

“Bridge-Building in the Chemical Sciences, a Collaboration Between Babes-Bolyai University and Grand Valley State University”

Fulbright Award #2326 (Romania)

“All Disciplines”

Summary/Goals

I propose to spend ~ one semester teaching and conducting research in the Chemistry Department of Babes-Bolyai University, Cluj, Romania for the period January – June 2013. The purposes of the project are several-fold: a) coursework in general and inorganic chemistry to members of the department (primarily students) in English, which will enhance professional contacts and professional development for said students, in future work potentially completed in the US; b) begin a research collaboration with Prof Cristian Silvestru (host) based on mutual scientific interests in applications to main group elements and battery technology, with plans for joint publication and hopes of future continuation (research and personnel exchanges); c) advance the existing partnership agreement between Grand Valley State University and Babes-Bolyai University in several ways (those mentioned above), including working on the logistics of facilitating future exchanges of personnel (students, especially). This work of facilitating exchanges will not only address mundane issues, but importantly issues of student learning goals, curricular coordination, and possibly joint degrees.

Project Description**Teaching Goals:**

The heart of my Fulbright proposal is the lecturing role I will have with students at Babes-Bolyai. I have 14 years of experience in chemistry instruction at the undergraduate level, in courses ranging through general chemistry, sophomore organic chemistry, and a variety of upper-level inorganic lecture and laboratory courses. The very large size of the Grand Valley State University Chemistry Department as a Primarily Undergraduate Institution (largest PUI department in the US) allows all GVSU chemistry instructors to impact large numbers of students at the introductory level, and offer a variety of upper-level courses, including equipment-intensive laboratory courses. As a result, I have developed and implemented a variety of teaching styles, tailored to each student environment.

In order to impact as broad a spectrum of students as possible, I plan to engage in instruction in both introductory and upper-level inorganic chemistry courses during the regular semester at Babes-Bolyai, Feb – May 2013 (~ 50% of the time spent on the grant). As part of my primary teaching philosophy, I intend to focus course content on applications and recent literature, a style that I already use routinely (and uniquely in my department) with US students, even at the freshman level. Specifically, I wish to learn how Romanian students would use their experiences outside the classroom to interpret information on the *applications* of chemistry, in the same manner as I have engaged my own US students (and then brought them into a broader understanding of chemistry). There are numerous examples, including a couple highly relevant ones I have used in the last 5 years on poisoning events in the Danube river basin (which drains most of Romania's watersheds). I can keep a flexible approach in the classroom, and make adjustments that seem appropriate in response to the observations taken above.

In general, I frequently select chemical literature and events from across the globe where there are impacts on economic, social, and environmental issues. It is my second most important teaching philosophy that chemistry coursework easily becomes abstract and unconnected to the world outside the university, without proactive attention to the applications listed above. When students question why a chemist would be interested in such things, it is not difficult to also give my extensive background in social advocacy; for instance, I was both student president of my Hispanic-American student association, 1991 – 93, and first president of the GVSU minority employees organization, 2006-07, amongst many other university governance leadership roles. I can act well outside my disciplinary expertise in chemistry, and provide experienced advice to both students and staff on issues of general social importance at the university.

In a practical way, Romanian students will benefit from instruction in English delivered by a native English speaker, which has become the international language of chemistry (I also speak Spanish and some German, and plan to become at least minimally functional in Romanian before returning to Cluj). This will enhance the Romanian students' future professional development in many ways: improved immersion in the international literature, professional contacts overseas, communication with other chemists, and facilitate anticipated future student exchanges between GVSU and Babes-Bolyai.

As indicated below (GVSU – Babes-Bolyai Partnership), there are curricular goals to achieve in terms of finding integration between the chemistry curricula of the two institutions. Future exchanges of faculty, and ultimately students, will require work of this kind to be completed, though it is anticipated that this important work will require only a small amount of the grant period (perhaps ~ 10% of the time spent).

Research Collaboration Goals:

In addition to teaching chemistry with Romanian students, I am optimistic about developing a research collaboration during my time in Cluj. I am currently working on a new project (begun Summer 2010) involving integrating phosphorus chemistry into the design of novel battery and fuel cell matrices, funded last year by the NASA Space Grant program.¹ As part of the plan to expand expertise in this project, I wish to take advantage of the unique opportunities that Prof Silvestru's group can offer in novel approaches to chalcogenide chemistry. This will help solve some of the problems experienced in cleanly producing materials from our current methodology.² This component of the proposal should take ~ 50% of the time of the PI during the grant period, Feb – May 2013.

Specifically, we need to solve problems related to the clean incorporation of chalcogenides into phosphorus (III) nitride and related main-group, solid state materials. While we have methods worked out for pure phosphorus (III) nitride solids,^{2a} probable modulation of the properties of the matrix will require incorporation of other elements, and chalcogenides have already been explored in a limited way by other groups working on related matrices.³ The expansion of expertise needed requires synthetic methods and solid state characterization, both of which Prof Silvestru's has extensive and on-going expertise in application to chalcogenide – main group chemistry.⁴ Prof Silvestru's group is currently completing a project which specifically involves organochalcogenide chemistry which would be a great fit for the chemical methods needed.⁵

Many chemical research groups have begun working to find the answer to more efficient and higher-power density batteries through phosphorus chemistry.⁶ Interest in battery technology in Western Michigan is very high, with large-scale industrial projects funded by both General Motors and LG Chem in the local area.⁷ GVSU is just beginning to take advantage of the opportunities here. Not only will our group benefit, but also Prof Silvestru's group in terms of future scientific and technological collaborations and contacts in the US.

Enhancing the GVSU – Babes-Bolyai Partnership

The GVSU College of Liberal Arts and Sciences and Padnos International Center initiated a Partnership agreement with Babes-Bolyai University in 2010. Using professional contacts already established by existing GVSU faculty members (Mihaela Freidelmeier, Psychology, and Dalila Kovacs, Chemistry), a GVSU delegation visited Babes-Bolyai University in early Summer 2010 to work out the basics of a possible partnership, and a plan for future elaboration.

I have previously visited Babes-Bolyai University (May 2009) for a brief period in the company of Prof Kovacs, and explored some of the basic issues in thinking about collaborative projects with the Babes-Bolyai chemistry department. This visit, though of a largely informal nature, was key in prompting the desire to seek Fulbright funding for both parties involved.

Problems in future exchanges between the two universities can be solved through an extended stay funded by Fulbright. The current issues mostly involve working out curricular equivalencies between the two chemistry degree programs, and secondarily the goals and logistics of exchanges of other faculty and staff. With an opportunity to work in an instructional capacity at Babes-Bolyai and in constant contact with Babes-Bolyai faculty members, I will be able to work out the equivalencies between the two curricula. A plan can then be put together that will allow students of each university to beneficially exchange coursework in either degree program. Many of the goals of faculty-staff exchanges will be achieved simply through continued extended contacts, of the nature of this proposal, and informal person-to-person discussion. The desired result is a regular flow of personnel that takes advantage of the mutual benefits the two institutions offer each other.