Undergraduate Research in the Chemical Sciences

2011 Potsdam Faculty Scholarship and Research Celebration

Fadi Bou-Abdallah
SUNY Potsdam
Chemistry Department
August 26, 2011
Most People’s View of a Chemist
Science is fundamentally a human endeavor driven by the same impulses that motivate much of human activity:

- Curiosity about the unknown
- Thrill of discovery
- Delight in creativity
- Benefits derived from understanding

CURIOSITY = Driving Force
Research in a Learning Environment

Bridging the Gap!

Calls to strengthen links btw Res. & Tch.

Growing interest in UR on our campus
Outline of My Talk

- Briefly Discuss the Benefits of UR
- Give a Brief Outline of my Research Program
- Highlight Students’ Achievements
- Discuss Recent Awards/Publ./Collab.
Undergraduate Research

Who Benefits?

Research at an undergraduate institution:

1. Enhances the educational experience of undergraduates
2. Reduces the rate of attrition (improves students retention)
3. Provides a pathway for exploration (undeclared students!)
4. Opens doors for collaborations between faculty at various institutions

Can be rewarding, frustrating or exhilarating

- publications
- Conferences
- Exposure

If things do not go as planned

Research outcome
Young students are like diamonds in the rough

**Damaged if mistreated ; Gems if handled properly.**

Thus, the care and nurturing of young, talented and prospective science students is crucial for developing the next generation of scientists.
Albert Einstein once reasoned:

“It is not so very important for a person to learn facts. For that he does not really need a college. He can learn them from books. The value of an education in a liberal arts college is not the learning of many facts but the training of the mind to think something that cannot be learned from textbooks”.

Teaching and Research are highly integrated and inquiry-based method is the best way to teach science!
Dr. Fadi Bou-Abdullah
bouabdf@potsdam.edu

Assistant Professor, SUNY at Potsdam (2007-present)
Research Scientist II, University of New Hampshire (2003-2007)
Pre-doctoral degree, Ecole Normale Superieure de Cachan (ENSC), Paris-France (1997)
M.S. Chemistry, Lebanese University (1996)

Interests and Field of Study
Bioinorganic Chemistry and Physical Chemistry of Biological Processes
My research interests are in the general area of iron protein biochemistry. The goal is to elucidate the structure-function relationships and better understand the role of these crucial proteins in the regulation of cellular iron homeostasis. Proteins such as human transferrin, cytoplasmic and mitochondrial ferritins of different origins, human and bacterial frataxin are being investigated. The hope is to generate new knowledge that is essential for the rational development of new treatments for iron overload diseases and other defects in iron metabolism.

Iron is a vital element for almost all living organisms due to its essential role in numerous metabolic processes. However, excess free iron has been implicated in neurodegenerative diseases, apoptosis, and also in the generation of harmful free radicals that cause damage to membranes, proteins and nucleic acids. The low solubility of iron at physiological conditions (~10^{-14} M) has compelled living organisms to adapt efficient iron transport and storage mechanisms, one of which is transferrin, a plasma transport protein which carries iron in the circulation from the gut to the bone marrow and other tissues for the synthesis of hemoglobin and other iron containing proteins.

The iron-transport protein "Transferrin"

Transferrin is a naturally occurring metal chelating protein that is responsible for the transport and donation of Fe to cells and tissues where it is utilized by many iron-containing enzymes. It is a dimeric protein (Fe and HbA) with two high affinity Fe-binding sites under conditions of normal 

The following research projects are being currently studied:

1. The thermodynamic investigation of recombinant human serum transferrin binding
The following research projects are being currently studied:

1. The thermodynamic investigation of recombinant human serum transferrin binding to the soluble portion of the transferrin receptor.

2. The iron binding, oxidation and deposition properties in a number of ferritin samples including recombinant homopolymer human H-, L-, and heteropolymer H/L ferritin and heme-free E. coli bacterial ferritin, (EcFtnA).

3. Characterization of several L-chain ferritin mutants that cause Neuroferritinopathy (also called hereditary ferritinopathies), a severe and rare disease characterized by iron accumulation in the basal ganglia and ferritin inclusion bodies in the glia and neurons of central nervous systems and other organs.

4. Investigation of iron release from ferritin by tridentate chelate ligands of 2,6-bis [hydroxy(methyl)amino]-1,3,5-trazine family (BHT).

5. Study of the thermodynamic stability of heteroleptic versus homoleptic metal complexes and the factors influencing the selective formation of these metal complexes.

6. Thermodynamic interaction of a novel leucine rich surface protein of Bacillus cereus protein with ferritin, heme and hemoglobin.

7. Characterization of the metal binding properties of the iron transport protein (EfeO) from Escherichia coli.

Our research is contributing to the understanding of important structure-function relationships in these crucial iron transport and storage proteins and is generating new knowledge that is essential for the rational development of new treatments for iron overload diseases and other defects in iron metabolism.

Interested students should contact Dr. Bou-Abdallah at bouabdf@postam.edu
Undergraduate Research in the Chemical Sciences - Achievements and Opportunities -

External Funding:


- **National Science Foundation** - Major Research Instrumentation Program (NSF-MRI), “Acquisition of an Isothermal Titration Calorimeter”, Award period 2009-2012 - ($126,525).

- **National Science Foundation – Early Faculty CAREER Award** - ($481,193) – **Under Review**

- **American Chemical Society** Innovative Projects Grant Program. Spring 2010. ($1500)
Internal Support:

1. Faculty-Undergraduate Summer Research Program Award
2. Kilmer Undergraduate Research Apprenticeships
3. Student-Faculty Travel Awards
4. Individual Development Grant Award
5. United University Professions (UUP) Individual Development Award
6. Mini-Grant Award
7. Research and Creative Endeavors Program Award
8. Grant Development Program Award
9. Faculty Professional Development Program Award (Title III)
10. Faculty Curriculum Development Award (Title III)
Students’ Awards:

- Faculty-Undergraduate Summer Research Program Award
- Kilmer Undergraduate Research Apprenticeships
- Student-Faculty Travel Awards
- Advanced Honors Independent-Study Program Award
- Presidential Scholars
Undergraduate Research in the Chemical Sciences
- Achievements and Opportunities -

Publications:


Undergraduate Research in the Chemical Sciences
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Students’ Presentations:

Oral Talks by Students

Poster Presentations

http://www2.potsdam.edu/bouabdf/List%20of%20publications.html
Undergraduate Research in the Chemical Sciences - Achievements and Opportunities -

Snapshots From Various Meetings
Presenting at the Sigma Xi meeting - April 2008 - Cornell Univ.
Having Fun?
236th National ACS Meeting
Philadelphia, PA
August, 2008
American Chemical Society- Northern New York Research Symposium, SUNY Potsdam, April 04-2009
Banu Kandemir was awarded "The Kilmer Undergraduate Research Poster Excellence Award"

April 16, 2009
Learning and Research Fair - SUNY Potsdam, April 21, 2010
For the Kilmer Awards, Justin McNally earned first place for his project “……” overseen by faculty mentor Dr. Fadi Bou-Abdallah.

American Chemical Society - Northern New York Research Symposium, SUNY Potsdam, April 16-2011
While at Ithaca College, we noticed the existence of a very tough parking policy!
Students involved in Undergraduate Research in my Lab

Gustavo Gonzales  Hiba Iqteit  Adeola Awomolo  Huidong Yang

Banu Kandemir  Justin McNally  Brenna Cooper  Tyson Tepstra

Sean Atkinson  Mariama Diallo
Where are they now?

Hiba Iqteit,
Health profession
John Hopkins Univ.

Gustavo Gonzales
Medical degree
Univ. of Health Sciences
Antigua, San Juan, PR

Adeola Awomolo
Medical degree
SUNY Upstate Medical Univ.

Huidong Yang
PhD in Neuroscience
Univ. of Illinois at Urbana-Champaign

Banu Kandemir
PhD in Physical Chemistry
Rochester Univ.
Current Students

Justin McNally
MD-PhD program
Dartmouth Medical School, NH

Tyson Terpestra
PhD/Research
or
Medical School

Brenna Cooper
Nursing School

Sean Atkinson
Medical School

Mariama Diallo
???
From left, Chelsea Richard, Justin McNally and Gregory Razzano pose with State Sen. Darrel J. Aubertine, D-Cape Vincent, in the Legislative Office Building in Albany.
<table>
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<th>Collaborators:</th>
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<tr>
<td><strong>US</strong> Professor N. Dennis Chasteen</td>
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<tr>
<td>University of New Hampshire</td>
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<td>Durham, NH</td>
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<tr>
<td><strong>Italy</strong> Professor Paolo Arosio</td>
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<tr>
<td>Faculty of Medicine,</td>
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<tr>
<td>University of Brescia,</td>
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<td>Brescia, Italy</td>
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<tr>
<td><strong>US</strong> Professor Anne Mason</td>
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<tr>
<td>The University of Vermont</td>
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<td>College of Medicine</td>
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<td><strong>Italy</strong> Professor Sonia Levi</td>
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<tr>
<td>Vita-Salute San Raffaele University</td>
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<td>Milano, Italy</td>
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<tr>
<td><strong>UK</strong> Professor Simon C. Andrews</td>
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<tr>
<td>University of Reading, UK</td>
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<td>School of Biological Sciences</td>
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<tr>
<td><strong>US</strong> Professor Artem Melman</td>
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<tr>
<td>Department of Chemistry &amp; Biomolecular Science</td>
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<td>Clarkson University</td>
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<tr>
<td><strong>France</strong> Professor Christina Nielsen-LeRoux</td>
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<tr>
<td>Institut Micalis</td>
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<td>Paris, France</td>
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- Curiosity about the unknown
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To me, the Excellence in Teaching, the Desire to Know and Share the Beauty of Science can be expressed in three ways:

1- Caring for & One-on-One Interactions with Students
2- Undergraduate Research
3- Chemical Demonstrations (Magic Shows !)
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