"Biosensors to Save Lives"
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This paper summarizes my accomplishments for the reporting period 2005-2010. It also presents my vision for the next phase of my career at Michigan State University. In summary, I am committed to empowering students (mentoring), saying lives (research), enhancing curricula (teaching) and serving others (service).

Accomplishments

1. Mentoring

One of my passions in life is to empower young people to achieve their potential. During the repotting period (2005~2010), I mentored 20 undergraduate professorial assistants, 10 summer research interns, 15 senior design students, 13 high school students, 15 PhD students, 2 MS students, 3 post-doctoral research associates, 2 visiting scholars, and 2 public school teachers. I trained them in conducting research, writing technical papers, thinking critically, analyzing data, doing good laboratory practices, teamwork, and research presentation skills. Through my guidance, encouragement, and training, these students gained skills that made them competitive in vying for awards. I am happy to report that 3 undergraduate (UG) students received the Department of Homeland Security Undergraduate Fellowship, one UG received the Duvall Fellowship, 12 undergraduate students received awards during the annual University Undergraduate Research and Arts Forum (UURAF), 3 graduate students received the Department of Defense SMART (Science, Mathematics, And Research for Transformation) Fellowship, 2 received the Fitch Beach Graduate Student 3W8td, and several received BAE department awards, These awards bring distinction and honor to these students as well as to MSU and the department. I have also graduated 6 PhD and 2 MS students during the reporting period all of whom are currently engaged in jobs related to their earned degrees, My previous student's have performed well in their respective assignments. For example, Cynthia Meeusen (MS 2000) is now a Senior Controls Engineer at Disney World; Stephen Radke (PhD 2004) is now the account manager at JBT Technologies. These graduates, students, postdocs, scholars, and teachers will likely become innovation leaders in their respective areas of specialization. In all their future endeavors, they will carry the name of MSU and impact society in extraordinary ways.

As a demonstration of my collaborative and interdisciplinary approach, I also mentored 3 graduate students from other departments by providing technical guidance, financial support, and laboratory facilities to develop diagnostic biosensors directly applicable to their field of specialization. This approach has

encouraged true collaboration, resulting in jointly authored peer-reviewed papers and jointly funded projects, contributing to MSU's brand of being a collaborative institution.

As evidence of my commitment diversity, I mentored a faculty-student team from a minority serving institution (MSI), in this case the Whittier College, California. This mentoring has led to the submission of a research proposal, and subsequent successful receipt of funding, to strengthen the MSI faculty's research capabilities, facilitate MSI's undergraduate research, and strengthen collaboration with MSU. This continued interaction will have long-lasting impact on the MSI and will expand the positive influence of MSU in the academic community.

My commitment to mentoring goes beyond the boundaries of MSU, I mentored 2 high school teachers to enhance their respective school's science-based high school curriculum by providing lab facilities, materials, and technical guidance during the curriculum development. I am proud to report here that a curriculum on "Nanotechnology and Biosensors" has been developed for the Union High School in Grand Rapids, Michigan which graduates about 200 seniors per year. Another curriculum is currently being developed for the Jonesville High School, Jonesville, Michigan. Hundreds of students now and in the future will be impacted by these curricula. Similarly, I mentored 2 visiting scholars from outside the US. These interactions have led to more scholars coming. Again, this Is a great way to expand MSU's reach in the international arena.

As part of recruitment and service, I mentored 13 high school students, 9 of whom have won national and international awards, such as the Siemens Math-Science-Technology Competition, Intel Science Talent Search Competition, BIO Competition, and Presidential Scholars. These students will carry the name of MSU wherever they go.

2. Research

I like the challenge of pioneering, This is the story of the Nano-Biosensors Lab (NBL) at MSU, Before my tenure, this facility and the biosensors research program did not exist ram proud to report that NBL and the biosensors program have gained international prominence in such a brief period of time. I initiated (from ground zero), equipped, and strengthened the facility and program mostly from externally sourced funds, Most of the lab's work and accomplishments can be found in the following URL: http://www.egr.msu.edu/~alocjlja. My research program can be summarized in one word "Biosensors" and its mission is "to save lives". Within the broad field of biosensors, my niche area is developing field operable handheld nanoparticle-based biosensors for the point-of-care and rapid diagnosis of infectious

disease agents in resource limited and clinically-relevant field settings. We have synthesized novel I multifunctional reagents and developed accompanying biosensor devices that will allow for rapid "cradle-to-grave" diagnosis, that is, from sample handling to diagnostic results, within one or two hours. Our technologies have resulted in 3 US patents and 13 patent applications, As an indicator of international prominence, my paper was selected as one of 16 (out of 1200 submissions) to be a plenary presentation during the 2010 World Congress on Biosensors, held in Glasgow, UK.

Biodefense is a field that I am committed to. I am so glad that r have been given the chance to be part of the first team of investigators in 2004 to propose the National Center for Food Protection and Defense (NCFPD), now a Homeland Security center of excellence (http://www.ncfpd.unn.edu/), I am also part of the second team of investigators to work for the renewal of the NCFPD for the second term (2010-2016), NCFPD is a network of universities, federal agencies, and private companies committed to the protection of the US food supply system.

I find writing proposals as an opportunity to express my creativity, This interest has helped me generate external federal and state funds in the amount of $4,5 million for the period 2005-2010, These grants allowed me to conduct research on biosensors with applications in global health, biodefense, food/water safety, and product integrity. These grants also allowed me to mentor excellent students) publish papers, and attend conferences. These research expenditures contribute greatly to the national ranking status of the department, college, and university.

I like writing papers; it is a window for others to see what we do. For the period 2005-2010, I contributed 1 book (in review), 5 book chapters, 1 magazine article, 60 peer-reviewed journal articles and proceedings, and 69 research presentations. Several of the articles included undergraduate and high school students as co-authors. The impact of these papers on the biosensor and rapid diagnostic communities can be measured by the Hirsch index (h-index)[1]. For this report, I used the software "Publish or Perish"[2] and Google Advanced Scholar h-index calculators; both evaluation tools gave the same result. As of September 15, 2010, my h-index is 15 and have received 768 citations with 26 citations/year. Furthermore, the most cited paper with 65 citations is a paper with only two authors: me and my graduate student. This paper is cited 8 times per year. The first 3 well cited papers, getting 50 or higher citations, have only two authors as well. These data show that my work on biosensors is useful to colleagues in the field. To put my scientific impact in perspective, I compared my h-index with that of two female

[1] *h*-index is a number system that "attempts to measure both the scientific productivity and the apparent scientific impact of a scientist" (http://en.wikipedin.org/wiki-index).
[2] (Harzing, A.W. 2010. Publish or Perish, version 3 available at www.barzing.com/pop.htm)

colleagues (a full professor and an associate professor) in two institutions (Cornell University and Purdue University) who are in similar departments as I am and who do biosensor work, The associate professor is in a similar ten tire time frame as J am. The full professor has an h-index of 19 and 1,039 citations and 104 citations/year. The associate professor has an *h*-index of 6 and 118 citations and 3 citations/year. Furthermore, my citation is increasing exponentially with time as shown in Figure 1. All these data show that my scholarly work has contributed to the scholarship of other scientists and is highly valued by the scientific community.

Research impact can also be measured by the number of invitations to speak at prestigious meetings and conferences. During the reporting period, I gave 11 invited presentations. These invitations included those by the National Academy of Sciences and the World Congress on Biosensors. These speaking engagements bring national prestige and recognition of the research excellence on biosensors at MSU. Correspondingly, they bring national and international recognition to the department, college, and university.

One way to test the creativity and utility of a technology is through rigorous patent review. I am happy to report that together with my students, I received 3 US patents and made 13 patent applications. I worked I with the Office of MSU Technologies and various companies to potentially commercialize these biosensor technologies.

Through my research work, I have established international collaborations with the Canadian Food Inspection Agency, Canada; CIATEJ (Centro de Investigacion y Asistencia en Tecnologia y Diseno del estado de Jalisco), Mexico; Zhejiang University, China; University of the Philippines Los Banos; Tamil Nadu University, India; University of Baghdad, Iraq; and Frannhofer, Germany. I intend to continue these collaborations into the future.

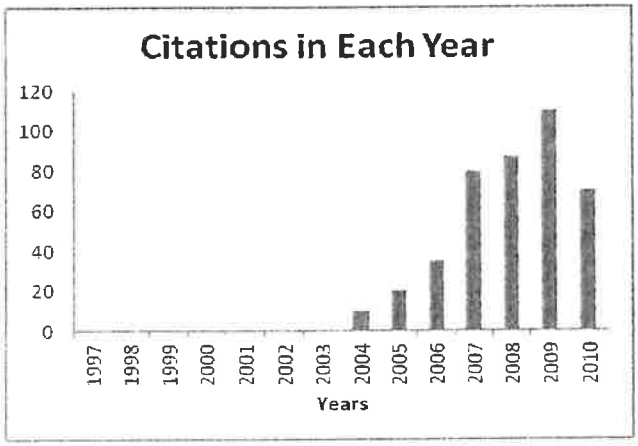

Figure 1. Citation Report by the ISI Web of Science, Author=(Alcilja E*)

3. Teaching

My latest achievement in teaching is developing 2 courses on biosensors and simultaneously laying the foundation for the BE-Biomedical Engineering (BE-BME) concentration for the BE students. Before this initiative, our BE-BME students did not have a BE-BME course in the department. Now, we have our own course which differentiates and provides uniqueness to our students. The BE-BME concentration prepares students to integrate various disciplines towards the early diagnosis and potential elimination of diseases. While they take classes in broader areas of biology, chemistry, and engineering, BE-BME students specialize in medical diagnostics and devices. In the long-term, the BE-BME concentration will include classroom education, industry internships, and study abroad program to train and develop students with a global perspective on diseases. The ultimate aim of the BE-BME program is to equip graduates for their careers in medicine, pharmaceuticals, and medical devices. Through their unique education at MSU, we hope that the graduates would be able to effectively diagnose diseases (medicine), understand the function of reagents in diagnostic assays (pharmaceuticals), and contribute to the efficient design of diagnostic tools (medical devices). As professionals in these fields, they can impact society through the control and eradication of infectious diseases, improving quality of life, and saving lives. The future of BE-BME is positive as the medical-related industries are booming. Together with the BAR faculty, I look forward to moving this field in unique and exciting ways to a level that is world-class and world-renown consistent" with MSU's goals and missions.

4. Outreach and Service

1 am actively involved in outreach and service to the university and the community, I enjoyed my membership in the department, college, and university-level committees and review panels. I also enjoyed my time as a faculty in teaching short summer courses offered by the university.

I actively presented papers and organized sessions at the following professional meetings: Institute of Biological Engineering, ASABE, IEEE, American Chemical Society, and PITTCON. I served as member of review panels for the National institutes of Health (NIH) and the National Science Foundation (NSF). Participation in these prestigious review panels indicates national recognition of the biosensors program at MSU. Because of my active involvement in review panels, NIH has granted me the privilege of continuous submission for 2010-2011. I also served as a reviewer for several journals.

Most of my community service is toward helping international students and families. They are a vulnerable group on campus due to their unique circumstances being

away from home, having to learn a new lallguage, adjust to a new culture, and live in a new environment. A small help always goes a long way in alleviating stress and homesickness.

The above summarizes my activities on mentoring, research, teaching, and service, I feel humbled by these accomplishments because I know that I could not have done these alone. It is all by God's grace! He is the ultimate source of wisdom, strength, and passion!

Vision

So where do I go from here? With God's gracious provision of wisdom and resources, I see the trajectory of my biosensor research as moving in two areas of application: biodefense and global health. My goal for the next phase of my career is to be the leader in developing biosensors for "personalized monitoring of infectious diseases" (PMID) in resource-limited settings, such as under field conditions and rural health clinics. The PMID concept will be used in the design, development, and validation protocols for' evaluating performance measures. Of particular interest is the development of biosensors for personalized diagnosis of tuberculosis (TB) and its associated challenges: human immunodeficiency virus (EN) co-infection and TB drug resistance. It is estimated that 1.8 million people die every year of TB, and it afflicts mostly the poor. It is my earnest desire to help reduce the deaths and emotional pain of losing a parent, a child, or a loved one from this disease. Thus, working to eliminate this disease in the world has become not only my research priority but my life-long mission. My vision is to make easily accessible diagnostics to the people in the comfort of their environment. Early diagnosis can lead to immediate treatment and interventions (while the patient is still in the clinic). I have already started to lay the groundwork for this long-term research, ram currently working with a scientist at the Centers for Disease Control and Prevention (CDC) in identifying early markers of TB infection before the organism shows up in saliva and phlegm. I am also working with colleagues from the Institute of International Health and the Center for Latin American and Caribbean Studies to set-up clinical trials of The TB biosensor in several villages in Mexico. Furthermore, I hope that my membership in the NIN review panels would provide me with tips on successful grant writing for N1H funding. In the broader sense, this biosensor platform can be adapted to detect other infections especially for neglected diseases in developing countries, and biodefense applications in field settings. These versatile platforms will allow me to strengthen my international presence with my collaborators around the world. Key initiatives will be immediately pursued with the Canadian Food Inspection Agency, the University of the Philippines Los Banos, and the University of Baghdad, Iraq.

As a complement to the BE-BME program, I would like to pursue the establishment of (1) an MS/MBA program in BE-BME, and (2) an interdisciplinary science-based PhD program on biosensors and rapid diagnostics. The rapid growth in medicine, biotechnology, pharmaceutical, and health care industries has created a demand for biomedical scientists with knowledge of business principles and practices. A science-based PhD program will allow non-engineering students to pursue the development of novel diagnostic technologies in various fields for the modem world we are in.

I recognize that my vision will not be accomplished by my might or by my power alone, but by God's grace according to His promise In Jeremiah 29: 11 which says: "For 1know the plans I have for you," declares the LORD, "plans to prosper you and not to harm you, plans to give you hope and a future," With Ged1s promise and enabling, I look forward to an exciting and rewarding professional endeavor ahead.