**Development of Human Resources & Broader Impacts under DOE Grant to
Professor Akbar Montaser**

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The products of this research during 2002-07 under DOE support consist of 24 publications, 4 U.S. patent/applications, 1 Cover Page article on the September 2006 issue of Journal Analytical Atomic Spectrometry (see attached), 53 presentations (37 invited or plenary lectures), organization of 8 invited symposia at key meetings such as FACSS (2002-06) and Pittcon (2005), 7 Ph.D. Dissertations, 7 MS degrees, and 6 undergraduate Theses. Also, 1 high school student and 2 visiting professors received training in ICP. Since 1998, I have mentored 33 postdocs and graduate/undergraduate students, with all having prestigious academic, industrial or government positions. As always, we strive to reach students from ethnically diverse background. For example in 2004-2007, my group had 5 US citizens and 4 international students/visitor from 3 countries and 3 religions, including 4 females, 2 Hispanics, 2 black females, 1 Asian American, and 1 physically-challenged student. My PhD graduates have had the most diverse educational and research trainings to an extent that major, prestigious firms, academic institutions, and federal laboratories gainfully employ them before graduation, and often with salaries ranging from \$5 K to \$15 K above their peers at other institutions. The students in these projects acquire modern technical skills, learn how to present the findings at local, national, and international meetings, and travel to national laboratories, instrument manufacturers, and prestigious research laboratories in countries such as Germany and France to conduct joint research and broaden their experience. Most significantly, they learn how to utilize the scientific method to explore their subject and ultimately how to use all these skills to contribute to society. For instance, B. W. Acon, an Asian American, conducted collaborative research with several colleagues worldwide and often in their laboratories such as Dr. Lloyd Allen, Leco Corp. (St. Joseph, MI); Dr. Michelle Cree, Varian Inc. (Florham Park, NJ); Dr. Meike Hamester, Thermo Finnigan MAT (Bremen, Germany); Dr. Wing Lai, Aerometrics-TSI Inc. (St. Paul, MN); Dr. William F. Bauer, Idaho National Engineering and Environmental Laboratory (Idaho Falls, ID); Dr. J. Sabine Becker and Dr. Hans J. Dietze, Research Center Jülich,(Germany); Dr. Chantal Stehlé, Observatoire de Paris (Meudon); Prof. Steve Patierno, Department of Pharmacology-GWU (Washington, DC); Prof. Akitoshi Okino, Tokyo Institute of Technology (Tokyo, Japan); Prof. Jose R. Chirinos, Universidad Central de Venezuela (Caracas, Venezuela); Prof. Yann Lahaye, Johann Wolfgang Goethe-Universität Frankfurt am Main (Frankfurt, Germany); and Prof. M. Dolores Calzada, Universidad de Cordoba (Cordoba, Spain). The record for Dr. Acon is remarkable (he also had one patent, 10 publications, and 22 conference presentation), but I can offer many such examples for other students during the funding period. For instance, the PI succeeded in attracting two PhD students (Kaveh Kahen and Kaveh Jorabchi) who had received Gold Medals at the International Chemistry Olympiads, and who collected

several impressive national and international awards during their PhD studies in our group. One of these individual is now conducting his postdoctoral studies with Professor Lloyd M. Smith at the University of Wisconsin-Madison, and has been so successful that he has been selected for the final stage of the stiff competition to win a Career Awards at the Scientific Interface sponsored Burroughs Wellcome Fund. This exceptionally competitive program provides up to \$500,000 over five years to support postdocs with backgrounds in the physical and computational sciences whose work addresses biological questions and who are dedicated to pursuing careers in academic research. The award bridges the postdoctoral appointment and early years of a faculty appointment. Clearly, this award trains first-class young faculty as our next generation.

Last year, two former PhDs began assistance Professorship positions at Vanderbilt University and Southern Oregon University. It would be prudent to highlight that Dr. Mclean, a dual-race American Indian student, published 20 papers, with one on the Cover of Analytical Chemistry (October 15, 2000), was a co-inventor on a patent which led to a commercial device, presented 57 conference papers (some as an invited speaker), and received 13 national and international awards during his PhD studies in my group. Among these awards, he received the esteemed Bunsen-Kirchhoff Prize in 2001 being the second American, after the former Editor-In-Chief (D. Bruce Chase) of Applied Spectroscopy in 1994, to receive such an honor but while John was only a PhD student. These and other graduates trained under DOE support contributed to the diversity of our Department by encouraging bright undergrads from underrepresented populations to pursue graduate degrees, not only because of the educational and research opportunities that the PI offers, but also zealous mentorship for all students.

The PI concludes this outline by providing the list of students' achievements during the DOE support in 2002-07, cataloging some of the awards and recognitions the students received at national and international conferences or from institutions for their contributions to the DOE projects. For instance, K. Jorabchi received the prestigious Swiss based Chorafas Foundation Prize (\$4,000) in an international national competition in 2006 for outstanding PhD research, the 2005 ACS-Analytical Chemistry Division Fellowship and the 2005 Society for Applied Spectroscopy Award for excellence in research. Daniel Mittelberger, an undergraduate scholar, received the Goldwater Fellowship in 2005 and 2006. Two recent PhD students (K. Kahen and K. Jorabchi) and the undergraduate scholar (J. Levine) received the Best Poster Award for fundamental research at 2004 Winter Conference on Plasma Spectrochemistry. Note that the undergraduate scholar was dyslexic and disgraphic, but the PI's mentorship for 4 years resulted in significant achievements by the student: 3 publications and 8 presentations at national meetings, graduation and the move to the University of Maryland, Baltimore in 2006 to obtain a Ph.D. in Biochemistry and Molecular Biology. Graduate students (C. S. Westphal, C. M. Benson, K. Kahen, K. Jorabchi, and S. E. O'Brien, C. M. Nechita) received Travel Scholarship during 2002-2004 to attend and present invited papers at FACSS. B. W. Acon received the Chateaubriand Fellowship, Office for Science and Technology of the Embassy of France (2002-2003) and conducted collaborative research in France for one year with a theoretical astronomist (Dr. Chantal Stehlé, Observatoire de Paris, Meudon). C. S. Westphal (6/2001) was among 39 US graduate students to spend an

all-expense paid week in Germany, meeting with over 60 Nobel Laureates. During the 2002-2004 period, he received two Achievement Rewards for College Scientists Foundation Endowment Fellowship for excellence in graduate research. Clearly, this blend of expertise is and has been of major benefits to the undergraduates trained, and through contribution to the society. Indeed, these students are the individuals that through their basic research and inventions of novel devices developed several practical applications not feasible previously. These include, for example, the most sensitive approach for the detection of radionuclides for DOE and other federal laboratories and with no radioactive solution waste. They devised the most selective and sensitive method for analyzing small-volume biological samples having Cr bound to human lung DNA, at the femtogram level, using our invented nebulization systems. Such studies has helped my colleagues in medical schools, for instance, Professor Steven Patierno (the Executive Director of The GWU Cancer Institute) to detect cancer, develop prevention methods and cure for certain forms of cancer. The PI's students also created the most precise method for the determination of depleted uranium in urine via isotope ratio measurements using the patented nebulization devices fabricated in the PI's laboratories. These applications are currently in use by DOD. For example, the Armed Forces Radiobiology Research Institute in Bethesda, Maryland applies our approach in the correct measurements of deleted uranium from urine and blood samples of personnel. As you know, depleted uranium is a by-product of the uranium enrichment process to produce reactor- and weapons-grade uranium. During the Persian Gulf War, the use of DU munitions resulted in DU fragment injuries among U.S. personnel.

The PI stresses that the real extent of the cited achievements was not realized because he was bed-ridden with a serious illness for nearly two years towards the end of the DOE support. Fortunately, he has fully recovered since February 2007 has now the drive and energy to deliver his best under DOE support.

**Cover Page article; JAAS 2006, vol. 21, Issue no. 09 available at
<http://www.rsc.org/Publishing/Journals/JA/Article.asp?Type=CurrentIssue>**

**A full paper by Akbar Montaser et al on "Interferometric Droplet imaging
for In-Situ Aerosol Characterization in an Inductively Coupled Plasma
<http://xlink.rsc.org/?DOI=b604403d>**

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