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Nancy Ryan Gray, Ph.D.

Director

**2008 GORDON RESEARCH CONFERENCE
on ENVIRONMENTAL BIOINORGANIC CHEMISTRY**

FINAL PROGRESS REPORT

DEPARTMENT OF ENERGY
GRANT NO. DE-FG02-08ER646807

The Gordon Research Conference on ENVIRONMENTAL BIOINORGANIC CHEMISTRY was held at Waterville Valley Resort, Waterville Valley, New Hampshire, June 15-20, 2008. The Conference was well-attended with 89 participants (attendees list attached). The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both U.S. and foreign scientists, senior researchers, young investigators, and students. Approximately 47% of the participants at the 2008 meeting were women.

In designing the formal speakers program, emphasis was placed on current unpublished research and discussion of the future target areas in this field. There was a conscious effort to stimulate lively discussion about the key issues in the field today. Time for formal presentations was limited in the interest of group discussions. In order that more scientists could communicate their most recent results, poster presentation time was scheduled. Attached is a copy of the formal schedule and speaker program and the poster program. In addition to these formal interactions, "free time" was scheduled to allow informal discussions. Such discussions are fostering new collaborations and joint efforts in the field.

Thank you for your support of this Conference. As you know, in the interest of promoting the presentation of unpublished and frontier-breaking research, Gordon Research Conferences does not permit publication of meeting proceedings. If you wish any further details, please feel free to contact me. Thank you.

Sincerely,
Anne Summers, PI & Conference Co-Chairperson
UNIVERSITY OF GEORGIA

ENVIRONMENTAL BIOINORGANIC CHEMISTRY

From Molecular Models To Global Cycles

June 15-20, 2008

Waterville Valley Resort

Waterville Valley, NH

Chairs:

Anne O. Summers & William G. Sunda

Vice Chair:

Rachel N. Austin

This highly interdisciplinary conference is known for rigorous and wide-ranging consideration of the roles of elements traditionally called "inorganic" in living systems at scales from the molecular to the global. EBIC brings together those studying the biotic-inorganic interface across the Periodic Table, mingling chemists, ecologists, geneticists, oceanographers, and computational biologists, among others. Topics range from transport, enzymology, and homeostasis in individual cells and organisms to the environmental processes they experience and influence, as well as the latest techniques enabling observation of these phenomena. This conference is distinct from other metallobiology meetings in having a substantial environmental theme and a broader view of the Periodic Table, regularly including radionuclides, metalloids, the halides, silicon, and non-metal essential nutrients. When possible we mix speakers working at the nanometer-nanosecond scale in the same session with those working at the kilometer-megayear scale, a practice demanding high quality introductory material from each speaker and discussion leader. EBIC provides a forum for leading scientists (many of whom will never have met before) with expertise in the inorganic dimensions of life to identify fundamental cross-cutting themes and unrecognized anomalies and share the latest on acquiring, analyzing, and applying bioinorganic chemical concepts to real world issues from public health to climate change.

SUNDAY

2:00 pm - 11:00 pm	Arrival and Check-in
6:00 pm	Dinner
7:30 pm - 7:45 pm	Welcome / Introductory Comments by GRC Site Staff and Conference Chair
7:45 pm - 9:30 pm	BIOINORGANIC CYCLES FROM CELLULAR TO GLOBAL
7:45 pm - 8:00 pm	Discussion Leader: Tom Spiro (U. of Washington)
8:00 pm - 8:30 pm	Sabeeha Merchant (UCLA) "Between a rock and a hard place: trace element nutrition in <i>Chlamydomonas</i> "
8:30 pm - 8:45 pm	Discussion
8:45 pm - 9:15 pm	Francois Morel (Princeton) "The cadmium carbonic anhydrase of diatoms: from the oceans to the

molecule, and now back to the oceans"

9:15 pm - 9:30 pm Discussion

MONDAY

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm **IRON AND SULFUR**

9:00 am - 9:20 am Discussion Leader: **Margo Haygood** (Oregon Health & Science University)

9:20 am - 9:47 am **Alison Butler** (UCal-SantaBarbara)
"Structure and Reactivity of Marine Siderophores"

9:47 am - 10:00 am Discussion

10:00 am - 10:30 am Coffee Break / Group Photo

10:30 am - 10:57 am **Ginger Armbrust** (U. of Washington)
"Iron nutrition in diatoms, surprising interactions on molecular and global scales"

10:57 am - 11:10 am Discussion

11:10 am - 11:37 am **Andy Johnston** (East Anglia)
"Cloning the smell of the seaside - A bewildering range of ways in which different bacteria make the weather-changing gas dimethyl sulphide"

11:37 am - 11:50 am Discussion

11:50 am - 12:17 pm **Jose Moura** (Universidade Nova de Lisboa)
"Dissimilatory sulfate reduction: A bioinorganic view"

12:17 pm - 12:30 pm Discussion

12:30 pm Lunch

1:30 pm - 4:00 pm Free Time

4:00 pm - 6:00 pm Poster Session

6:00 pm Dinner

7:30 pm - 9:30 pm **IMPORTANT TRACE ELEMENTS**

7:30 pm - 7:45 pm Discussion Leader: **Brad Tebo** (Oregon Grad. Inst.)

7:45 pm - 8:08 pm **Anne Valentine** (Yale)
"Titanium in organisms: Abundant, bioactive, and surprisingly bioavailable"

8:08 pm - 8:20 pm Discussion

8:20 pm - 8:43 pm **Peter Kroneck** (U. Konstanz)
"It takes tungsten, plus some Fe-S, to breathe acetylene: structure and function of bacterial acetylene hydratase"

8:43 pm - 8:55 pm Discussion

8:55 pm - 9:18 pm **Steve Ragsdale** (U. Michigan)
"Metabolism of greenhouse gases by nickel metalloenzymes"

9:18 pm - 9:30 pm Discussion

TUESDAY

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm LATEST ANALYTICAL TECHNOLOGIES

9:00 am - 9:20 pm Discussion Leader: **Steve Lippard** (MIT)

9:20 am - 9:47 am **Bridget Bergquist** (U. Michigan)
"Metal isotopes: New tracers in the environment"

9:47 am - 10:00 am Discussion

10:00 am - 10:30 am Coffee Break

10:30 am - 10:57 am **Ken Kemner** (Argonne Nat. Lab)
"Hard X-ray micro(spectro)scopy for bioinorganic chemistry"

10:57 am - 11:10 am Discussion

11:10 am - 11:37 am **Joe Caruso** (U. Cincinnati)
"Environmental trace element analysis - more than just metals"

11:37 am - 11:50 am Discussion

11:50 am - 12:17 pm **Bill Burgos** (Penn State U.)
"Reaction-based modeling of metal-microbe interactions"

12:17 pm - 12:30 pm Discussion

12:30 pm Lunch

1:30 pm - 4:00 pm Free Time

4:00 pm - 6:00 pm Poster Session

6:00 pm Dinner

7:30 pm - 9:30 pm BIOENERGY AND NANOTECHNOLOGY

7:30 pm - 7:45 pm Discussion Leader: **Tom DiChristina** (Georgia Tech)

7:45 pm - 8:08 pm **Ted Betley** (Harvard)
"A ligand field chemistry of oxygen generation by the oxygen-evolving complex and synthetic active sites"

8:08 pm - 8:20 pm Discussion

8:20 pm - 8:43 pm **Elena Shevchenko** (Argonne Nat. Lab)
"Hybrid structures at nanoscale"

8:43 pm - 8:55 pm Discussion

8:55 pm - 9:18 pm **Derek Lovley** (U. Mass-Amherst)
"Microbe-electrode interactions: Mechanisms of electron transfer and applications for power production and bioremediation"

9:18 pm - 9:30 pm Discussion

WEDNESDAY

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm BIOINORGANIC CHEMISTRY AND EVOLUTION

9:00 am - 9:20 am Discussion Leader: **Ariel Anbar** (Arizona State)

9:20 am - 9:47 am	Lucia Banci (U Florence) "The Metallome through the three domains of Life"
9:47 am - 10:00 am	Discussion
10:00 am - 10:30 am	Coffee Break
10:30 am - 10:57 am	Mak Saito (WHOI) "Was there co-evolution of cyanobacteria and trace metal ocean biogeochemistry during a cyanobacterial era? What we know, what we need to know, and what is knowable"
10:57 am - 11:10 am	Discussion
11:10 am - 11:37 am	Felisa Wolfe-Simon (Harvard) "The geobiochemical evolution of the photosynthetic metalloproteome: physiological proxies, biochemical inertia, and the stalled diversification of algae"
11:37 am - 11:50 am	Discussion
11:50 am - 12:17 pm	Chris Dupont (U Cal-San Diego) "Diversity and evolution of the metal-binding proteome"
12:17 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	Poster Session
6:00 pm	Dinner
7:30 pm - 9:30 pm	TOXICOLOGY AND BIOREMEDIATION
7:30 pm - 7:45 pm	Discussion Leader: Jenny Jay (UCLA)
7:45 pm - 8:08 pm	Ellen Silbergeld (Johns Hopkins) "The unbearable heaviness of metals: Exposures, outcomes, and mechanisms of the toxic metals"
8:08 pm - 8:20 pm	Discussion
8:20 pm - 8:43 pm	Rich Meagher (U Georgia) "Multigene strategies for the phytoremediation of mercury and arsenic"
8:43 pm - 9:55 pm	Discussion
8:55 pm - 9:18 pm	John Coates (U Cal - Berkeley) "Between a rock and a hard place - nitrate-dependent Fe(II) oxidation"
9:18 pm - 9:30 pm	Discussion

THURSDAY

7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	MINERAL NUTRITION AND HOMEOSTASIS
9:00 am - 9:20 am	Discussion Leader: Al Crumbliss (Duke)
9:20 am - 9:47 am	Frithjof Kuepper (Scottish Association for Marine Science) "Iodide in kelp: an inorganic antioxidant in life impacting atmospheric

	chemistry"
9:47 am - 10:00 am	Discussion
10:00 am - 10:30 am	Coffee Break
10:30 am - 10:57 am	Leif Pallesen (U Illinois-Chicago) "P-loop NTPases in cytosolic FeS cluster biogenesis"
10:57 am - 11:10 am	Discussion
11:10 am - 11:37 am	Nigel Robinson (Affiliation) "Allocating the correct metals to proteins in the periplasm"
11:37 am - 11:50 am	Discussion
11:50 am - 12:17 pm	Anne Kraepiel (Princeton) "The multiple roles of siderophores: from iron bearers to metal custodians"
12:17 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	Poster Session
6:00 pm	Dinner
7:30 pm - 8:00 pm	<u>Business Meeting</u> (Nominations for the next Vice Chair; Fill out Conference Evaluation Forms; Discuss future Site & Scheduling preferences; Election of the next Vice Chair)
8:00 pm - 9:30 pm	BIOINORGANIC ENVIRONMENTAL CHEMISTRY AND FUTURE FUELS
8:00 pm - 8:20 pm	Discussion Leader: Francois Morel (Princeton)
8:20 pm - 9:15 pm	Roger Prince (Exxon-Mobile) "Will we drive on biofuels?"
9:15 pm - 9:30 pm	Discussion
FRIDAY	
7:30 am - 8:30 am	Breakfast
9:00 am	Departure

The project described was supported by Grant Number R13ES016679 from the National Institute Of Environmental Health Sciences. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute Of Environmental Health Sciences or the National Institutes of Health.

Registration List

Name	Organization	Participation
Anne O. Summers	University Of Georgia	Chair
William G. Sunda	Beaufort Laboratory, Nos, Noaa	Chair
Rachel N. Austin	Bates College	Vice Chair
Ariel D. Anbar	Arizona State University	Speaker
Ginger Armbrust	University Of Washington	Speaker
Lucia Banci	University Of Florence	Speaker
Bridget A. Bergquist	University Of Toronto	Speaker
Theodore A. Betley	Harvard University	Speaker
William Burgos	Penn State University	Speaker
Alison Butler	University Of California Santa Barbara	Speaker
Joseph Caruso	University Of Cincinnati	Speaker
Alvin L. Crumbliss	Duke University	Speaker
Thomas Dichristina	Georgia Institute Of Technology	Speaker
Christopher L. Dupont	J. Craig Venter Institue	Speaker
Morel Francois	Princeton University	Speaker
Jenny A. Jay	Ucla	Speaker
Andrew Johnston	Univ Of East Anglia	Speaker
Ken Kemner	Argonne National Laboratory	Speaker
Anne Kraepiel	Princeton University	Speaker
Peter M. Kroneck	Universitaet Konstanz	Speaker
Frithjof C. Kuepper	Scottish Association For Marine Science	Speaker
Stephen J.. Lippard	Massachusetts Institute Of Technology	Speaker
Derek Lovley	University Of Massachusetts	Speaker
Richard B. Meagher	University Of Georgia Genetics Dept	Speaker
Sabeeha Merchant	University Of California, Los Angeles	Speaker
Jose J.G.. Moura	Universidade Nova De Lisboa	Speaker
Leif J. Pallesen	University Of Illinois At Chicago	Speaker
Roger Prince	Exxonmobil Research & Engineering Co.	Speaker
Stephen W. Ragsdale	University Of Michigan Medical School	Speaker
Nigel Robinson	Newcastle University	Speaker
Mak Saito	Woods Hole Oceanographic Institution	Speaker
Elena Shevchenko	Argonne National Laboratory	Speaker
Ellen Silbergeld	Johns Hopkins University	Speaker
Thomas G. Spiro	University Of Washington	Speaker
Bradley M. Tebo	Oregon Health & Science University	Speaker
Ann M. Valentine	Yale University	Speaker
Felisa L. Wolfe-Simon	Harvard University	Speaker
Katie Alexander	Arizona State University	Poster Presenter

Shady A. Amin	San Diego State University	Poster Presenter
Jean-Philippe S. Bellenger	Princeton University	Poster Presenter
Erin M. Bertrand	Woods Hole Oceanographic Institution	Poster Presenter
Claudia A. Blindauer	University Of Warwick	Poster Presenter
Saumyaditya Bose	University Of California Berkeley	Poster Presenter
Shawn C. Burdette	University Of Connecticut	Poster Presenter
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Madeli Castruita	Ucla	Poster Presenter
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Jennifer B. Glass	Arizona State University	Poster Presenter
Brian M. Hopkinson	Princeton University	Poster Presenter
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John S. Magyar	Barnard College	Poster Presenter
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Elena A.. Rozhkova	Argonne National Laboratory	Poster Presenter
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Robert C. Scarrow	Haverford College	Poster Presenter
Steven W. Singer	Joint Bioenergy Institute	Poster Presenter
Rhona K. Stuart	Scripps Institute Of Oceanography, Uc San Diego	Poster Presenter
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Yan Xu	Princeton University	Poster Presenter
Deborah B. Zamble	University Of Toronto	Poster Presenter
Limei Zhang	Univ Of Saskatchewan	Poster Presenter

Rebecca A.. Adler	Johns Hopkins Bloomberg School Of Public Health	Attendee
Beth A. Ahner	Cornell University	Attendee
Juergen Gailer	University Of Calgary	Attendee
Landis Hare	Universite Du Quebec /Inrs-Ete	Attendee
Margo Haygood	Oregon Health & Sciences University	Attendee
Isabel Moura	Universidade Nova De Lisboa	Attendee
Gillian E. Robbins	Institute Of Marine And Coastal Sciences	Attendee
Allison P. St. Vincent	Whoi	Attendee
Alison G. Tebo	Ucla	Attendee
Jake S. Yeston	Science Magazine/Aaas	Attendee