody feedstocks.

Starting in 2001, I served on the ESF Faculty Governance Committee on Public Service and Outreach and, during 2004-2006, I was Chair of this committee. I am no longer active on this committee.

I currently serve as an Ad Hoc Reviewer for research proposals for the USDA CSREES NRI (Program Areas 51.2 and 71.2), the ACS Petroleum Research Fund and the ESF McIntire-Stennis Program. During the past year I have reviewed papers for publication in the Journal of Agricultural and Food Chemistry (an ACS Journal), Cellulose, Carbohydrate Polymers, Bioresource Technology, Biomacromolecules, Applied Biochemistry and Biotechnology, Polymer Degradation and Stability **B.** *Funded Service Projects*: None

V. **Professional Development**:

A. Professional Organization Activities:

- Member of the American Chemical Society plus the following divisions: CELL, POLY, PMSE, PROF
- Former Chairman of the Syracuse Section of the ACS (no longer active on the Executive Committee).

B. Additional Assignments: Member of the ESF Biotechnology faculty and joint UMU / SU / ESF SB^3 faculty. During the past year, completed my involvement (by Presidential appointment) in the design of a vehicle refueling station for biofuels. Continuing as faculty advisor to the student-run biodiesel reactor that makes renewable fuel from used cooking oils obtained from Syracuse University and NYS Fair butter.

C. Coursework, Workshops: None in 2009-10.

VI. **Administrative and Governance Service:**

A component of my work effort at SUNY-ESF (30%) is dedicated to my role as Director, Analytical and Technical Services. In this capacity, I supervise one secretarial and 4 professional employees including Performance Program development, annual Performance Evaluations and the discretionary salary increase process. In addition, I manage the A&TS operations budget and the accounts associated with two major college-wide "service centers" (Chemical Stockroom, Analytical Services). Direct interaction with A&TS customers is also a major element of my position. Other administrative and governance activities include:

A. Faculty: Regularly attend ESF Faculty Meetings ! Served as panelist for a session on "TA's roles and expectations" held in conjunction with a Faculty Governance Meeting.

B. Search Committee for 3 Empire Innovation Professorships (9 applicants interviewed).

C. College: MSCHE 10 Year Assessment Steering Committee. Continued involvement with the Entrepreneurship Program that includes an 18-credit minor, a seminar series

and, during the Spring 2008 semester, a 3 credit "Green Entrepreneurship" course that includes a business concept competition taught by Adjunct Professor Gary Lim. Panelist (judge) for the business concept competition.

D. University: Participated as a SB^3 program faculty member involving ESF, Syracuse University and the SUNY-UMU. (SB^3 = Structural Biology, Biochemistry and Biophysics). Biotechnology faculty member. FCH representative on the Academic Council. Made a presentation to SUNY Chancellor Zimpher on ESF's Outreach Program as a fill-in for Chuck Spuches.

RETROSPECTIVE NARRATIVE:

Since joining ESF in September 1998, I have been challenged by two distinct job assignments. Generally, 70% of my effort is dedicated to my position in the Department of Chemistry including teaching, research and university service responsibilities while, at a 30% effort level, I also serve the College as Director, Analytical and Technical Services. In August 2007, I was appointed as the Chemistry Department Chairperson for a 3 year term which ends on August 31, 2010 (☺).

A&TS Director (30%)

I continued to supervise a group of 4 professionals and one administrative assistant charged with the following mission: "To provide specialized customer focused, value-added support services contributing to the ESF missions of instruction, research and public service in the following areas: instrumental analytical methods; scientific equipment / instrument repair, design and fabrication; computer repair / upgrading; chemical / laboratory apparatus stockroom services. We will also maintain the flexibility to develop new services in response to evolving campus needs".

Progress against specific objectives is detailed separately in the A&TS Annual Report. Highlights include:

- Development of a multi-institutional proposal to the NSF Chemistry Division that would fund an upgrading of our 300 and 600 MHz NMR instruments. Collaborators: UMU, SU (Chem, Bio, Engineering), NCSU, and Cornell.

- NMR and MS Specialist, Dave Kiemle, was awarded the SUNY Chancellor's Award for Excellence in Professional Service.

- Collaboratively established a new analytical competency: MALDI TOF MS

- A new, improved ICP lab was established in 126 Baker Lab and space in B19 was re-designed to accommodate the MALDI instrument.

Professor and Chair, Faculty of Chemistry (70%)

My objectives and accomplishments as FCH Chair are detailed in the Chemistry Department Annual Report. Several highlights are summarized below:

- Recruiting / enrollment: 8 new graduate students 13 new undergraduates will start at ESF in Fall 2010

- An undergraduate "minor" in chemistry was initiated that is expected to attract students from Environmental Science, PBE and Biotechnology (EFB).

- The undergraduate FCH Student Outcomes Assessment Plan, developed last AY, was implemented this past year.

- No additional progress was made toward the goal of obtaining ACS certification of our B.S. curriculum due to space and faculty limitations for required new lab courses.

- Completed Performance Evaluations and new Performance Programs for each professional staff member in FCH.

- Conducted regular FCH faculty meetings and initiated an electronic "virtual meeting" format when scheduling meetings was difficult.

- Organized social events to "celebrate success" within our department (December Student Awards Ceremony and Graduate of Distinction Seminar by Robert Lenz, Spring Students Awards Picnic, Convocation Breakfast).

In my role as Professor of Chemistry, I've also maintained an active research effort serving as co-advisor to four graduate students, one Post-Doc and several undergraduates and summer research assistants. Since joining ESF in 1998, I have generated approximately $2.4 million in external research funding (exclusive of start-up funding) plus an additional $650,000 in equipment that was donated to ESF or purchased through grants from the USDA or NYS CoE. Funding includes both industrial support plus grants from agencies including the DOE, USDA and NYSERDA. During the past year, I was the PI on two grant applications (pending) that would benefit ESF significantly: (1) At the request of President Murphy, I am PI on a DoC - NIST building grant application that would help complete the 3rd floor of the CNY Biotechnology Research Center as a biofuels testing lab and algal bio-oil production facility ($5.7 million) and, (2) A NSF equipment grant application to upgrade the ESF 300 and 600 MHz NMR spectrometers ($500,000).

My research program areas are highlighted below:

- The impact of solid-state structure and morphology of cellulose on the activity of recombinant cellulase enzymes (Ms. Jessica Hatch, Ph.D. Candidate; Joint initiative with Cornell University and Dr. W. Winter).

- Reducing the recalcitrance of woody biomass using electron beams and microwaves (Vincent Barber, Post Doc; Kun Cheng), both programs joint with Dr. Mark Driscoll.

- NMR, high throughput TGA and Near IR methods in the characterization of lignocellulosic biomass for willow feedstock development (Michelle Serapiglia; Jointly with Prof. Larry Smart (EFB).

- Extraction of hemicellulose from biodelignified wood and the development of new applications for xylan hemicellulose as a renewable, biodegradable material (Collaboration with Drs. Amidon and Scott; PSE; Kunal Mishra, MS, May 2007).

- The characterization of thermoplastic, biodegradable, microbial polyesters using wood-based feedstocks such as xylose and levulinic acid (Collaborations with Prof Nomura (FCH) and Prof Nakas, (EFB)). Fabrication of polyester blends with cellulose and xylan derivatives (Dan Nicholson, MS candidate - PBE).

- The fabrication, characterization and release rate modeling of micron-sized controlled release polymer particles for insect pheromones (Patrick Hennessy, MS 2003; Co-PI: Dr. Fran Webster). No recent activity in this program area due to lack of external funding.

PROSPECTIVE NARRATIVE:

A&TS Director (30%): It is likely that a major initiative in the 2010-2011 academic year will involve re-submission of a NIH proposal to acquire a 800 MHz NMR establishing A&TS as a "regional" NIH NMR center. A multi-institutional effort in 2008 in which UMU (PI), Cornell, U of Rochester and SU collaboratively participated in this "center" concept, to be located in B-18 Jahn, came very close to being funded. See the A&TS Annual Report for more details.

Faculty of Chemistry (70%)

Administrative Activities: I will complete my 3 year appointment as Chair in late August and do not plan on continuing in this capacity into the future.

Research: My research effort will continue to evolve toward technologies part of the cross-departmental integrated wood-based biorefinery concept. Since this work is multidisciplinary in nature, it will involve considerable collaboration with colleagues in FCH, other departments at ESF (PSE, EFB) as well as groups from external institutions. Results on the use of electron beams to reduce the recalcitrance of woody biomass to enzyme hydrolysis appear very promising and continued attention will be focused on this project in the next year. New analytical methods for the compositional characterization of woody biomass will also remain a priority and is part of a new collaboration with Dr. Stephane Corgie of the Biofuels Research Lab at Cornell and Dr. Larry Smart of NYSAES in Geneva. As the ESF Biofuels Testing Lab at the NYS CoE is completed, more activity in feedstock characterization using NIR is planned for this facility.

ACADEMIC STAFF -- ANNUAL REPORT

Mark Teece

FACULTY OF CHEMISTRY

May 15, 2009 - May 15, 2010

I. Instructional Activities

A. Undergraduate Course Offerings

Course No., Title, Semester, No. of students

FCH 496 –Special Topics in Chemistry, Spring, 1 student
Michael Eveland

FCH 498 –Introduction to research in chemistry, Spring, 1 student
Zach Stultz

B. Graduate Course Offerings

Course No., Title, Semester, No. of students

FCH797 Stable isotopic tracers in the environments. Spring, 11 students

FCH 797 Environmental and Biochemistry Seminar, Spring, 8 students

FCH 899 – Masters research Fall 2009. 2 students
Ben Estes
William Wurzel

FCH 899 – Masters research Spring 2010. 2 students
Ben Estes
William Wurzel

FCH 999 – Doctoral research Spring 2010. 1 student
Jesse Crandall

C. Continuing Ed Courses and Workshops

D. Guest Lecturer Activities

EFB 415/610 Ecological Biogeochemistry
ESC 132 Environmental Science Orientation Seminar

II. Student Advising and Counseling (Grad and Grad)

Undergraduate curriculum coordinator for chemistry

5 Chemistry undergraduates

Graduates:
Major Professor for:
Sarah Fitzpatrick (FCH) – graduated Summer 2009
William Wurzel (GPES)
Benjamin Estes (FCH)
Jesse Crandall (FCH)
Steering Committee for:

Amy Dechen (EFB)
Matthew Domser (EFB)
Stephanie Figary (EFB)
Kwasi Gilbert (SU Earth Sciences)
Jake Gillette (EFB)
Lucas Kirby (EFB)
Amos Quaye (EFB)
Laura Schifman (EFB)
Cheryl Whritenour (EFB)

III. Research and Other Scholarly Works

A. Departmental Research

Kendra Nash – Using stable isotopes to discern diets of reef-associated zooplankton

Mike Eveland – Fatty acids of hard corals

Zach Stultz – Lipid content of corals in the Florida Keys National Marine Sanctuary

B. Grant-Supported Research (Existing grants plus grants pending)

Active:

Mark Teece and Diego Lirman: Sources of coral nutrition: The role of autotrophy and heterotrophy on coral growth and survivorship. NOAA-NURC. $59,334.

Kimberly Schulz, John Farrell, Karin Limburg, Mark Teece: Can fatty acids improve our ability to trace food webs. NSF Ecology $583,800.

John Stella and Mark Teece A new tool for restoration ecology: Stable carbon isotopes in tree rings as indicators of ecosystem change. ESF Seed Grant Program. $8,000

Associate Investigator with Hairston, N. G., Kraft, C. E. and Jones, L. E. (Cornell) Ecological controls of lake-water clarity at the dynamic South end of Cayuga Lake. Hatch Foundation.

Jacqueline Frair and Mark Teece: Evolving niche of the “coy-wolf” in northeastern forests and implications for biodiversity. Northeastern States Research Cooperative $40,046

Kelley Donaghy et al. Environmental Scholars: A scholarship program in environmental chemistry, biology, and engineering. NSF $600,00

Renovation of Wet Labs and Cyber-Infrastructure to Enhance Integrated Research and Teaching in Aquatic Science at ESF. Ringler et al. NSF $1,757,801

Attendance and presentation of talk at AGU Ocean Sciences Meeting. UUP Development Fund $626

Pending:

J. Farrell, C. Whipps, and M. A. Teece: (2010) Assessing the role of invasives in the transmission and maintenance of disease in Great Lakes fish communities. Great Lakes Fisheries Commission 3 year $107,000

John Farrell, Kimberly Schulz, and Mark Teece A Multipurpose building to promote research and training activity at the Thousand Islands Biological Station. $225,093

Mark Teece (2010) Production and fate of urea in coral reef systems. NSF Chemical Oceanography, $469,340.

Declined:

Mark Teece (2009) Urea – The missing pool of bioavailable nitrogen on coral reefs. NSF Chemical Oceanography, $477,222

CCI Phase Center for the Fate and Reactivity of Organic Matter in the Environment. Kieber, Boyer, Teece, Dibble and Hassett. NSF $1

C. Publications (include "in press" but not "in preparation", Licenses, Inventions and Patents, Awards

Teece, M. A., Estes, B., Gelsleichter, A. and Lirman D. (2010) Heterotrophic and autotrophic assimilation of fatty acids by Scleractinian corals. *Submitted to Limnology and Oceanography.*

Henry T. Mullins, William P. Patterson, Mark A. Teece, Adam W. Burnett (2010) Regional Holocene climate and environmental change in central New York (USA) - the lacustrine record. *Submitted to Journal of Paleolimnology*

Presentations:

Teece, M.A. and Lirman, D. (2010) Effects of degraded water quality and availability of food resources on the health of Scleractinian corals in the Florida Keys, U.S.A. AGU Ocean Sciences, Portland OR.

B. A. Estes, M. A. Teece and Diego Lirman (2010) Deep vs. Shallow: Coral feeding behavior in reefs off the coast of the Florida Keys AGU Ocean Sciences, Portland OR.

Kwasi N. Gilbert, Linda C. Ivany, Mark A. Teece, Mark D. Uhen (2010) Neogene Sperm Whales on the Atlantic Coastal Plain: Constraining Life History and Ecology from Teeth NE Geological Society of America (March, 2010).

Estes, B. and Teece, M. A. (2010) A hope for corals: The importance of heterotrophy. ESF Spotlight on Research, Syracuse NY.

Wurzel, W., Lirman, D. and Teece, M. A. (2010) Coral feeding strategies as a function of reef environment in the Florida Keys. ESF Spotlight on Research, Syracuse NY.

Stulz, Z. and Teece, M. A. (2010) Lipid content of corals in the Florida Keys. ESF Spotlight on Research, Syracuse NY.

Schifman, L.A., Stella, J.C., Volk, T.A., and Teece, M.A. (2010) Plant growth and water stress response of hybrid willow (*Salix* spp.) among sites and years in central New York. ESF Spotlight on Research, Syracuse NY.

Teece, M. A. (2009) Coral reefs – Protecting a global treasure. Antique Boat Museum, Clayton, NY.

Teece, M.A. and Lirman, D. (2009) Compound specific isotope analysis to determine feeding behavior on coral reefs. Continuous Flow Stable Isotope Mass Spectrometry Conference, Ithaca, NY

IV. **Public Service and Outreach**

A. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.

New York State Fair – demonstrations of chemical techniques and research to the public

Temporary display and presentation to the Onondaga County Library patrons on the science of coral reefs.

B. Funded Service Projects

1. Government Agencies

Manuscript reviewer for
National Science Foundation
Freshwater Biology
Geochimica et Cosmochimica Acta
Limnology and Oceanography
Limnology and Oceanography – Methods
Marine Biology
Organic Geochemistry

2. Industrial and Commercial Groups

V. **Professional Development**

A. Professional Organization Activities

Membership in:
European Association of Organic Geochemists
International Society of Coral Reef Scientists
American Society of Limnology and Oceanography
American Chemical Society

B. Leaves, Additional Assignment, etc.

C. Course Work, Workshops, etc.

VI. **Administrative and Faculty Governance Service**

A. Faculty

At-large member of faculty governance

Member of the Committee on Research

B. College

Undergraduate curriculum coordinator for chemistry department.

Vice president and board member – Friends of Moon library

C. University, including Research Foundation

Service learning:

No courses this year

Retrospective

Teaching: I taught the stable isotope tracers graduate class which is increasingly popular and this year attracted 3 Syracuse University students. The class is a very hands on course and 11 students is near the limit of the number that I can accommodate with the number of individual projects that are undertaken in the class. Again, the class was a great success and the changes and improvements obtained from last year's class made the class even better. Attracting SU students was a bonus. The graduate seminar for Environmental and Biochemistry students focused on the Copenhagen Accord and by the end of the class all students at least knew the importance of this accord and the issues of global climate change – a topic that many of our students seem relatively ignorant about.

I continued my work as the Undergraduate Curriculum Coordinator for Chemistry and make some changes and improvements to the way that we advise undergraduate students in the discipline. This included providing course lists to our faculty on "professional electives" something that had not been updated since 1996. I submitted and had approved the Minor in Chemistry, and further, as coordinator of chemistry department's assessment plan for the undergraduate program, I worked with fellow committee members, Ted Dibble and Kelley Donaghy, and Jill Winterhalt, to assess our program. We completed our initial assessment of the program for both Fall and Spring semesters and will spend time this summer working on the next steps of the plan. I was also included in the Who's who of teachers 2010.

Research: I am currently funded by NSF, NOAA, ESF Seed Grant program, and Northeastern States Research Cooperative, and submitted two manuscripts this year. In the area of coral reef chemistry and biogeochemistry, I am funded by NOAA and submitted a manuscript to *Limnology and Oceanography* on our work and have several more in preparation for the coming year. My 2 current M.S. students are continuing their work in collaboration with ecologists from University of Miami that is currently funded by NOAA-NURC. We presented our findings at several meeting this year and the results were well received.

Last year, I began a new line of research and submitted a proposal to the NSF Chemical Oceanography panel to expand my research program in these directions. The first submission was declined, and I resubmitted a second version and am confident of the outcome.

I submitted proposals with my EFB colleagues using chemical techniques to investigate fish diseases and also to enhance the research and training facilities at the ESF Thousand Islands Station. Along with colleagues at SU, Colgate, and University of Saskatchewan, we submitted a manuscript to the *Journal of Paleolimnology*.

As a component of my research program, and for several other faculty, we are required to SCUBA dive to collect samples. In order for ESF to be compliant in SCUBA diving for scientific research, I

developed an ESF Scientific Diving Program. Our program is currently under review, including the 86-page manual, by the American Association of Underwater Scientists (AAUS). This initiative was approved by Provost Bongarten and I expect to receive full accreditation for this program in the summer. This program would allow faculty and students to become qualified scientific divers.

I hosted 2 undergraduates for their research projects and their data was presented at the ESF Spotlight on Research and included in a presentation at the AGU Ocean Sciences meeting. I presented my work at several national and international meetings and also to the general public.

New partnerships: I expanded my new collaboration with John Stella of EFB focused on reconstruction of precipitation patterns using stable isotopes, and we received ESF Seed Program funds to pursue this work. A successful proposal to Northeastern States Research Cooperative with Jacqueline Friar in EFB is another new venture that was funded this year. My partnership with Nelson Hairston at Cornell has led to successful funding from the Hatch Foundation, and I continue my collaborative projects with Linda Ivany of SU Earth Sciences. New opportunities with colleagues from Baruch College in NYC, and the Caribbean Marine Institute were developed this year.

A new PhD student, Jesse Crandall, began working in my lab this Spring, and Sarah FitzPatrick graduated with a M.S. in summer 2009.

Prospective

Teaching: With the continuing popularity of my graduate stable isotopes class, I will offer this class again this coming year. Using comments and suggestions, I will improve this course offering. I will teach Marine Biogeochemistry for undergraduates and graduates and this course often attracts students from several disciplines including chemistry, EFB, Env. Science, and SU Earth Sciences. I will continue my work as the Undergraduate Curriculum Coordinator for Chemistry and work to improve our program through the assessment process.

Research: I am pleased that Caresse Fernandez, a new Ph.D. student, will begin working with me in Fall 2010. Along with Jesse Crandall, who started in January, both students will work on the new research initiatives in my group. My funding from NOAA means that these students and I will spend several weeks in the field collecting samples, and we will use these opportunities to collect preliminary data for future proposals. This year, I intend to apply to NSF Biological Oceanography, and Chemical Oceanography to support my research. New collaborations developed this year with colleagues from Baruch College and the Caribbean Marine Institute will likely result in submissions to NOAA programs to initiate research in the Cayman Islands. All of these projects will enhance my research program and add an international portion to my initiatives. Publications from last years work are in preparation, and I hope that my GPES student, Will Wurzel, will not only submit a manuscript this year, but also graduate.

Manuscripts from my collaborations with Kim Schulz in ESF will be submitted this year and I will continue several new projects with EFB colleagues, John Stella, Jacqueline Friar, and John Farrell. These projects will likely result in submission of proposals to continue these projects.

SIGNIFICANT ACTIVITIES AND ACC0MPLISHMENTS

This year I submitted proposals for more than $900k in grants, and developed new partnerships for myself and ESF. I was also a co-PI on an additional successful $1.7 million project to enhance ESF infrastructure. I recruited 2 new PhD students, and graduated a MS student. New collaborations resulted in successful grant applications and I presented results of my research groups studies at several national and international meetings. As undergraduate curriculum coordinator for chemistry, I simplified and clarified outstanding issues, developed, had approved, and started a Minor in Chemistry, and began the assessment of the BS program. I also started the ESF wide Scientific Diving Program that will allow faculty and students to become qualified scientific divers.

ANNUAL REPORT: June 1, 2009 – May 31, 2010
(i.e., Summer 2009, AY 2009-2010)
DEPARTMENT OF ENVIRONMENTAL AND FOREST CHEMISTRY
SUNY-ESF

NAME William T. Winter

Summer 2009 **Academic Year 2009-2010**

I. INSTRUCTIONAL ACTIVITIES

1. Regular Course Offerings

	Course No.	Title	Credit Hrs.	No. Students	No. of Lab. Sections
FALL:	FCH551	Polymer Techniques	3	8	1
	FCH552	Polymer Science II	3	4	0

SPRING:

2. Non-Scheduled Course Offerings (e.g., 496, 899, 999)

Course No.	Title	No. Students	Credit Hrs.
FCH496	Biomass Chemistry	2	3
FCH796	Biomass Chemistry*	2	3
FCH 999	PhD Dissertation (Fall)	3	9
FCH999	PhD Dissertation (Spring)	3	3
FCH999	PhD Dissertation (Summer)	1	3

*Dual listing with FCH496 (15)

3. Continuing Education and Extension (Short courses, workshops, etc.)

CHESS User group meeting June 2009, participant, invited lecturer and poster presenter

Eastman Chemical Co workshop on cellulose (Insstructor) Scheduled for Summer 2009 and then canceled because of a weather delay , rescheduled meeting was also canceled by Eastman due to financial downturn

4. Guest Lecture Activities

None

II. STUDENT ADVISING AND COUNSELING

A. Number of undergraduates for whom you are the student's official advisor is 2 and unofficial advisor is ~4.

B. Graduate Students - (Name, degree sought, starting date, month & year; if a degree was completed, please give date and full citation for the thesis or dissertation).

MAJOR PROFESSOR

Barnhart, DeAnn	PhD-SB3	Entered Sept
Cheng, Kun*	PhD	Entered July 2003
Zhao, XingFei	PhD-SB3	Entered Sept 2008

*Co-Major with A. Stipanovic

Theses Completed:

None

CO-MAJOR PROFESSOR

Spiese, Jessica – with A. Stipanovic

MEMBER, STEERING COMMITTEE (other than those listed above)

Darya Prokhorova PhD Chemistry, I also prepared her candidacy exam. At the end of the written exam period the student elected not to submit and has transferred into the MS Chemistry program.
Mellony Manning PhD Chemistry

CHAIRMAN OR READER ON THESIS EXAMS, ETC.

Ann Dechen Quinn, Doctoral Defense, EFB
Kathleen Baier, MS Defense, EFB

III. RESEARCH COMPLETED OR UNDERWAY

A. Departmental Research (unsupported, boot-legged; title - % time spent)

1. Maintain x-ray diffraction laboratory, operation and safety training for new users, alignment, maintenance, vacuum system servicing 10%
2. Oversee thermal analysis laboratory – with A. Stipanovic, 3%
3. Influence of residential communities on surrounding wilderness in the Adirondacks (Elizabeth Dowling thesis) 3%

B.1. Grant-supported Research (source, subject, amount - total award and current year, award period starting and ending dates; list graduate research assistants supported by each grant)

a) US Dept of Energy, The Effect of Cellulose Crystal Structure and Solid-State Morphology

on the Activity of Cellulases, $777,149, , 9/15/02-9/14/09, J. Spiese. K. Cheng.

b) Electron Beam and X-Ray Irradiation of Lignocellulosic Biomass - Synergies with Biodelignification and Hemicellulose Remediation USDA-CSREES award #2007-35504-18341,$499,299.,, 9/1/07-8/31/10 ,supports Kun Cheng, partial support for J. Spiese.

c) Using NMR Spectroscopy to Identify Composition and Structure Changes in Poplar Biomass with Exposure to Endophytic Bacteria, Brookhaven National Laboratory/ESF $12,000, $12,000. 5/17/2010-8/23/2010, DeAnn Barnhart.

B.2. Research Proposals pending (as in B.1., above)

None- NSF proposal under development for July submission

IV. PUBLICATIONS (Full bibliographic citation, i.e., do not use "with Jones," or "Jones, et al."; please list only publications published, in press, or actually submitted --- **do not list manuscripts in preparation**).

A. Refereed Publications

Driscoll, M., A. Stipanovic, **W. Winter**, K. Cheng, M. Manning, J. Spiese, R. A. Galloway, and M. R. Cleland (2009)Electron beam irradiation of cellulose**,** Radiation Physics and Chemistry, 78(7-8): 539-542.

Goodrich, Jacob D and **William T. Winter** (2009) Green Composites Prepared from Cellulose Nanoparticles *In* Polysaccharide Materials, Performance by Design, ACS Symposium Series v. 1017, pp 153-168 Eds. Kevin J. Edgar, Thomas Heinze, and Charles M. Buchanan **DOI:** 10.1021/bk-2009-1017.ch008

Winter, William T. and DeAnn Barnhart (2009) HR-MAS: The Other NMR Approach to Polysaccharide Solids *In* Polysaccharide Materials, Performance by Design, ACS Symposium Series v. 1017, pp 261-270, Eds. Kevin J. Edgar, Thomas Heinze, and Charles M. Buchanan **DOI:** 10.1021/bk-2009-1017.ch015.

Jacob D. Goodrich, Deepanjan Bhattacharya and **William T. Winter** Cellulose and Chitin as Nanoscopic Biomaterials *In* The Nanoscience and Technology of Renewable Biomaterials (Eds. Lucian A. Lucia and Orlando Rojas) 2009 Wiley, New York Ch8, 207-229.

B. Non-refereed Publications

None

C. Papers Presented at Science Meetings (give title, date, occasion, and location)

"The *in situ* characterization of plant cell wall polysaccharides through HR-MAS NMR spectroscopy and X-ray diffraction." DeAnn Barnhart & William T. Winter, Chemistry Department / Cellulose Research Institute SUNY Environmental Science and Forestry, Ana L.F. Bertolo, Breeanna Urbanowicz & Jocelyn Rose, Dept. of Plant Biology, Cornell University, Detlef Smilgies & Ruipeng Li, June 9-10. 2009, CHESS, Cornell Univ. CHESS User Meeting, Ithaca, NY.

"Scattered Thoughts on Fiber Diffraction at the Dawn of Its 2nd Century" **William Winter,** June 10, 2009, CHESS, Cornell Univ. CHESS User Meeting, Ithaca, NY. (Invited lecturer)

"An Investigation of Irradiated Wood Dissolution in DMSO/TBAF Using NMR and GPC" March 24,

2010, Kun Cheng, Vincent A Barber, Mark Driscoll, Arthur J Stipanovic, **William T Winter** Amer. Chemical Society National Mtg, San Francisco, CA

"Factors influencing the formation of spherical cellulose nanoparticles and other applications" March 21, 2010, Xingfei Zhao, Kun Cheng, **William T Winter**, Amer. Chemical Society National Mtg, San Francisco, CA

"When it comes to cellulose diffraction drives us to distraction" March 23, 2010, **William T Winter**, Amer. Chemical Society National Mtg, San Francisco, CA

"The *in situ* characterization of plant cell wall polysaccharides through NMR spectroscopy and X-ray diffraction" July 26-31,2009, DeAnn Barnhart and **William T. Winter**, Cellulosomes, Cellulases & Other Carbohydrate Modifying Enzymes Gordon Research Conference, Proctor Academy, Andover, NH

D. Public Service Presentations (lectures, seminars, etc. to and for the public; give group or occasion, date(s), and attendance)

None

V. PUBLIC SERVICE

A. Funded Service (include consulting activities)

1. Government Agencies (Federal, State, Local):

None

2. Industrial and Commercial Groups, etc.

A 2nd workshop on Cellulose Chemistry was scheduled for presentation at Eastman Chemical, Kingsport TN but was cancelled by Eastman in response to the economic downturn.

B. Unfunded Service to Governmental Agencies, Public Interest Groups, etc.

White House Office of Science and Technology-replied to a request for a written assessment of the future of cellulose nanotechnology.

Negotiated transfer of Siemens/Bruker D5000 x-ray powder diffraction system from Xerox (Webster, NY to ESF) I also oversaw the disassembly of the equipment and executed its reassembly at ESF. This is not 'research' because I only do powder diffraction as a service to others, my research interest is fiber diffraction which utilizes different instrumentation.

VI. PROFESSIONAL DEVELOPMENT

A. Professional Honors and Awards (for teaching, research, outreach, etc.)

None

B. 1. Activities in Professional Organizations (Offices held, service as chairman, member, participant or consultant)

Cornell High Energy Synchrotron Source (CHESS) – user group member/participant
Argonne National Laboratory

2. Professional Society Membership

American Chemical Society (Cellulose and Renewable Materials Division, Executive Committee Member, Awards Chair 2006-2009, member-at-large 2009-; Polymer Materials Science and Engineering member)
Council for Chemical Research – ESF delegate through 2009, we have not renewed for financial reasons)

3. Other Professional Activities

a. Editorial activity

Journal(s)	Responsibility

Other (books, symposia, etc.)

b. Reviewer

Journal(s)	No. of manuscripts
Advanced Materials	1
cks, 2009, 622 pp.	
Amer Chemical Society Symposium Series	2
Biofuels	2
Biomacromolecules	5
Carbohydrate Polymers	2
Cellulose	2
Holzforschung	1
Journal of Physical Chemistry A	1
J. American Chemical Society	1
Nature Nanotechnoology	1
Physical Chemistry Letters	1
Plant Physiology	1

Agency	No. of proposals
Der Wissenschaftsfonds (Austrian Sci. Found.)	1
National Science Foundation	1
NSERC (Canada)	1

Other

c. Participation (workshops, symposia, etc.)

Name of workshop, etc.	Date	Place
Organization of Anselme Payen Award Symposium	Mar 22-23,2009	ACS mtg, San Francisco CA

C. Further Education/Re-training Undertaken, Leaves, Workshops, etc.

CHESS (Cornell High Energy Synchrotron Source) – participate in data collection June 2009, March 2010

D. Foreign Travel (Where, When, Purpose)

None

VII. ADMINISTRATIVE AND SERVICE RESPONSIBILITIES (include committee participation)

A. Department-level

Assist in Departmental Biochemistry Comprehensive examination
Senior faculty committee –handles promotion and tenure issues

B. College-level

I maintain the x-ray diffraction laboratory and since 1988 have maintained our x-ray diffraction equipment.
Like the NMR, this facility is no longer supported by the manufacturer and there is a clear need to replace the instrumentation.
Maintain the thermal analysis laboratory which is used by several Chemistry, EFB and PSZE students as well as outside guests.

Director, Cellulose Research Institute
ESF representative to the SB3 (structural Biochemistry, Biology, and Biophysics program)
Member, Syracuse University Biomaterials Institute

Coordinate the Eastman Chemical Graduate Research award competition. This past summer we had 5 applicants and made three awards ranging from $800 to $1500.
I have been asked to organize/ chair the Tenure committee for Stephen Weiter, Director of Libraries.

For several years I have served as the College's representative to the Council for Chemical Research, an area that I do feel is important for our continued recognition as a center for advanced education in Chemistry. I participated in the graduate education and industrial academic collaboration programs and I have lectured on our biorefinery program at the 2008 meeting. I do think that we should continue to be a member and participate in this group and, while I think it is time that someone else become our voting delegate and meeting attendee, I will do so if necessary.

I was requested to oversee the preparation of a college NSF instrumentation proposal. This, in my opinion, was ill conceived since the objectives, a suite of instrumentation serving several departments under the broad rubric of a biorefinery was directly at odds with the NSF call for proposals.

C. University-wide, including Research Foundation

I represent ESF for the New York Structural Biology Center in New York City. We have a project that we would like to bring there but it will have to wait until it is funded.

VIII. SUMMARY OF SIGNIFICANT ACTIVITIES AND ACCOMPLISHMENTS DURING THIS REPORTING PERIOD, ESPECIALLY THOSE MOST NOTEWORTHY AND RELATIVE TO THE COLLEGE'S AND DEPARTMENT'S MISSION. A paragraph on each of the following would be very helpful: this past year, what have you done for our students, department/college, and self professionally?

Accomplishments for our students: We held the 2nd annual Eastman Chemical Graduate Research paper competition. Seven students submitted papers three awards were made. The program will continue in 2010.

Accomplishments for the department and College:
Oversaw the donation, transfer and installation of a Siemens D5000 Powder diffraction system donated by Xerox.

We had two visiting scientists in my group this year. Wan Rosli Wan Daud is a professor at University Sains, Penang Malaysia and we worked on his cocoanut palm waste. Prof. Yuhong Feng, is a professor at the College of Materials and Chemical Engineering, Analytical and Testing Center, Hainan University. She has been working on bioengineering a chitin cellulose copolymer. There stays at ESF were supported by their parent institutions.

Accomplishments in professional growth: I have reworked my biomass chemistry course (formerly wood chem.) and moved from a linear format organized by compounds to a more realistic format organized by a serious of 14 basic questions about biomass chemistry, not bioprocessing. The student participation was much better although they complain that the course is not organized in a simple manner. They are right, but the organization forces them to address questions more like the ones that they will encounter in their future work.
We added an experiment to FCH551, Polymer techniques, using Matrix Assisted Laser Desorption Ionization / Mass Spectroscopy (MALDI/MS) to measure polymer molecular weight distributions. This is becoming an extremely powerful method that is finding widespread application in many areas of analytical chemistry.

IX. A. FUTURE PLANS, AMBITIONS, AND POTENTIAL CONTRIBUTIONS FOR YOUR OWN PROFESSIONAL DEVELOPMENT AND THE ENHANCEMENT OF THE PROGRAM IN ENVIRONMENTAL AND FOREST CHEMISTRY (brief summary)

I really believe that we are on the cusp of a major new technique for understanding the complexity of plant cell wall organization that will have wide-applicability in both fundamental research and the analysis of commercial techniques for destructuring biomass. I am working on proposals to NSF and DOE that will bring life into this project and have already enlisted Lee Newman, new faculty member in EFB, as a collaborator. We continue to have a substantial backlog of unpublished but completed research and are working on that as well. While I hope to expand the visibility of the Cellulose Research Institute, it is difficult to do so with a zero budget. I am thinking about my eventual retirement, probably at the end of 2014 and am trying to make sure that any new gradient students in my lab have a co-major professor who will allow them to see their project through to completion. On the lab side, I have a significant learning curve in front of me to get the new diffraction unit up to speed. Its automated capabilities will greatly enhance our ability to do routine analysis. On the more fundamental side I see a major need to replace the Rigaku x-ray generator. It has played a significant factor in numerous theses but it is no longer possible to obtain parts for it. ESF has been active the use of x-ray diffraction to study biomass since at least 1936. There is much more that can be done but not without replacing our current rotating anode. It has been out of service more than not for the past year and as fast as one problem is corrected, a new one surfaces.

In teaching, I like the direction that I have taken for the biomass chemistry course and will seek to recruit students into it more aggressively. The Polymer Lab functions quite nicely and we usually adjust one or two experiments each year. The option of a second section/ course in biomass chemistry techniques is attractive but the decrease in the number of chemistry TA's makes it unlikely. I also have the task of overseeing the tenure process for our Director of Libraries during the coming year.

B. PROJECTED ACTIVITIES FOR NEXT YEAR.

1. Summer 2010

a. Course(s) to be offered

FCH999 Oversee doctoral research for students named above

b. Proposed research activity

Recovery of cellulose from algae harvested at Minoa Water Treatment facility- Xing Fei Zhao
NMR study of the chemical effects of endophytic bacteria on Poplar growth w. Lee Newman and D. Barnhart
Completion of thesis – K Cheng
Thesis preparation w. K Cheng, D. Barnhart, and J. Spiese.
Submission of manuscripts: K Cheng – NMR studies of biomass breakdown, Goodrich – MALDI study of molecular weight distribution of polycaprolactone

polymerized on cellulose nanocrystals, Winter – structure of capsular antigen from Type 5 *Streptococcus pneumoniae*

c. University, professional society, and public service

Work as Director of Cellulose Research
Continue to strengthen our relationship with Eastman Chemical Co, Hercules and other suitable organizations.

2. Fall Semester 2010

a. Course(s) to be offered
FCH 551– Polymer Techniques Laboratory
FCH552 – Polymer Science II

b. Proposed research activity

Submission of manuscript on emulsan polysaccharide with D. Kaplan (Tufts), D. Kiemle and D. Barnhart (ESF)
Submission of manuscripts

c. University, Professional society, and public service

Continue my activity in the Cellulose and Renewable Materials division of the American Chemical Society. I continue on the executive committee, now as member-at-large.

3. Spring Semester 2011

a. Course(s) to be offered

FCH 496/796 – Biomass Chemistry

b. Proposed research activity
Submission of manuscripts with D. Barnhart – endophytic bacteria effects on biomass composition in poplar. Low angle x-ray studies of cellulose nanocrystals at CHESS.

c. University, Professional society, and public service

Continue activities noted above