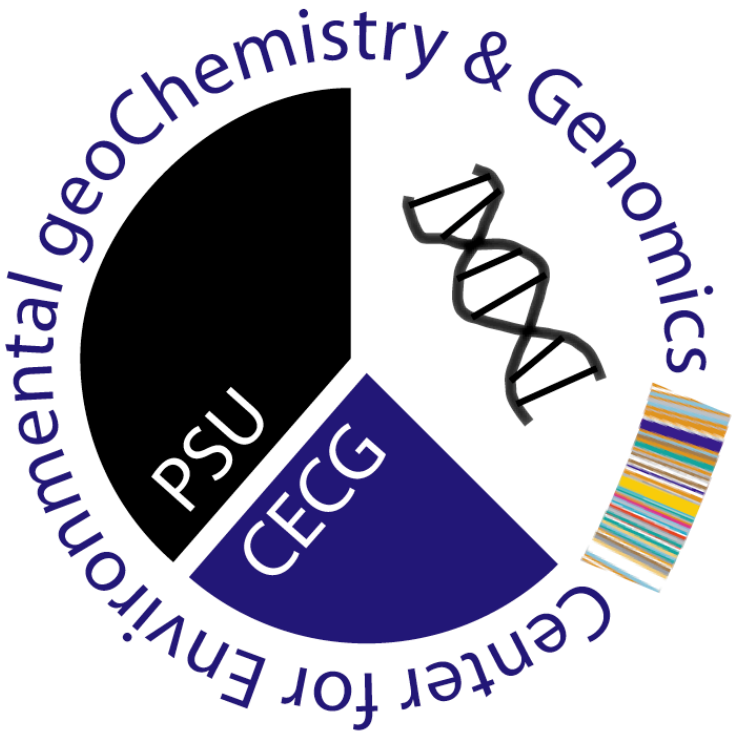
April 15, 2011
Center Proposal for:
Penn State's Earth and Environmental Science Institute, Susan Brantley, Director
In response to Call for Proposals Spring 2011

1. Center for Environmental geoChemistry and Genomics (CECG)



## 2. CECG Overview

**Proposed CECG Director:**
Jennifer Macalady
Assistant Professor of Geosciences
Penn State University
Department of Geosciences, 210 Deike Building
University Park, PA 16802-5013
tel: 814-865-6330 (office)
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**Proposed CECG Associate Director:**
John Regan
Associate Professor of Civil & Environmental Engineering
Penn State University
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**Abstract**
The EESI Center for Environmental geoChemistry and Genomics (CECG) will bring experts in geochemistry (broadly defined and including atmospheric, marine, and terrestrial realms) and genomics together to focus on investigations with environmental relevance. The challenges and needs CECG uniquely addresses will be met by facilitating interactions among geochemists, genomics and metagenomics practitioners, and bioinformaticians. This will be accomplished by assembling a steering committee composed of experts in environmental chemistry and genomics, by hosting talks and workshops that inform about the promise and practice of genome-enabled studies in geochemistry, and by sponsoring genome-enabled research aimed at understanding the chemistry of the earth system. The CECG structure, spanning the College of EMS, ECOS, COE and CAS, is ideal for the new activities and foci of CECG. We propose CECG as an evolution and renewal of the Center for Environmental Chemistry and Geochemistry, requiring a similar level of Center-class support.

**Proposal Outline**
1. Center Name
2. Center Overview
3. Participants & CECG Steering Committee (see Appendix 2 -- CECG Participants)
4. Rationale (see also Appendices 1 and 3)
5. Proposed Activities and Funding Opportunities
6. Center Needs and Budget
7. Management Structure (see also Appendix 4)
8. Past Budgets and Work
9. Letters of Support (see Appendix 5)

**Appendices:**
A-1 Acronym List
A-2 CECG Participant List
A-3 CECG Facilities Resources in 2010
A-4 Director & Associate Director CVs
A-5 Letters of Support

**3. CECG STEERING COMMITTEE (12 participants)**
(* indicates current or former CECG steering committee member)

Listed by college, the proposed Steering Committee members are:

*Jennifer L. Macalady (Geosciences, EMS), Director
*James Kubicki (Geosciences, EMS)
*Matthew Fantle (Geosciences, EMS)
Christopher House (Geosciences, EMS)
*John Regan (Civil & Environmental Engineering, COE), Associate Director
William Burgos (Civil & Environmental Engineering, COE)
*Carmen Enid Martinez (Crop & Soil Science, CAS)
Seogchan Kang (Plant Pathology, CAS)
Beth Shapiro (Biology, ECOS)
Anton Nekrutenko (Biochemistry & Molecular Biology, ECOS)
Illiana Baums (Biology, ECOS)
Don Bryant (Biochemistry & Molecular Biology, ECOS**4. CECG RATIONALE**

**A. OVERALL CENTER JUSTIFICATION**
The Center for Environmental Chemistry and Geochemistry (CECG) has brought biologists, chemists, engineers and geoscientists together in joint research and educational initiatives since 1997 (Participants in Appendix A-2). Common themes in CECG activities have been investigations into chemical processes in the environment and the employment of a unique set of analytical capabilities across the Penn State campus (Listed in Appendix A-3). By bringing together researchers from multiple disciplines, CECG collaborations have created new Centers and research collaborations and brought enhanced visibility to Penn State's environmental research and educational programs. BRIE (NSF IGERT) and CEKA (NSF STC) are among the best examples. The Environmental Chemistry Student Symposium (ECSS) now attracts students across the Commonwealth to its annual forum at University Park, including minority institutions such as Howard University. The ***future CECG (Center for Environmental geoChemistry and Genomics)*** will build on the strengths and infrastructure of previous incarnations of CECG, renewing an energetic commitment to fundamental environmental investigations, while directing new efforts toward genomics-enabled investigations of the earth system. The latter means (1) creating a path for geo- and environmental chemists at PSU to harness genomic tools for research; (2) adding new people, instrumentation and computational capabilities to the existing CECG

complement; and (3) reaching to other EESI Centers and beyond to leverage capabilities and expertise where appropriate. In collaborations with other universities, CECG will partner with scientists in interdisciplinary research and education at both majority and minority institutions.

**B. SCIENTIFIC RATIONALE and WHY A CENTER IS NEEDED**

Penn State researchers study basic chemical and physical properties of the Earth system and impacts of global change in all of the "spheres" (atmosphere, lithosphere, hyrosphere, biosphere). EESI unites hundreds of members of the Penn State community across disciplinary lines to study numerous aspects of the changing planet in unique and creative ways. CECG has been superbly effective since 1977 in integrating chemical and biogeochemical environmental research on campus and beyond. As a recent example, CEKA (spawned by CECG) has brought together chemists, geochemists, engineers, biochemists, and others to study fundamental aspects of dissolution, precipitation, and bioreactions in the environment. CEKA enabled new research collaborations to attack such problems as reactive surface area in the environment, linking laboratory and field rates of important physical and chemical processes, and a deeper understanding of bacterially-mediated dissimilatory Fe reduction. The successes of EESI, CEKA, CECG, and other departmental and crosscutting programs in biogeochemistry and environmental science at Penn State have allowed us to emerge as a global leader in biogeochemistry, with a strong impact in both research and education.

Penn State is also a global leader in bioinformatics (the analysis of biological information using computers and statistical techniques) and has great strength in genomics (concerned with the sequencing, mapping, function, and evolution of genomes), particularly as applied to disease organisms in agriculture and medicine. Evidence of this leadership is abundant and includes:

- Beth Shapiro (Biology) named a MacArthur Fellow in 2009 for her work on genomics of extinct mammals revealed by ancient DNA;

- Webb Miller (Computer Science & Engineering) and Stephan Schuster (Biochemistry & Molecular Biology) included in the Top 100 Most Influential People in 2008 by Time Magazine for their pioneering genomics work;

- Seogchan Kang (Plant Pathology) spearheaded a large USDA environmental genomics training grant, funded currently

- Anton Nekrutenko (Biochemistry & Molecular Biology) developed Galaxy, a DNA sequence analysis platform (set of tools) that is implemented on the web and used worldwide

Expertise in bioinformatics and genomics on campus is concentrated in Centers such as the Center for Infectious Disease Dynamics (CIDD, http://www.cidd.psu.edu/people/faculty) and the Center for Comparative Genomics and Bioinformatics (CCGB, http://www.bx.psu.edu/). Participants in these centers generally do not have an environmental science focus. The premise of the Center for Environmental geoChemistry and Genomics is that ***Penn State's expertise in bioinformatics and genomics can be strategically leveraged to create new interdisciplinary***

***funding opportunities, with the goal of making Penn State a global leader in genome-enabled environmental science in the next decade.***

**Genes and geochemical cycling**

Genome sequencing is now a routine method in biology, with the sequencing operation itself commonly accomplished in less than a day for microorganisms. There are currently 1679 published genomes, and approximately 6500 more in progress (http://www.genomesonline.org/). These figures serve to illustrate the ongoing exponential rise in sequencing made possible by developments in technology that continue to rapidly lower the cost of DNA sequencing. The vast majority of genome sequencing projects involve human, animal, or crop pathogens. However, progress has recently been made toward genome sequencing of environmentally relevant microorganisms, fungi, and plants. Some of this progress can be attributed to aggressive sequencing programs carried out at the Department of Energy (DOE) Joint Genome Institute (JGI), which prioritizes projects that support its missions in bioenergy and environmental science (http://www.jgi.doe.gov/). Examples of recent successes resulting from JGI programs include:

- The genome sequence of an algal bloom species with impacts on environmental quality and ecoystem health, and the potential to serve as a carbon sequestration tool (Gobler et al.)
- The metagenome sequence of the microbial community in the cow rumen, yielding 30,000 novel enzymes with the potential to improve biofuel production (Hess et al.)
- The development of a new approach to target and sequence the genomes of specific types of organisms in complex microbial communities without the need to first grow them in the lab (in this case a methane-eating bacterium) (Kalyuzhnaya et al., 2008)
- The retrieval of genomic sequences indicating the reactions carried out by a microorganism abundant in marine oxygen minimum zones that are expanding as a result of human activities (Walsh et al., 2009)

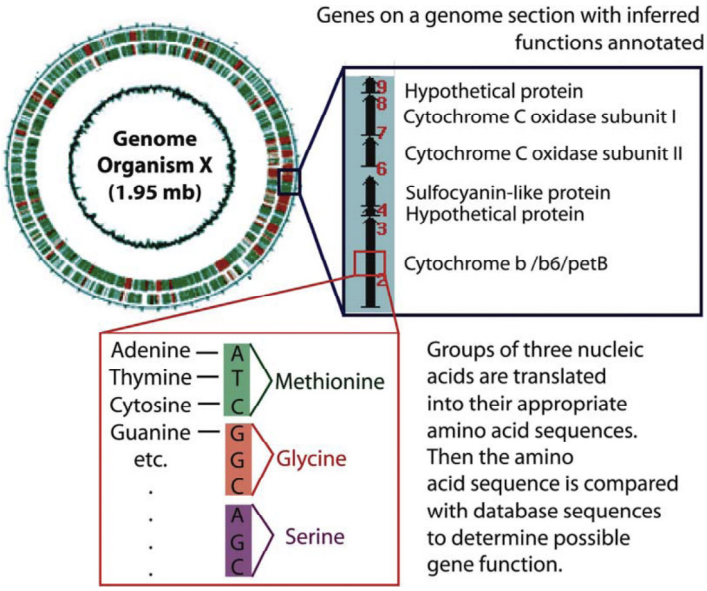

**Figure 1. Relationship between genomes, DNA sequences, and enzymes that potentially carry out geochemical reactions, from (Macalady and Banfield, 2003).**

Recent reviews highlight several challenges that must be overcome in order for environmental scientists to harness the power of genomics. First, we are challenged by the computational power and availability of bioinformatics algorithms for comparing the content of public sequence databases with sequences in complex environmental samples likely to be of interest to geochemists studying earth surface processes (Committee on Metagenomics:Challenges and Functional Applications, 2007; Hugenholtz and Tyson, 2008). The same reviews highlight the fact that cost has become less likely to be an impediment than know-how for researchers that want to begin to use genomic approaches. In order for geochemists and enviromental scientists to capitalize on the current unprecedented access to genomic sequencing power offered by agencies such as JGI and sequencing facilities including the PSU Core Genomics Facility (http://www.huck.psu.edu/facilities/genomics-core-up), ***CECG will network geochemists and scientists with genomic and bioinformatics expertise, with the goal of attracting medium- and large-scale external funding resources for genome-enabled studies with environmental relevance.***

## 5. CECG ACTIVITIES AND FUNDING OPPORTUNITIES

### A. NETWORKING and FACILITATION

CECG's highly successful facilitation of networking has created new opportunities for joint research among Affiliates, with associated educational activities and curricula for Penn State students. Chief among these are: (1) the annual Wine and Cheese Reception that mixes students and faculty from across four Colleges and the Materials Research Institute; (2) a Newsletter and website: <http://www.essc.psu.edu/CECG/>, expertly produced by CECG Assistant Debra Lambert in the EESI office; (3) sponsorship of the Environmental Chemistry Student Symposium (ECSS) and competitive Summer Fellowships for student research; (4) cooperative use of Center-class analytical facilities across Penn State (See Appendix A-3). These activities will continue in the future CECG. The networking is vital, as it has led to large Center-class grants. Agency Federal Program Managers have been invited as Wine and Cheese Speakers, as have large Center Directors at Penn State. Networking will also be facilitated by: (1) regular meetings of the Steering Committee and interested parties aimed at proposal solicitations, including an annual half-day retreat with brief research activity highlights from each participant to promote new and unexpected collaborations; (2) sponsoring of Research Initiation Grants (RIGs) at the highest level afforded by the budget. In light of the new center direction and the infusion of participants with expertise not formerly associated with CECG, CECG will also undertake new activities aimed at genomics technology transfer and interdisciplinary proposal development: (1) Organizing a yearly Genomics in Geochemistry Workshop to enhance awareness of the potential offered by the use genomic tools in the PSU environmental chemistry community in an informal setting, and (2) Sponsoring two participants per year to attend the 3-day Genomics/Metagenomics Training Course offered by the Department of Energy (DOE) Joint

Genome Institute (http://www.jgi.doe.gov/meetings/mgm/).

**B. FUNDING TARGETS**

The following are potential initiatives to target (not exhaustive):

(1) NSF Division of Environmental Biology - both the Ecosystem Science and the Population and Community Ecology programs. The redirected CECG emphasis will promote the development of team capabilities that are well poised to compete in the primary interests of these two programs. Their stated emphases are "research that advances the conceptual or theoretical understanding of population ecology, species interactions and community dynamics in terrestrial, wetland and freshwater habitats" and "biogeochemical cycling and element budgets from local to global scales; roles of microbes in ecosystem functioning; primary productivity; stoichiometric relationships; climate-ecosystem feedbacks; energy and radiatively-active gas fluxes; relationships between diversity and ecosystem function; ecosystem services; and landscape dynamics." This is precisely the intended core strengths that would emerge through this center from the deliberate intersection and expansion of our biogeochemistry and bioinformatics capabilities.

(2) NSF Division of Chemical, Bioengineering, Environmental, and Transport Systems – the Environmental Engineering and Sustainability cluster. The funding priorities of this cluster align well with the acid mine drainage and biomass energy focus areas in the proposed CECG renewal and redirection. This compatibility spans several of the programs, including the Environmental Engineering, Environmental Sustainability, and Energy for Sustainability programs which have an expressed interest in supporting "biogeochemical and transport processes driving water quality in the aquatic environment" and "fundamental science for identifying, evaluating, and developing new methods and technologies for assessing the waste assimilative capacity of the natural environment and for removing or reducing conventional and emerging contaminants from polluted air, water and soils." The proposed steering committee has inroads to these programs, and the competitiveness will be enhanced by complementation of the broader CECG collaborations.

(3) NSF IGERT--An IGERT theme that could develop from the redirected CECG focus would be the merging of computational and genomic analyses in the service of engineering microbial communities. There is two decades of existing literature characterizing complex microbial communities from various environments, with speculative interpretations of the implications of those communities for their environment or the environmental determinants on the communities. The proposed CECG structure and the associated analytical capabilities would allow us to make substantial progress in getting past speculation from circumstantial evidence and being able to predict and even tailor microbial community development and activity.

4) USDA National Institute of Food and Agriculture – Environment and Natural Resources program. The supported research of this program spans the soil, water, forest, and air domains of the collective ecological expertise of our team members. The particular emphasis is on agricultural or agriculturally impacted systems. New collaborations that develop from the CECG-fostered networking and exchange activities may enable the development of innovative, genome-enabled strategies to address the scientific problems being addressed by this agency.

(5) Department of Energy (DOE) Joint Genome Institute (JGI)
Multiple opportunities for genomic and metagenomic sequencing are offered by JGI, including calls for "large-scale genome sequence-based projects to advance the frontiers of DOE-misson science relevant to bioenergy and the environment". Successful JGI proposals can be used as strong leverage to obtain NSF and DOE funding because they significantly offset the cost of performing the research. (http://www.jgi.doe.gov/)

**6. CECG NEEDS AND BUDGET**
CECG requests for EESI support are for staff support (Debra Lambert). The budget plan is as follows:

EESI 15K (request)
PSIEE 15K (committed, as per Tom Richard in early April 2011)

Expenses are envisioned as follows:
Research Support
- 3 CECG Summer Fellows (2K each) 6K
- 2 DOE Genomics/Metagenomics Training Course (1.5K each) 3 K
- 2 Research Initiation Grants (RIGs, 7K each) 14K

Wine and Cheese 2K
Environmental Chemistry Student Symposium (ECSS) contribution 3K
PSU Genomics in Geochemistry Workshop 1 K
Miscellaneous Expenses (guest travel supplements, etc.) 1 K

TOTAL expenses: 30K/year

Matches will also be sought from ECOS, COE, and CAS. An updated budget will be presented at the EESI center proposal presentation in May 2011. If obtained, additional funds would go to the Research Support category, and to enhance existing or new relationships with minority serving institutions.

**7. MANAGEMENT STRUCTURE**
Jennifer Macalady (Asst. Professor of Geosciences, EMS) and John Regan (Assoc. Professor of Civil & Environmental Engineering, COE) will serve as CECG Director and Associate Director, respectively (CVs in Appendix 4). A Steering Committee, consisting of the Director and Associate Director, with a diverse group of Affiliates, will meet regularly each semester. The proposed Steering Committee includes several Affiliates active in CECG and new members from across EMS, ECOS, COE and CAS:

***Continuing CECG Steering Committee Members (5):***
Jennifer Macalady (Geosciences, EMS), Director
John Regan (Civil & Environmental Engineering, COE), Associate Director

James Kubicki (Geosciences, EMS)
Matthew Fantle (Geosciences, EMS)
Carmen Enid Martinez (Crop & Soils Science, CAS)

***New CECG Steering Committee Members (7):***
Beth Shapiro (Biology, ECOS)
Illiana Baums (Biology, ECOS)
Anton Nekrutenko (Biochemistry & Molecular Biology, ECOS)
Don Bryant (Biochemistry & Molecular Biology, ECOS)
Seogchan Kang (Plant Pathology, CAS)
William Burgos (Civil & Environmental Engineering, COE)
Christopher House (Geosciences, EMS)

Disciplines of the Steering Committee include geochemistry, environmental engineering, soil chemistry, geomicrobiology, bioinformatics, molecular microbiology, and genomics/metagenomics. As a continuing Center with a concrete, new emphasis, CECG Steering Committee meetings are envisioned to build momentum for new collaborations across disciplines and to refine strategic initiatives for funding medium to large scale projects.

## 8. PRIOR CECG BUDGET AND ACCOMPLISHMENTS (2008-2011)

***Annual Wine and Cheese Reception***
The annual Wine and Cheese Reception, held in the Fall or early Winter, brings together the Penn State geo- and environmental chemistry community for an evening that features a guest speaker, along with socializing and informal information sharing. The guest speaker has meetings with faculty and students, and may also present a second talk that is more department or program specific. In the past six years, the Wine and Cheese speakers have been: Dr. Russell Kelz (Program Director, Division of Earth Sciences, NSF), Prof. Carlo Pantano (Director of the MRI, PSU), Dr. Michael Kuperburg (program officer from DOE BER), Klaus Keller (Director, EESI Center for Climate Risk Management), Tom Richard (Director of Penn State Institutes for Energy and the Environment), and Dr. Jim Bristow (Assoc. Director DOE Joint Genome Institute).

***Research Initiation Grants (RIGs)***
The CECG was able to reinstate its successful RIG program in 2009-2011, and made the following awards:

**Jose D. Fuentes**, Department of Meteorology, and **Karl Mueller**, Department of Chemistry, $10,000. "Environmental Controls on Floral Volatile Emissions."

**Lee Kump** and **Kamini Singha**, Department of Geosciences, $10,000."The Ecosystem of the Green Lake (Fayetteville, NY State) Microbial Community."

**Jenn Macalady**, Department of Geosciences, and **Bill Burgos**, Department of Environmental Engineering, $9,000. Biogeochemistry of Coal-associated Iron Mounds"

**Ken Davis, Thomas Lauvaux, and Soumaya Belmecheri**, Department of Meteorology, $5,000. "Preliminary Investigation of Trace Gas Emissions from Marcellus Shale Drilling"

### *CECG Summer Scholars Program*

The CECG continues to offer a scholars program for Penn State undergraduate or graduate students to pursue work on research topics related to environmental chemistry during summer sessions. This is a broad request where research areas ranging from the biological sciences to engineering to geochemistry are considered. Students submitting winning proposals receive $3,000 in wages and are selected on the basis of intellectual promise, academic record, and faculty recommendations. Through 2007, CECG supported 45 summer fellows. Recent awards were made to:

**Carrie Clippard**, Department of Chemistry, Undergraduate student
**Camille Stephen**, Department of Biochemistry and Molecular Biology, Graduate student
**Robbie Wolford**, Department of Civil & Environmental Engineering, Graduate student
**Khadouja Harouaka**, Department of Geosciences, Graduate student
**Stephen Meckler**, Department of Chemistry, Undergraduate student
**Cara Nordberg**, Department of Toxicology and Environmental Resource Management, Undergraduate student
**Carla Rosenfeld**, Department of Crop and Soil Sciences, Graduate Student
**Meredith A. Hill Bembenic**, Depart of Energy & Geo-Environmental Engineering, Graduate student
**Quanying Du**, Department of Ecology, Graduate student
**Prashanti Iyer**, Department of Integrative Biosciences, Graduate student
**Jana James**, Department of Forensic Science, Graduate student
**Ortiz Rivera**, Department of Chemistry, Graduate student
**Sara Smith**, Department of Forensic Science, Graduate student

Number of CECG summer scholars by College

| | *before 2005* | *2006-2007* | *total* |
|---|---|---|---|
| ECOS | 14 | 6 | 28 |
| EMS | 7 | 3 | 12 |
| COE | 4 | 3 | 8 |
| CAS | 3 | 2 | 7 |
| Not recorded | 3 | - | 3 |

### *Environmental Chemistry Student Symposium (ECSS)*

The CECG has continued to sponsor the highly attended Environmental Chemistry Student Symposium. The ECSS is a consistent success, with environmental students beyond Penn State joining to present papers on a wide variety of environmental topics. In the past 2 years, participants have included multiple students from Howard University (minority serving institution). The statistics for the past three years are:

Distribution of participants for the ECSS

| | TOTAL | ECOS | EMS | Ag | Eng | Ecology | External |
|---|---|---|---|---|---|---|---|
| 2008-2009 | 65 | 15 | 14 | 9 | 10 | 2 | 15 |
| 2009-2010 | 60 | 10 | 17 | 13 | 16 | 1 | 3 |
| 2010-2011 | 68 | 10 | 23 | 11 | 10 | 0 | 14 |

Summary of winners for the ECSS

| | TOTAL | ECOS | EMS | Ag | Eng | Ecology | External | Other Colleges |
|---|---|---|---|---|---|---|---|---|
| 2008-2009 | 26 | 6 | 5 | 2 | 4 | 0 | 5 | 4 |
| 2009-2010 | 20 | 4 | 5 | 4 | 5 | 1 | 0 | 1 |
| 2010-2011 | 17 | 4 | 3 | 4 | 2 | 0 | 2 | 2 |

***Past CECG Budgets:***

Summary of Past Budget Expenditures

| 2008-2009 | | | |
|---|---|---|---|
| CECG Carryover | $ 4,456.00 | | |
| CECG Income | $30,000.00 | CECG Expenses | $14,257.99 |
| ECSS Income + carryover | $10,536.00 | ECSS Expenses | $11,075.46 |

| 2009-2010 | | | |
|---|---|---|---|
| CECG Carryover | $20,198.01 | | |
| CECG Income | $18,476.52 | CECG Expenses | $33,767.33 |
| ECSS Income | $ 9,000.00 | ECSS Expenses | $10,710.84 |

| 2010-2011 | | | |
|---|---|---|---|
| Carryover | $ 4,906.82 | | |
| CECG Income | $ 25,000.00 | CECG Expenses | $ 3,467.27 |
| ECSS Income | $ 7,500.00 | ECSS Expenses (expenses not all in yet) | $ 8,952.31 |

**9. SUPPORT LETTERS**

Included as Appendix A-5.

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**APPENDIX 1 – ACRONYM LIST**

BRIE Biogeochemical Research Initiative for Education
CEER Center for Energy and Environmental Risk
CEKA Center for Environmental Kinetics Analysis
CECG Center for Environmental geoChemistry and Genomics *(formerly Center for Environmental Chemistry and Geochemistry)*
CNH Coupled Natural and Human Systems
COE College of Engineering
CZ Critical Zone
CZEN Critical Zone Exploration Network
EAR Earth Sciences
ECOS Eberly College of Science
ECSS Environmental Chemistry Student Symposium
EESI Earth and Environmental Systems Institute
EMS Earth and Mineral Sciences
ESSC Earth System Science Center
ETBC Emerging Topics in Biogeochemical Cycles
GEO Geosciences
IGERT Integrative Graduate Education and Research Traineeship
OCE Ocean Sciences
STC Science and Technology Centers

**APPENDIX 2: CECG Affiliates**

**COLLEGE OF AGRICULTURE**
***Agricultural and Biological Engineering***
**Doug Archibald,** Research Associate Crop and Soil Sciences
**Jean Marc Bollag,** Professor of Soil Microbiology
**Mary Ann Bruns,** Assistant Professor of Agronomy Soil/Micro
**Jerzy Dec**, Research Associate, Soil Chemistry
**Sridhar Komarneni,** Professor of Clay Mineralogy
**Carmen Enid Martinez,** Assistant Professor of Environmental Soil Chemistry
***Agronomy***
**Hershcel Elliott**, Professor of Agriculture and Biological Engineering
**Jason Kaye,** Assistant Professor
**Horticulture**
**Dennis Decoteau,** Professor
***Plant Pathology***
**Gretchen Kuldau,** Assistant Professor
***School of Forest Resources***
**Hunter Carrick,** Assistant Professor of Aquatic Ecology
**David De Walle,** Professor of Forest Hydrology
**James Lynch,** Professor of Forest Hydrology
**William Sharpe,** Professor of Forest Hydrology

**COLLEGE OF EARTH AND MINERAL SCIENCES**
***Energy Institute***
**Sharon Miller,** Research Associate
***Energy and Geo-Environmental Engineering***
**Andre Boehman,** Assistant Professor of Fuel Science; Director of the Combustion Lab
**Subhash Chander,** Professor
**Serguei Lvov,** Associate Professor
**Sarma Pisupati,** Assistant Professor of Fuel Science
**Harold Schobert**, Professor of Fuel Science
***Geography***
**Derrick Lampkin,** Assistant Professor
***Geosciences***
**Sue Brantley,** Professor, Director of Earth and Environmental Systems Institute, Director of Center for Environmental Kinetics Analysis
**Matt Fantle**, Assistant Professor
**Ray Fletcher,** Professor
**Kate Freeman,** Professor
**Tanya Furman,** Professor
**Peter Heaney,** Professor

**Klaus Keller**, Assistant Professor
**Jim Kubicki,** Associate Professor of Geochemistry
**Lee Kump,** Professor
**Jennifer Macalady,** Assistant Professor of Geomicrobiology
**Hiroshi Ohmoto,** Professor of Geochemistry
**Richard R. Parizek,** Professor of Geology and Geo-Environmental Engineering
**William B. White**, Professor Emeritus of Geochemistry
**Materials Science and Engineering**
**Carlo Pantano,** Distinguished Professor, Director of Materials Research Institute
**Jorge O. Sofo**, Associate Professor
***Meteorology***
**William Brune,** Distinguished Professor and Head
**Kenneth J. Davis,** Associate Professor
**Dennis Lamb,** Professor
**Ray Najjar,** Associate Professor
**Anne Thompson,** Professor

**EBERLY COLLEGE OF SCIENCE**
***Biochemistry and Molecular Biology***
**Jean Brenchley,** Professor of Microbiology and Biotechnology
**J. Greg Ferry,** Stanley Person Professor
**Ming Tien,** Professor of Biochemistry
***Biology***
**Charles Fisher,** Professor of Biology
***Chemistry***
**Harry Allcock,** Evan Pugh Professor
**A. Welford Castleman, Jr.,** Evan Pugh Professor of Chemistry and Physics**,**
Eberly Distinguished Chair in Science
**Peter Jurs,** Professor of Chemistry
**Tom Mallouk,** DuPont Professor of Materials Chemistry
**Robert Minard,** Senior Lecturer, Emeritus

**COLLEGE OF ENGINEERING**
***Chemical Engineering/Biotechnology Institute***
**Wayne Curtis,** Professor
**Darrell Velegol,** Associate Professor
***Civil and Environmental Engineering***
**William Burgos,** Associate Professor of Environmental Engineering
**Fred Cannon,** Associate Professor
**Brian Dempsey,** Professor
**Bruce Logan,** Kappe Professor of Environmental Engineering
**John Regan,** Associate Professor
**Richard Unz,** Professor Emeritus of Environmental Engineering

***Electrical Engineering***
**Tim Kane,** Associate Professor

**OTHER INSTITUTES, CENTERS, DEPARTMENTS**
***Materials Research Institute***
**Barry Scheetz,** Professor of Materials, Civil, and Nuclear Engineering
**William B. White,** Professor of Geochemistry
***Environmental Engineering, Penn State Harrisburg***
**Yuefeng Xie,** Associate Professor; Director of Small Public Water Systems Technology Assistance Center

**APPENDIX 3: Laboratory Facilities Affiliated Through the CECG**

High Resolution Magnetic Sector Inductively Coupled Plasma Mass Spectrometer (HR ICP-MS) is up and running in the CECG-sponsored analytical lab in 316 Hosler Building. The following is a short listing of analytical or computational facilities available in the labs of individual affiliates of the CECG:

**Harry Allcock -**

- Gel permeation chromatography. Light scattering, electrical conductivity, hangminblodgett trough, DSC, T.G.A.

**Andre Boehman** -

- FTIR for gaseous emissions analysis
- Several gas chromatographs for species characterization
- Sierra instruments BG-1 mini-dilution tunnel for particulate collection
- R & P Co. Series 5100 diesel particulate analyzer for particulate composition analysis
- California Analytical hot Hydrocarbon analyzer

**Susan Brantley -**

- HR-ICP-MS (Finnigan Element) Dionex IC

**Jean Brenchley** -

- Microbiological Techniques
- PCR Equipment

**William Burgos** -

- Varian model 3400 gas chromatographs (two) equipped with Flame Ionization
- Thermal Conductivity and Electron Capture Detectors, and a Varian 8200 Autosampler Hewlett Packard Model
- 5890 Series II gas chromatographs (two) with Flame Ionization
- Thermal Conductivity and Electron Capture Detectors, and HP 6890 Autosampler
- Hewlett Packard 5890 Series IIG gas chromatograph fitted with Hewlett Packard
- 5972 Mass Selective Detector
- Waters 2690 High Performance Liquid Chromatographs (two) with a Waters 996 photodiode array detector and a Waters 2487 dual wavelength detector and Waters autosamplers
- Perkin Elmer Atomic Absorption Spectrometer
- Dionex 100 and Dionex 500 Ion Chromotographs, both with autosamplers

**Fred S. Cannon** -

- Accelerating Rate Calorimeter (CSI)
- Micromeritics 2000 Accelerated Surface Area and Porosimetry units (three)
- Thermogravimetric Analyzers (Cahn TG-131) with Flame Ionization Detector (SRI 110)
- Gas Chromatograph-Flame Ionization Detection unit (Hewlett Packard 5870)
- Bench-Scale Advanced Oxidation SonoperoxoneTM system, Furness-Newburge
- Atomic Absorption Spectrophotometer (Shimadzu AA-6601F)
- Ozone Analyzer (Dasibi Environmental Corp 1008-HC)
- UV lamp advanced oxidant generation systems

- Automatic Titrator (two) (Metler Toledo DEL 53),
- Ion Chromatography units (two) (Dionex 100 and 500)
- Activated Carbon Thermal Reactivation Pilot Furnace
- High Pressure Liquid Chromatography, - Ternary Gradient LC-95-33
- Supercritical Extraction unit (SFX 2-10)
- Liquid Scintillation Counter (LKB Wallac 1217 Rackbeta)
- Roto Evaporator (Buchi R-114) and Freeze Dryer (Lab Conco 4.5)
- Reverse Osmosis Units (Desal)
- Curie Point Pyrolyzer JHP-5/5S
- Japan Analytical Industry Co.

**Hunter Carrick** -

- My laboratory offers state of the art faculties to carry out aquatic microbial ecology research. Analytical capabilities include: radio-tracer experiments to measure metabolism and food web dynamics, oxygen microsensors and ultratitrators to assess metabolism, fluorometry to estimate photopigments, Coulometric carbon analysis (DIC, CDOM, and particulate carbon), Microscopy (DIC, phase, and epifluorescence), and facilities to support mesocosm experimentation (incubators, and plant growth chambers).

**Subhash Chander** -

- Zeta meter
- Tensionmeters for static and dynamic surface tension
- Potentiostat
- Device to measure contact angles
- Rheometer
- Surface charge determination by automatic titrator
- Rapid-Scan UV-VIS spectrophotometer
- Electroacoustic analyzer
- TOC (total organic carbon) analyzer

**Wayne R. Curtis** -

- Supercritical C02 extractor
- HPLC
- MC-A 1200 Mass Spec.
- access to Chemical Engineering Bioprocess Center equipment

**Kenneth J. Davis** -

- extensive field site in N. Wisconsin for the study of ecosystem-atmosphere exchange of $CO_2$, $H_2O$, energy and trace gases.
- tower based observations. Links to airborne and tethered platforms, as well as lidar and radar remote sensing technology.

**Jerzy Dec** -

The Laboratory of Soil Biochemistry in Penn State Institutes of the Environment (PSIE) has five laboratories for microbiological, biochemical, and physiological investigations with a total floor space of approximately 2800 square feet, and is equipped with:

- Two gas chromatographs (Hewlett-Packard with computers and data processing software)

- Two high-performance liquid chromatographs (Waters, with computers and data processing software)
- Supercritical fluid extractor SPE-400, Supelco
- Biological sample oxidizer OX 600 (R.J. Harvey Instrument Corporation)
- Liquid scintilation counter (Beta Trac 6805, Tracor Analytic)
- Photospectrometer UV-1601 (Shimadzu)
- Biological oxygen monitor (YellowSprings Instruments)
- System 200 Imaging TLC Scanner (Bioscan)
- Sorvall refrigerated superspeed centrifuge (RC-5Cplus) Incubators, shakers, autoclave, freeze-drier, pH meter, chloridometer

**Peter Deines -**

- Mass spectrometers and sample preparation facilities for the measurement of stable isotopes of carbon, oxygen and nitrogen

**Brian Dempsey** -

- Environmental Engineering Laboratories are approximately 16,000 sq. ft., including a 2,000 sq. ft. laboratory at the University Wastewater Treatment Plant (less than one mile from the Department of Civil and Environmental Engineering). Major equipment:
- AAS with flame and graphite furnace
- Various gas chromatographs
- HPLC
- Spectrophotometers
- Scintillation counters
- Carbon analyzers
- Particle counters
- Zeta Meter
- Axiophot microscope with image analysis and photometric detection
- Anaerobic and aerobic respirometry systems

**Herschel Elliott** -

- Atomic absorption, gas chromatograph, ion chromatograph

**J. Greg Ferry** -

- Protein purification equipment

**Charles Fisher** -

- Analytical: Gas Chromatograph (for dissolved gases in environmental samples)
- HPLC
- Scintillation counter
- Spectrophotometer
- Fluorometer
- Gel apparatus
- Assortment of contrifuges, balances, ovens, microscopes, and small lab equipment.
- Image analysis and mosaicising facilities
- A wide variety of specialized equipment for acquiring environmental samples using submersibles in the deep sea.

**Kate Freeman** -

- Molecular and Isotopic Biogeochemical facilities at Penn State University include laboratory equipment, glassware and supplies for extraction and isolation of organic materials from rock, sediment, soil and water samples and a wide array of chromatographic techniques. Multiple high-resolution gas-inlet stable-isotope mass spectrometers are available, and are equipped with conventional dual inlet systems, combustive and reductive elemental analyzers and a GC interface for compound-specific isotopic (13C, D) analyses.

**Peter C. Jurs** -

- Three DEC workstations, numerous PCs.

**Sridhar Komarneni** -

- Autosorb -1 for N2 adsorption-desorption isotherms for porosity, pore-size distribution and surface area determination. Water adsorption-desorption device - home built.

**Jim Kubicki** -

- Octane, MXE workstation and Cerius2 molecular modeling software.

**Lee Kump -**

-Autoanalyzer II for automated analysis of nutrient concentrations in aqueous samples. Polarographic analyzer for trace metal speciation of aqueous samples.

**Dennis Lamb** - Ion chromatography (IC)

**Bruce Logan**

- Atomic force microscopes (2)
- Microbial fuel cell laboratory
- Image analysis and fluorescent microscopies
- Particle counters (Coulter and laser; liquid samples)
- Dissolved organic carbon
- Gas, liquid and ion chromatography
- Pure culture bioreactors
- Anaerobic glove box

**Serguei Lvov** -

- Hydrothermal reactors
- Potentiometric cells
- Electrochemical kinetics cells
- Electrophoresis cells
- Electronic devices
- Fuel cell systems
- Conductivity cells
- Lab has most of the essential facilities and resources for conducting electrochemical, electrochemical kinetics, and electrokinetic studies in high temperature aqueous environments

**Robert Minard** -

- HPLC, GC, GC-MS, LC-MS, NMR, IR UV/Vis, Polarimetry, Synthesis

**Ray Najjar** -

- Sun Workstations

**Hiroshi Ohmoto** -

- 3 mass spectrometers for stable isotope analyses
- Carbon, nitrogen, sulfur and hydroflex elemental analyzer; X-ray chemical microscope; liquid chromatography

**Carlo Pantano -**
- glassmelting and fiberdrawing facilities
- microscopy and surface analysis
- thin films by sputtering, evaporation and sol/gel

**Richard R. Parizek**
- 546 Deike, clean organic laboratory facilities provided by Kate Freeman, Associate Professor of Geosciences and newly renovated hydro lab 326 Deike.

**John M. Regan** -
- Real-time PCR thermocycler
- Electrophoresis and gel documentation equipment
- Epifluorescent microscope with video, color CCD, Polaroid, and 35-mm imaging

**Barry Scheetz** -
- Automated x-ray diffractometer
- Lauie diffractometer
- Full thermal analysis capabilities

**William Sharpe** -
- Soil processing and extraction**John M. Skelly** -
- Continuously stirred tank reactor chamber facility licor 6200; 6400
- Air Quality Monitoring; Ozone

**Bradley A. Striebig** -
- Gas chromotography
- Mass spectrometry
- Flame ionization detector
- Ozone analyzers
- Ozone generators
- pH meters
- DO meter
- Hach spectrophotometer
- Gas standards generator
- UV reactors
- moisture meters
- temperature probes
- personnel samplers
- Draeger CMS
- relative humidity meter

**Dan Sykes -**
- HP GC-FID (7)
- Shimadzu GC-MS with purge and trap
- HP GC-ECD
- Shimadzu HPLC w/PDA

- Shimadzu HPLC w/standard UV-VIS (2)
- Dinoex IC
- Bruker 400 MHz NMR variable T/liquid/solids capable (departmental)
- SensIR FTIR microscope
- Bruker bench FTIR near/mid-IR w/ATR
- Nicolet bench FTIR near/mid/far-IR w/Orbit
- DeltaNu Raman spectrometer red-line (instructional grade)
- Perkin-Elmer Fluorimeter
- Shimadzu Fluorimeter
- Varian Flame AA
- Leica polarizing light microscope (5)
- Leica microtome

**Darrell Velegol -**

- microelectrophoresis with video microscopy
- laser trapping
- bacterial cell culturing

**William B. White** -

- Infrared and Raman spectroscopy

**Yuefeng Xie** -

- Two gpm conventional drinking water treatment pilot plant
- Gas chromatograph
- Gas CHromatograph/mass spectrometer
- Atomic absorption spectrophotometer
- Water and wastewater pilot filters

**APPENDIX 4: CVs of Proposed Center Director and Associate Director**

**JENNIFER L. MACALADY**
Geosciences Department, Pennsylvania State University, University Park, PA 16802 U.S.A.
tel: (814) 865-6330, fax: (814) 863-7823, email: jlm80@psu.edu, web:
http://www.geosc.psu.edu/~jmacalad/

## EDUCATION

1990 Dartmouth/Moscow Ecology Exchange Program, Dartmouth College
1991 B.A. Geology (*cum laude* and Thesis Honors), Carleton College
1998 M.S. Soil Science, University of California Davis
2000 Ph.D. Soil Science, University of California Davis

## APPOINTMENTS

| | |
|---|---|
| 2004- | Pennsylvania State University, Assistant Professor of Geosciences |
| 2002-2004 | Carleton College, Visiting Assistant Professor |
| 2002 | University of California-Berkeley, Visiting Postdoctoral Researcher |
| 2001-2002 | University of Wisconsin-Madison, Postdoctoral Research Associate |
| 1994-2000 | University of California-Davis, Graduate Research Assistant |
| 1991-1993 | URS Consultants, Inc., Environmental Technician |

## HONORS AND AWARDS

EMS College Faculty Mentoring Award (2009), U.S. EPA Science to Achieve Results (STAR) Graduate Fellow (1988-2000), Jastro-Shields Fellow (1988, 1989), Lawrence McKinley Gould Prize in Natural Science (1991), Duncan Stewart Fellow (1990), Richter Fellow (1990)

## COURSES TAUGHT

Geosc 570 --Geogenetics, Geosc 409W –Geomicrobiology, Geosc 597 –Microbial Biogeochemistry, Geosc 021 –Evolution of Earth and Life, Ecology 497 --Microbial Biogeography, Astrobiology 570--Field Course

## SELECTED PUBLICATIONS (10 out of > 25)

Jones, D. S., Albrecht, H.L., Dawson, K., Schaperdoth, I., Freeman, K.H., Pi, Y., Pearson, A., and Macalady, J. L.. Community genomic analysis of an extremely acidophilic sulfur-oxidizing biofilm. *In review*, **ISME Journal**.

Meyer, K. , Freeman, K. , Macalady, J. L. , Fulton, J., Schaperdoth, I., and Kump, L. Benthic okenone production in Fayetteville Green Lake (NY). **Geobiology***, accepted with revisions.*

Brown, J. F., Jones, D. S., Schaperdoth, I., **Macalady, J. L.** and Burgos, W. Role of environmental gradients and depositional facies in controlling acid mine drainage microbiology and precipitation kinetics. **Applied and Environmental Microbiology**, *published ahead of print, doi:10.1128/AEM.01550-10.*

Jones, D. S., Tobler, D., Schaperdoth, I., Mainiero, M., and Macalady, J. L. 2010. Community structure of subsurface biofilms from the thermal sulfidic caves of Acquasanta Terme, Italy. **Applied and Environmental Microbiology** 76 (17): 5902-5910.

Dattagupta, S., Schaperdoth, I., Montanari, A., Mariani, S., Kita, N., Valley, J. W. and Macalady, J. L. 2009. A recently evolved symbiosis between chemoautotrophic bacteria and a cave-dwelling amphipod. **ISME Journal** 3: 935-943*,* doi:10.1038/ismej.2009.34.

Macalady, J. L., S. Dattagupta, I. Schaperdoth, G. K. Druschel, D. Eastman. 2008. Niche differentiation among sulfur-oxidizing bacterial populations in cave waters. **ISME Journal** 2: 590-601, doi:10.1038/ismej.2008.25.

Strąpoć, D., F. Picardal, C. Turich, I. Schaperdoth, J. L. Macalady, J. Lipp, Y.-S. Lin, T. Mohr, F. Schuboltz, K.-U. Hinrichs, M. Mastalerz, A. Schimmelmann. 2008. Coalbed methane-producing microbial community in the Illinois Basin. **Applied and Environmental Microbiology** 74(8): 2424-2432.

Macalady, J. L., D. S. Jones and E. H. Lyon. 2007. Extremely acidic, pendulous microbial biofilms from the Frasassi cave system, Italy. **Environmental Microbiology** 9(6): 1402-1414.

Macalady, J. L., E. H. Lyon, B. Koffman, L. K. Albertson, K. Meyer, S. Galdenzi and S. Mariani. 2006. Dominant microbial populations in limestone-corroding stream biofilms, Frasassi cave system, Italy. **Applied and Environmental Microbiology** 72 (8): 5596-5609.

Macalady, J. L., and J. F. Banfield. 2003. Molecular geomicrobiology: genes and geochemical cycling [*invited Frontiers review*]. **Earth and Planetary Science Letters** 209 (1-2): 1-17.

**SYNERGISTIC ACTIVITIES (last 4 years)**

- Director, PSU Center for Environmental geoChemistry and Genetics (begin 9/2011); Biogeochemistry Ph.D. Program (2008-present); Astrobiology Minor Degree Program (2006-2008)
- Faculty or Member (2005-present): Penn State Insitutes for Energy and Environment (PSIEE), Penn State Astrobiology Research Center (PSARC), Ecology Interdepartmental Graduate Degree Program, Center for Environmental Chemistry & Geochemistry (CECG), Huck Institute of Life Sciences
- Science communication: NOVA PBS, Los Angeles Times, BBC TV, National Geographic Magazine, Le Scienze, www.LiveScience.org, Philadelphia Enquirer, www.microbeworld.org
- Graduate student committees: Member of 26 in Geosciences, Astrobiology, Biogeochemistry, Ecology, Biochemistry and Molecular Biology, Biology, Civil & Environmental Engineering, Energy and Mineral Engineering, Marine Microbiology
- Undergraduate research mentor: Supervised 17 in Mechanical & Electrical Engineering, Biology, Chemistry, Mathematics, Geobiology, Geosciences, SROP, Women in Science and Engineering (WISER), NSF REU

**COLLABORATORS (Last 2 Years)**

Matthew Fantle (PSU), Katherine Freeman (PSU), William Burgos (PSU), Christopher House (PSU), Mary Voytek (NASA/USGS), Susan Brantley (PSU), Alessandro Montanari (OGC), Greg Druschel (UVT), John Valley (UW-Madison), Ron Amundson (UC Berkeley), Stephanie Ewing (MSU), Clara Chan (U. Delaware), Ann Pearson (Harvard), Roger Summons (MIT), Paula Welander (MIT)

**GRADUATE AND POSTDOCTORAL ADVISEES**

Bryn Kimball (USGS), Joel Moore (Northwestern U.), Sharmishtha Dattagupta (U. of Goettingen), Dominique Tobler (U. of Glasgow), Daniel S. Jones, Heidi Albrecht, Katherine Dawson, Maria Babakhanyan, Rebecca McCauley, Kristine Korzow-Richter

**GRADUATE AND POSTDOCTORAL ADVISORS**

Kate M. Scow, UC Davis (graduate); Jillian F. Banfield, UC Berkeley (postdoctoral)

**JOHN M. REGAN**
Associate Professor, Department of Civil and Environmental Engineering
The Pennsylvania State University
212 Sackett Building, University Park, PA 16802
Phone: (814) 865-9436, Fax: (814) 863-7304, Email: jregan@engr.psu.edu

**PROFESSIONAL PREPARATION**

| | | |
|---|---|---|
| Cornell University | Agricultural and Biological Engineering | B.S. 1990 |
| University of Illinois at Urbana-Champaign | Environmental Engineering | M.S. 1992 |
| University of Wisconsin – Madison | Environmental Engineering | PhD 2001 |

**APPOINTMENTS**

| | |
|---|---|
| 2008 – Present | Associate Professor, Pennsylvania State University, University Park, PA |
| 2009 | Visiting Scientist, Pontificia Universidad Católica, Santiago, Chile |
| 2002 – 2008 | Assistant Professor, Pennsylvania State University, University Park, PA |
| 1992 - 1997 | Associate Environmental Engineer, Montgomery Watson, Madison, WI |

**AWARDS**

Distinguished Service Award, Assoc. Environmental Engineering and Science Professors, 2010
Fulbright Scholar, 2009
American Water Works Assoc. 1st Place Academic Achievement Award - Best Dissertation 2003
NIH Biotechnology Training Program Fellowship, U. Wisconsin – Madison, 1998-2001
Burton A. Jennings Award, Cornell University, 1988 and 1989

**PROFESSIONAL MEMBERSHIPS**

American Chemical Society, American Society for Microbiology, American Society of Civil Engineers, American Water Works Association, Association Environmental Engineering and Science Professors, International Water Association, Professional Engineer (WI), Water Environment Federation

**PUBLICATIONS (10 most recent and relevant)**

Ren, Z., H. Yan, W. Wang, M.M. Mench, J.M. Regan (2011). Characterization of Microbial Fuel Cells at Microbially and Electrochemically Meaningful Timescales, *Environmental Science & Technology*, 45(6): 2435–2441.

Jung, S., J.M. Regan (2011). External Resistance Influences Electrogenesis, Methanogenesis, and Anode Prokaryotic Communities in MFCs. *Applied and Environmental Microbiology*, 77(2):564-571.

Huang, L., J.M. Regan, J. Chen (2011). Electron Transfer Mechanisms, New Applications, and Performance of Biocathode Microbial Fuel Cells. *Bioresource Technology*, 102(1):316-323.

Ren, Z., R.P. Ramasamy, S. Red Cloud-Owen, H. Yan, M.M. Mench, J.M. Regan (2011). Time-Course Correlation of Biofilm Properties and Electrochemical Performance in Single-Chamber Microbial Fuel Cells. *Bioresource Technology*, 102(1):416-421.

Kiely; P., G. Rader; J.M Regan; B.E Logan (2011). Long-Term Cathode Performance and the Microbial Communities that Develop in Microbial Fuel Cells Fed Different Fermentation Endproducts. *Bioresource Technology*, 102(1):361-366.

Kiely, P.D., R. Cusick, D.F. Call, P.A. Selembo, J.M. Regan, and B.E. Logan (2011). Anode Microbial Communities Produced by Changing from Microbial Fuel Cell to Microbial Electrolysis Cell Operation Using Two Different Wastewaters. *Bioresource Technology*, 102(1):388-394.

Kiely, P.D., D.F. Call, M.D. Yates, J.M. Regan, B.E. Logan (2010). Anodic Biofilms in Microbial Fuel Cells Harbor Low Numbers of Higher-Power Producing Bacteria than Abundant Genera. *Applied Microbiology and Biotechnology*, 88(1):371–380.

Xing, D., S. Cheng, B.E. Logan, and J.M. Regan (2010). Isolation of the Exoelectrogenic Denitrifying Bacterium *Comamonas denitrificans* Based on Dilution-to-Extinction of the Microbial Community. *Applied Microbiology and Biotechnology*, 85(5):1575-1587.

Xing, D., S. Cheng, J.M. Regan, and B.E. Logan (2009). Change in Microbial Communities in Acetate- and Glucose-Fed Microbial Fuel Cells in the Presence of Light. *Biosensors and Bioelectronics*, 25(1):105-111.

Steinberg, L.M. and J.M. Regan (2009). *mcrA*-Targeted Real-Time Quantitative PCR Method to Examine Methanogen Communities. *Applied and Environmental Microbiology*, 75(13):4435-4442.

**SYNERGISTIC ACTIVITIES**

Dr. Regan has been a member of the Penn State Institutes of Energy and the Environment (PSIEE), the College of Engineering Environmental Institute (COE EI), and the Penn State Hydrogen Energy ($H_2E$) Center since 2002; a member of the executive board of Penn State's Center for Environmental Chemistry and Geochemistry (CECG) since 2007; and a member of Penn State's Biomass Energy Center Steering Committee since 2010. He co-organized and co-hosted the 1st International Microbial Fuel Cell Symposium in 2008. He has served on the American Water Works Association University Student Activities Committee since 2004, and on the Pennsylvania Water Environment Association Research Committee since 2004.

**COLLABORATORS (Last 4 Years)**

Mark Guiltinan (PSU), Liping Huang (Dalian University of Technology), Jung-Rae Kim (U Glamorgan), Bruce Logan (PSU), Matthew Mench (U. Tennessee), Booki Min (Kyung Hee U), Sang-Eun Oh (Kangwon National U), Gonzalo Pizarro (Universidad Católica de Chile), Ramaraja Ramasami (U. Georgia), Tom Richard (PSU), Richard Unz (PSU), M. Todd Walter (Cornell), Yuefeng Xie (PSU), Defeng Xing (Harbin Institute of Technology).

**GRADUATE ADVISORS**

Daniel Noguera and Gregory Harrington, University of Wisconsin – Madison
Bruce Rittmann, University of Illinois at Urbana-Champaign.

**GRADUATE STUDENTS AND POST-GRADUATE RESEARCHERS**

Current M.S. Students: Nick Rose, Arupananda Sengupta
Current Ph.D. Students: Hiroyuki Kashima, Lijiao Ren, Hengjing Yan
Current Postdoctoral Researcher: Ignacio Vargas
Former M.S. Students: Ah-Young Cho, Elizabeth Engelbert, Heather Hunt, Sunhyung Kim, Joseph McIntyre, Hong-Keun Park, Jeanine Terrill, Hengjing Yan
Former Ph.D. Students: Sok-Hee Jung, Zhiyong Ren, Lisa Steinberg, Hao Tang, Hsin-Hsin Tung

**APPENDIX 5: Letters of Support**

PENNSTATE

Department of Geosciences

The Pennsylvania State University
503 Deike Building
University Park, PA 16802-2714

814-865-6711

April 8, 2011

James D. Kubicki
Department of Geosciences &
the Earth & Environmental Systems Institute
The Pennsylvania State University
University Park, PA 16802

To whom it may concern:

This letter is written in support of the proposed Center for Environmental geoChemistry and Genomics. As a long active and former board member of CECG, I have a strong interest in promoting interdisciplinary environmental science at PSU and elsewhere. The concept proposed by Jenn Macalady builds upon the strong foundation of CECG fostering education and collaboration and promises to grow our strengths in environmental sciences. I wholeheartedly recommend that this center be funded at the full level requested in order to reach the goals set forth.

The first reason I think adding genomics to the portfolio of CECG expertise is that genomics is a rapidly growing field which will provide exciting research and job opportunities for our students. New collaborations between environmental scientists and genomics researchers are likely to generate successful proposals because the fundamental and applied science research questions are broad and numerous. For example, Jim Bristow (DOE Joint Genome Institute) presented ground-breaking research in the discovery of enzymes active in ligno-cellulose degradation. Combining this genomics research with experimental, analytical and computational studies will provide for new insights into this important aspect of ecosystem processes and aid in the development of ligno-cellulosic biofuels.

Second, major driving forces behind the expansion of genomics into environmental science have been the development of instrumentation to collect large databases of genetic sequences and the bioinformatics software capable of analyzing these tremendous amounts of data. These new techniques should be made available to PSU students (through access to equipment and expertise here and in collaboration with DOE) in order to better prepare them for the science of the 21$^{st}$ century. The Huck Institutes of Life Science and the Institute for CyberScience are already promoting genomics centers at PSU, the new CECG will allow environmental scientists to take advantage of state-of-the-art research facilities.

PENNSTATE

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814-865-6711

Furthermore, Dr. Edward Seidel of NSF recently visited PSU and gave a talk on "The Data and Compute-Driven Transformation of Modern Science" which demonstrates that U.S. funding agencies are aware that the complex problems we face today require a new, cyber-based approach in which teams of researchers tackle questions in a more comprehensive manner. The new CECG will be a great example of how interdisciplinary teams can take advantage of information and computer sciences to realize solutions to today's environmental problems. Funding for this type of approach is increasing which should position PSU in competition for limited Federal research funds in this decade.

Yours truly,
James D. Kubicki
Professor of Geochemistry

PENNSTATE

Phone: (814) 865-1226
FAX: (814) 863-7304

Department of Civil and Environmental Engineering

The Pennsylvania State University
114 Sackett Building
University Park, PA 16802-1408

April 15, 2011

*To:* Jenn Macalady, CECG

*Subject:* Letter of support for 2011 CECG renewal proposal

*From:* Bill Burgos

---

I am extremely happy to provide a letter of support for the reoriented and reinvigorated Center for Environmental geoChemistry and Genomics that you have prepared. I have been affiliated with the original CECG since its inception both as a faculty affiliate and as a board member. The CECG has been an absolute success with respect to introducing faculty and students to one another, stimulating interdisciplinary research projects, and leading directly to several high-visibility, large-dollar, multi-PI research grants awarded to Penn State. The CECG was the seed for the Biogeochemical Research Initiative for Education (BRIE) program, initially established and funded through an NSF IGERT grant (ca. $2.7M). Faculty affiliated with the CECG and BRIE were then successful in establishing the Center for Environmental Kinetics Analysis (CEKA) funded through the NSF's Environmental Molecular Sciences Institutes program (ca. $6.7M).

The CECG has also supported summer research fellowships and research initiation grants (RIG) that have benefited faculty and the University. For example, Brian Dempsey and I were awarded a ca. $15k CECG RIG to refurbish a Mossbauer spectrometer that became a key piece of equipment for a $1M DOE proposal that we subsequently won. A number of faculty have been able to recruit the undergraduates who participated in the summer fellowship program into their respective graduate programs. The continuation of these activities, as you have proposed, should also yield similar future benefits.

The expanded focus of the CECG to include genomics-enabled studies of environmental systems is a fantastic and timely idea. As you know, almost any exciting and intellectually interesting field site is a complex system where changes in geochemistry, mineralogy, hydrology and microbial communities are all inter-related in underappreciated ways. Advances in molecular biology and genomics can now be readily applied to explore these types of relationships. Based on its past success and your vision for its future, I think the CECG will continue to stimulate some of the best science coming out of Penn State.

PENNSTATE

**Department of Geosciences**
**The Pennsylvania State University**

235 Deike Building
University Park, PA 16802-2714

(814) 863-8177
khf4@psu.edu

15 April 2011

Prof. Jennifer Macalady
Department of Geosciences
The Pennsylvania State University
University Park, PA 16802

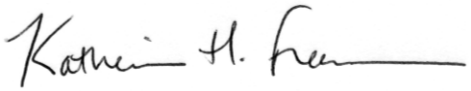
Dear Jenn:

I am delighted to support your proposal for the Center for Environmental geoChemistry and Genomics within the EMS Earth and Environmental Systems Institute.

PSIEE and ESSI along with several colleges and departments are financially supporting development of the Environmental Stable Isotope Mass Spectrometry Facility, which will focus on serving the light, stable isotope analytical needs of ecological and environmental science communities on our campus. I hope a fruitful partnership can emerge between the environmental isotope facility with the activities and membership of the new CECG. Our facility is set to open this fall, and we will offer analytical tools and expertise needed to advance stable isotope analyses of minerals, inorganic and organic carbon, major nutrients, and even DNA (SIP), lipid fractions (SIL) and other geobiological materials of interest to members of the CECG research community.

I endorse the new directions for the center, and I look forward to working with you under the auspices of the CECG and the ESIMS to advance innovation and excellence in environmental and geobiological research on our campus.

Sincerely,



Katherine H. Freeman

Director, Environmental Stable Isotope Mass Spectrometry Facility
Professor, Department of Geosciences

PENNSTATE

Phone: 814.863.9968 Fax: 814.863.7823

**Department of Geosciences**

Dr. Matthew S. Fantle
212 Deike Building
The Pennsylvania State University
University Park, PA 16802
mfantle@psu.edu

April 12, 2011

Dr. Jenn Macalady
Geosciences Dept.
Penn State University
University Park, PA 16802

Dear Dr. Macalady,

I am writing to express my interest in and support of your recently proposed Center for geoChemistry and Genomics (CECG). I understand that this center is a new take on an established acronym, which allows you to build on the goodwill and accomplishments of past incarnations of CECG while expanding in new directions. As an isotope geochemist, I am scientifically attracted by the new directions you will take. My biosignature research requires the sort of information that genomics can supply, information to which most geochemists do not have access. Accordingly, I believe that your center can be the nucleus for groundbreaking work in geochemistry, especially in areas that require multiple datasets and perspectives to completely understand (i.e. natural systems).

In short, I am interested in not only voicing support for your center but in being part of its operation. I would like to continue my membership on the CECG board and will bring my energy and ideas to this new endeavor.

Good luck on your center proposal and presentation.

Sincerely,

Matt Fantle

Dr. Matthew S. Fantle
Assistant Professor
Geosciences Dept.