

Kamal A. Rashid

Academic Experience

Research Professor	Department of Biology and Biotechnology Worcester Polytechnic Institute	2013-Present
Research Professor	Department of Animal, Dairy & Veterinary Science Utah State University	2000–2013
Adjunct Research Professor	Department of Biological Engineering, USU	2006-2013
Research Professor	Department of Biochemistry & Molecular Biology The Pennsylvania State University	2000
Research Associate Professor	Department of Biochemistry & Molecular Biology The Pennsylvania State University	1991–1999
Senior Research Associate	The Pennsylvania State University, Biotechnology Institute	1989-1990
Visiting Professor	The Pennsylvania State University	1984–1988
Assist. Professor	University of Sulaimani/Salahaddin, Iraqi Kurdistan	1979–1983

Administrative Experience

Director	Biomanufacturing Education & Training Center Worcester Polytechnic Institute	2013-Present
Associate Director	Center for Integrated BioSystems Utah State University	2002–2013
Interim Executive Director	Biotechnology Center Utah State University	2001–2002
Associate Director	Education & Outreach Biotechnology Center Utah State University	2000–2001
Director	Summer Symposium in Molecular Biology The Pennsylvania State University	1991–2000
Director	Instructional & International Programs Biotechnology Institute The Pennsylvania State University	1992–1995
Director	Biotechnology & Bioprocessing Training Programs The Pennsylvania State University	1989–2000

Education

Penn State University Ph.D. Environmental Toxicology

Penn State University M. Sc. Environmental Toxicology

University of Baghdad BS Plant Protection

Title of Ph.D. Thesis: The relationship between mutagenic and DNA-damaging activity of pesticides and their potential for carcinogenesis. Co-supervised by Dr. Charles Ercegovich, Professor of Pesticide Chemistry and Dr. Stanley Person, Professor of Molecular and Cell Biology. Penn State University. 1978.

Research Emphasis:

In Vitro mutagenesis and DNA repair studies in microbial and mammalian systems. Molecular mechanism of chemical mutagenesis. Structure-activity relationship studies with polycyclic aromatic hydrocarbons. Comparative studies of the P-450 system for activation of xenobiotics. Studies involving virus induced cell fusion and cell entry of herpes simplex virus. Studies involving recombinant protein production in mammalian cell systems.

Publications:

Rashid, K and Mardirosian, D., 2013. Training programs for today's biomanufacturing workforce. *Bioprocessing Journal* 12(3) p.7-8.

LaDonya, J., S. Barnett., Z. Wang, **K.A. Rashid**, 2013. Growth and protein production of a recombinant CHO cell line utilizing a novel Antibody-free fetal bovine serum. In preparation.

Hatton, T., S. Barnett, R., M. Sha, **K.A. Rashid**, 2013. A comparative study between conventional reusable (Glass) vs. Single-use disposable (CelliGen[®] BLU) bioreactors for the production of recombinant proteins. *Bioprocessing Journal*. .

Tarbet, E. B., Dorward, J.T., Day, D.W. and **Rashid, K.A.** (2012) Vaccine production training to develop the workforce of foreign institutions supported by BARDA influenza vaccine capacity building program. *Elsevier Vaccine*. In Press. Available on line: <http://www.sciencedirect.com/science/article/pii/S0264410X12009073>

Hatton, T., S. Barnett, A. Benninghoff, **K.A. Rashid** (2012) Productivity studies utilizing recombinant CHO cells in stirred-tank bioreactors: a comparative study between pitch-blade and packed-bed bioreactor systems. *Bioprocessing Journal*, 11(2): p. 29-36.

Hatton, T., S. Barnett, **K.A. Rashid** (2012) CHO Cell Culture with Single Use CelliGen® BLU Packed-Bed Fibra-Cel® Basket. *Bioprocessing Journal*, 11(2): p.48-50.

Hatton, T., S. Barnett, **K.A. Rashid** (2012) CHO Cell Culture with Single Use CelliGen® BLU Packed-Bed Fibra-Cel® Basket. *Bioprocess International*, 10(7): p.96.

Brown J., Signs, M., White, J., Viamajala, S., and **Rashid, K. A.** (2011) Large-scale, developmentally synchronous *C. elegans* liquid cultures using a new tangential-flow filtration method. *Bioprocessing Journal*, Vol. 9 Issue 2, pp34-43.

Rashid, k. and Weimer, B. 2006. Academia's Response to the Growing Biopharma's Workforce Needs. *Biotrends*. Volume 2, Issue 3.

Rashid, K. and B. Weimer. 2005 The Role of Academia in Biotechnology and Bioprocess Workforce Development. *Bioprocessing International*. Vol. 3 No. 1, pp 16-22.

Murinda, S. E., **Rashid, K. A.**, Kunze, E. and Roberts, R.F 2006. Novel real-time method for in vitro cytotoxicity assessment of bacteriocin mode of action against mammalian cells with interactive laser image cytometry and DiOC5(3), a membrane potential-sensitive, fluorescent dye. In Press.

Murinda, S.E.; **Rashid, K.A.**; and Roberts, R.F. 2003. In Vitro cytotoxicity of bacteriocins: Nicin, Pediocin, and Colicin in SV40 transfected Human Colon and Vero Cells. *J. Food Prot.* 66:847-853

Allcock, H. R.; S. R. Pucher; R. J. Fitzpatrick and **K. A. Rashid**. 1992. Antibacterial activity and the mutagenicity studies of water-soluble phosphazine cyclic trimers and polymers. *Biomaterials*, 13: 857-862.

Mumma, R. O.; **K. A. Rashid**; D. C. Raupach; B. S. Shane; J. M. Scarlet-Kranz; C. A. Bache; W. H. Gutenmann and D. J. Lisk. 1988. Mutagens, toxicants, and other constituents in small city sludge in New York State. *Arch. Environ. Contam. Toxicol.* 17:657-663.

Rashid, K. A.; J. G. Babish and R. O. Mumma. 1988. In vitro activation assays with hepatic S9 preparations from wild and laboratory reared woodchucks. *Toxicology*, 48:53-59.

Rashid, K. A.; M. Arjmand, H. Sandermann and R. O. Mumma. 1987. Mutagenicity of Chloroaniline/lignin metabolites in the Salmonella/microsome assay. *J. Environ. Sci. Health*, B22:721-729.

Mullin, C. A.; **K. A. Rashid** and R. O. Mumma. 1987. Mutagenic potential of some conjugated nitroaromatic compounds and its relationship to structure. *Mutation Res.*, 188:267-274.

Rashid, K. A.; N. S. Kavar; L. A. Hull and R. O. Mumma. 1987. Residue-mutagenicity studies with captan applied to apples trees and potential human exposure. *J. Environ. Sci. Health*, B22:71-89.

Rashid, K. A. and RO Mumma. 1986. Screening pesticides for their ability to damage bacterial DNA. *J. Environ. Sci. Health*, B21:319-324.

Mumma, R. O.; **K. A. Rashid**; J. M. S. Kranz; J. H. Hotchkiss; R. H. Eckerlin; C. Y. Lee, W. H. Gutenmann; C. A. Bache and D. J. Lisk. 1986. Toxic and protective constituents in Pet food. *J. Amer. Vet. Med. Assoc.*, 47:1633-1637.

Rashid, K. A. and R. O. Mumma. 1986. Evaluation of Beta-naphth-oxyacetic acid for mutagenic activity in the Salmonella/mammalian microsome assay. *J. Environ. Sci. Health*, B21:243-250.

Rashid, K. A.; C. A. Mullin and R. O. Mumma. 1985. Structure-mutagenicity relationships of chalcones and their oxides in the Salmonella assay. *Mutation Res.*, 169:71-78.

Rashid, K. A.; J. G. Babish and R. O. Mumma. 1985. Comparative mutagenicity assays with rat and woodchuck hepatic S9 preparations. *Toxicology*, 36:139-146.

Rashid, K. A.; I. T. Baldwin; J. G. Babish; J. C. Schultz and R. O. Mumma. 1985. Mutagenicity test with Gallic and tannic acid in the Salmonella/mammalian microsome assay. *J. Environ. Sci. Health*, B20:153-165.

Rashid, K. A. and R. O. Mumma. 1984. Genotoxicity of methyl parathion in short term bacterial tests systems. *J. Environ. Sci. Health*, B19:565-577.

Rashid, K. A.; J. G. Babish and R. O. Mumma. 1984. Testing of 2, 4, 5-T-amino acid conjugates for mutagenic activity in Salmonella typhimurium strains. *Mutation Res.*, 136:217-221.

Rashid, K. A.; C. D. Ercegovich and R. O. Mumma. 1984. Evaluation of chlordimeform and degradation products for mutagenic and DNA-damaging activity in Salmonella typhimurium and E. coli. *J. Environ. Sci. Health*, B19:95-110.

Rashid, K. A. and R. O. Mumma. 1983. Mutagenicity assays with 2, 4-D-amino acid conjugates. *J. Agric. Food Chem.*, 31:1371-1372.

Gauhar, K. A.; **K. A. Rashid** and Z. Noory. 1980. Population density of the red scale insect *Aonidiella aurantii* mask (Diaspididae, Homoptera) on citrus trees in Basrah, Iraq. *Iraqi J. Agric. Sci.*, 6:77-88.

Rashid, K. A. and C. D. Ercegovich. 1976. New laboratory tests evaluate chemicals for cancer or gene damage. *Sci. Agric.*, 23:7.

Abstracts:

Benoit, Kristen and **Rashid, Kamal**, 2013. The role of the Biomanufacturing Education and Training Center (BETC) at Worcester Polytechnic Institute in workforce development efforts for the biotechnology industry. ISBioTech Conference, October 14-16. Rosslyn, VA.

LaDonya, J., S. Barnett., Z. Wang, K.A. **Rashid**, 2013. Growth and protein production of a recombinant CHO cell line utilizing a novel Antibody-free fetal bovine serum. ISBioTech 3rd Annual Meeting. March 2013. Roslyn, Virginia

Hatton, T., S. Barnett, A. Benninghoff, **K.R. Rashid**, 2012. Productivity studies utilizing recombinant CHO cells in stirred-tank bioreactors: a comparative study between pitch-blade and packed-bed bioreactor systems. ISBioTech 2nd Annual Meeting. April, 2012. Roslyn, Virginia.

Tarbet, B., Dorward, J., Day, C., and **Rashid K.** 2011. Vaccine Production Training to Develop the Workforce of Foreign Institutions Supported by the BARDA/WHO Influenza Vaccine Capacity Building Program. A 5th Vaccine and International Society for Vaccines (ISV) Annual Global Congress. October 2012. Seattle, Washington.

Taylor, H., and **Rashid, K.** 2011. Growth, viability and productivity studies utilizing recombinant CHO cells in Stirred-tank bioreactors: A comparative study between the pitched-blade and the packed-bed bioreactor systems. In: The Proceedings of the VII International Congress on Interdisciplinary Research and Investigations. June 9-10, 2011. Santo Domingo, Dominican Republic.

Rashid, K. and Mark Signs. 2007. Integrating Biotechnology Training, Services and Research at Utah State University. SIM Annual Meeting, Denver CO.

Rashid, K. 2005. The Academic Institution's Response to the Biotechnology Industry's Demand for a Well Trained Workforce. (Abstract). 05AIChE Annual Meeting, Cincinnati, OH

Rashid, K. A. 2003. Academic Institutions Response to the Staffing Needs of the Biopharmaceutical Industry. Congress on *in vitro* Biology Proceedings Abstract Issue Volume 39. Spring 2003.

Rashid, K. A. 2002. The Role of Academic Institutions in Preparing a Trained Workforce August 2002. Philadelphia, Pennsylvania. SIM Proceedings.

Rashid, K. A. 1994. Complex Organic Mixtures and Their Significance in Environmental Toxicology and Carcinogenesis. Proceedings of the XVIII Scientific Research Congress. Universidad Interamericana de Puerto Rico, Recino de Arecibo. San Juan, Puerto Rico. Fe. 24-25.

Rashid, K. A. and R.O. Mumma. 1993. Development of a mixed function oxidase system from woodchucks for *in vitro* metabolic activation assays. NATO advanced Study

Institute International Conference on Molecular Aspects of Oxidative Drug Metabolizing Enzymes. June 20-July 2, Kusadasi, Turkey.

Rashid, K. A and A. E. Humphrey. 1992. The role of Penn State's Biotechnology Institute in transfer of technology to developing countries. The 9th International Biotechnology Symposium. Crystal city, Virginia Aug. 16-21 (Abstract).

Continuing Education Program Development (Training Programs, Symposia and Forums):

At Penn State University:

- Animal Cell Culture Methods
- Fermentation Methods and Scale-Up Strategies
- Scale-up Strategies for Animal Cell Culture
- Separation and Purification Strategies for Biotechnology Products
- Plant Biotechnology
- cGMP and Validation Practices in Pharmaceutical Applications.
- Applications of Biotechnology in Space.
- Monoclonal Antibody Production and Purification.
- Applied Finance and Economic Analysis for Engineers and Scientists.
- PCR Technology
- Practical Aspects of Biological Drug Development
- The Annual Summer Symposium in Molecular Biology (From 1991-2000)

At Utah State University:

- Protein Purification: Isolation and Characterization
- Techniques in Animal Cell Culture and Scale-up Strategies
- Microbial Fermentation: Development and Scale-Up
- Baculovirus Expression Vector System and Insect Cell Culture
- Biotechnology in Agriculture for Extension Agents
- Biotechnology Summer Academy for High School Students
- Biotechnology Symposium for Science Teachers
- Bioterrorism: A Panel Discussion
- The Commercialization of Biotechnology in Utah in collaboration with Westminster College and Wasatch Digital IQ Magazine: A Forum 2002
- Symposium on Agriculture Genomics organized for the Pacific Division of AAAS Branch meeting held in Logan, Utah 2003
- Nano/Bio Brain Storm Session. Center for Integrated BioSystems, Logan, Utah 2006
- First Annual Intermountain Systems Biology Symposium, Logan, Utah. In Collaboration with INRA. June 2007
- Intermediate and Advanced Vaccine Manufacturing Workforce Development Funded by BARDA/USDHHS. 2011-2014

Training Programs Developed and Delivered On-Site for Industry and Internationally:

- Animal Cell Culture Methods. Cairo, Egypt 1992 and 1993
- Bench Scale Fermentations. Inter-American University of Puerto Rico. 1994
- Recent developments in Fermentation and Cell Culture. Pacific Rim Countries: Korea, Malaysia, Philippines, Thailand, Taiwan. 1995
- Fermentation Technologies at DuPont Corporation, Delaware Fermentation Facility. April 1999
- Fermentation and Protein Purification, Hercules Corporation, Delaware. November 1999.
- Separation of Biotechnology Products, STC Technologies Inc., Bethlehem, Pennsylvania. March 2000.
- Animal Cell Culture. Pfizer Inc. Groton, Connecticut. April 2001
- Animal Cell Culture Techniques. Hyclone, Inc. Utah 2003
- Animal cell Culture. Amgen, Thousand Oak, California. 2004
- Animal Cell Culture. Baxter Healthcare, Thousand Oak, California 2004
- Strategies for Nuclear Transfer and Stem Cell Research Bangkok, Thailand, March 2006
- Scale-up Strategies for Mammalian and Microbial Bioprocess, Singapore 2003, 2004, 2007.
- Introduction to Biotechnology, Dominican Republic, 2007
- Advanced Biotechnology, Dominican Republic, 2007
- Biosafety and GMO Testing, Dominican Republic, 2008
- Cell Culture Techniques, Dominican Republic, 2008
- Protein Purification and Proteomics, Dominican Republic, 2008
- Scale-up Strategies for Animal Cell Culture, China, 2010
- Cell-Based Flu Vaccine Manufacturing, BioFarma, Indonesia, 2012
- Cell-Based Flu Vaccine Manufacturing , Vabiotech, Vietnam, 2012

Teaching Experience:

Courses Developed and Taught At Utah State University:

Animal Cell Culture Methods (Biology 5160), spring 2001-Present
Introduction to Biotechnology (Bio 2040), Spring 2003-2007
Graduate Seminars (ADVS 6800), spring 2007-Present

Courses Developed and taught At Penn State University:

Introduction to Biotechnology (Biotc 001) Fall Semesters 1990, 1991 and 1995-1999.
Introductory Microbiology (Micro 106) Fall Semester 1991.
Animal Cell Culture Methods (Biotc 489) Fall 1994-2000.
Freshman Seminar in Biotechnology (PSU16-Section 50) fall 1999

Professional Level Teaching Experience (Continuing Education Programs)

Lectures were developed and are continuously revised for the short courses in the Biotechnology Training Program both nationally and internationally.

These lectures include:

Animal cells in culture: From T-Flasks to Bioreactors

Mycoplasma detection and control

Cell line characterization and quality control, FDA's Point to Consider

Cell line preservation

Mass culture techniques

Microbial growth and bioprocessing

Safety considerations and regulatory aspects of bioprocessing

Scale-up strategies in animal cell culture.

Monoclonal Antibody and Hybridoma Technology

Hollow fiber bioreactors for cell culture

Microcarrier technology for cell culture

The Impact of biotechnology in Healthcare

Biotechnology and Agriculture

Biotechnology and the Environment

Ethics of Biotechnology

Safety Issues in Biotechnology

Genetically Modified Organisms and Biosafety Protocols (Several Lectures)

Graduate and Undergraduate Education:

Chaired and served on more than 15 graduate students committees at Utah State, Penn State and University of Sulaimani, Iraq. Most recent students that I supervised are:

Jason Brown, MS Degree in Biological Engineering 2009

Taylor Hatton, MS Degree in ADVS 2012

On-going undergraduate research efforts in the bioprocess laboratory resulting in publications and presentations at national and international meetings.

Recent Departmental and CIB Committees:

Member Seminar Committee 2008-Present

Chair Seminar Committee 2011, 2012

Member of Research Faculty Promotion Committee (Dale Bernard) 2012

Member of numerous search committees for the Center for Integrated BioSystems (CIB).

Industry Experience:

I have a long standing presence in industrial circles. I co-founded Cogenics, Inc., where I served as Vice President for Research and Development from 1988-1990. I am also the founder and president of the International Biotechnology Associates that has provided the biopharmaceutical industry and international organizations with consultations for the past fifteen years. I have established several collaborations with the biotechnology and biopharmaceutical industries during the past twenty five years and have trained hundreds of employees of these industries in bioprocess technology. I am an advocate of industry academia collaborations and have given many presentations at national conferences emphasizing this collaboration and have published articles in bioprocess related journals with the same emphasis. Biotechnology workforce development has been a significant part of my professional career. I can proudly say that I have trained more than 2500 employees of biopharmaceutical industries and other scientists from academia and government laboratories during the past 25 years.

Awards & Honors

International Professor of the Year, College of Agriculture, USU 2011

Member, WHO Organizing Committee; Workshop on Enhancing Workforce Development in Vaccine Manufacturing. 2011.

Received FASEB/MARC Appreciation Award 2004

Charter Member, Advisory Committee for FASEB- MARC Program, Washington, D.C.

Listed in American Men and Women of Science 2007-

Faculty Service Award, Penn State University 1997

Finalist for the Penn State outreach award 1998

Listed in Who's Who in Science and Engineering 2006-

Listed in Who's Who in America 1995-

Listed in Who's Who in Medicine and Health Care 2011

Ranked superior by the Ph.D. thesis examination committee at The Pennsylvania State University, USA

Awarded a full scholarship to a Toxicology Ph.D graduate program at The Pennsylvania State University by The Ministry of Higher Education, Iraq.

Graduated from University of Baghdad with Distinction

International Collaborations and Activities:

Represent Utah State University and the Office of Global Engagement at the First Education USA University Fair in Erbil, Iraqi Kurdistan October 13-15, 2011. The Fair was sponsored by the US Embassy in Iraq and organized with Assistance from the US Institute of International Education

Workshop on: Animal cell culture techniques at Koya University, Iraqi Kurdistan Region. By invitation from the Ministry of Higher Education and Scientific Research. Iraqi Kurdistan Regional Government. Erbil, Iraq October 8-13, 2011

*US DHHS/BARDA Program to train and retrain scientists from 13 developing countries including, Brazil, Egypt, India, Indonesia, Kazakhstan, Korea, Mexico, Romania, Russia, Serbia, South Africa, Thailand, and Vietnam, in vaccine biomanufacturing with emphasis on Influenza vaccines and cell-based technology development. Year 1 (2010): \$322,000. Year 2 (2011) \$485,000 (PI). With potential for continuation for 3 more years and totaling \$2.6M in funding.

*Working with the Ministry of Higher Education in Kurdistan region of Iraq to develop cell-based technologies for potential biopharmaceutical production. (PI). Initial phase \$5M to establish cell culture laboratories and trains scientists in Kurdistan region universities.

* Member of the Biotechnology and Biomedical Engineering Committee formed by the Iraqi Ministry of Higher Education through the Iraqi Cultural Attaché Office in Washington D.C. The committee submitted to develop an advanced PCR laboratory in Iraq which will include training Iraqi scientists in new PCR techniques and instrumentation in the amount of \$240,000. Part of the training will be at USU/CIB.

*Iraqi Agricultural Extension Revitalization: Collaborator (train the trainer) in the multi-university grant from USDA-FAS to train Iraqi Agriculture engineers in irrigation engineering. Phase I-2006-7 (\$5.3M)

*Biotechnology Training Program Development and Delivery in Dominican Republic in collaboration with The Dominican Republic State Secretary for Higher Education, Science and Technology and the “Instituto de Innovación en Biotecnología e Industria” (IIBI). Five training courses in areas of general biotechnology, cell culture, protein purification, proteomics, and Biosafety of Genetically Modified Organism were developed and delivered between September 2007 and May 2008. (\$76,400)

*Introduction of biotechnological methodologies in poultry production in Egypt. Involved in developing a cell culture laboratory at Cairo University and training personnel in cell culture technology. Visited Egypt in 1992, 1993 and 1994. Co-investigator
Three year project, 1991- 1994 Funded by USAID. (\$780,000)

*Biotechnology program development with Interamerican University of Puerto Rico-Metropolitan Campus, San Juan and Penn State from 1995-2000. Funded by FASEB/MARC

*Biotechnology training programs in the Pacific Rim countries including: Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand. 1995. Funded by New Brunswick Scientific. Inc. Co. \$ 40,000

Fund Raising:

I have been involved heavily with fund raising for my programs both at Penn State and Utah State Universities

- Managed to bring into my programs at Penn State more than \$2 million from 1991 to 2000.
- Managed to bring into my programs more than \$1,000,000 at Utah State University from July 2000-present.
- Funds were cash sponsorships, equipment donation, in kind or registration fees for professional training courses and symposia.
- Industrial sponsors included major biopharmaceutical companies such as Merck, SmithKline, Amgen, and Monsanto. New Brunswick Scientific, Hyclone, Broadly-James Corp., Applikon Biotechnology, and others

Recent Grants:

Monsanto, Biotech Academy	\$ 20,000	(2002-2006)
Northern Utah Health Education Center	\$ 20,000	(2005-2006)
USDA Genomic Initiative	\$ 1.20 Million (Co-PI)	2004
	\$ 1.34 Million (Co-PI)	2005
	\$ 1.50 Million (Co-PI)	2006
	\$ 1.20 Million (Co-PI)	2007
Eccles Foundation	\$ 10,000 (Co-PI)	2006
Iraqi Ag. Extension Revitalization-USDA	\$5.3 Million (Collaborator)	2006-7
Dominican Republic Biotech Program	\$ 76,400 (Co-PI)	2007
Utah Economic Development Office	\$ 19,600 (Co-PI)	2007
Utah Economic Development Office	\$ 14,600 (Co-PI)	2008
US DHHS/ BARDA/ Vaccine Biomanufacturing	\$2.6Million (PI)	2010-2014
Agriculture Experiment Station	\$18,500 (PI)	2011
New Brunswick Scientific Co. Inc.	\$10,000 (PI)	2011
New Brunswick Scientific Co. Inc.	\$ 8,000 (PI)	2012
Thermo Fisher Scientific Co. Inc.	\$ 1,500 (PI)	2012

Other Professional Activities:

Actively involved in the development and establishment of the Biotechnology Institute and the Bioprocessing Resource Center at Penn State from 1989-2000.

Actively involved in the industrial projects through Penn State's Bioprocessing Resource Center from 1990-1998.

Actively involved in the Industrial Liaison Program initiated by the Bioprocessing Resource Center at Penn State University. 1993-1995.

Developed and implemented, in collaboration with the undergraduate program director in the Department of Biochemistry and Molecular Biology at Penn State, the biotechnology undergraduate degree program at Penn State University and acted as the advisor to all the biotechnology major incoming students. 1996-2000.

Managing Editor for the Biotechnology Newsletter at Utah State University 2001-2007.

Developed in collaboration with the education coordinator at Utah State University Biotechnology Center the annual Summer Biotechnology Academy for talented high school students. This program is designed to attract students to life sciences at USU. It is in its 12th year.

Developed educational programs for Agricultural Extension Agents at Utah State University with emphasis on genetic engineering and genetically modified organisms.

Presented lectures on biotechnology and recombinant DNA technology to numerous groups visiting the Biotechnology Center. These groups include high school students, teachers, agriculture extension agents and general public.

Developed in collaboration with the Education Coordinator at the Biotechnology Center, USU an annual biotechnology symposium for high school science related teachers. It is in its 12th year.

Developed the bench scale fermentation and cell culture laboratory at the Center for Integrated BioSystems, Utah State University.

Active member of the advisory board of MARC/FASEB (Minority Access to Research Careers) program since its initiation and have participated effectively in the visiting scientist program of MARC giving presentations at minority institutions.

Trained hundreds of employees of biotech/biopharma companies in bioprocess technology especially up-stream bioprocessing of both mammalian and microbial cell systems.

Presentations at National and International Conferences:

BARDA/USU Influenza Vaccine Manufacturing Training Program. International Partners on Prospects for Influenza Vaccine Technology Transfer to Developing Countries Vaccine Manufacturers organized by WHO. Belgrade, Serbia. March 27-29. **(Invited)**

Toward a Standardized Curriculum for Vaccine Manufacturing Workforce Development. WHO Workshop on Enhancing the Global Workforce for Vaccine Manufacturing. Cape Town, South Africa. November 20-December 2, 2011 **(Invited and Member of the Organizing Committee).**

Developing Cell-Based Technologies for Production of Viral Vaccines in Kurdistan Region. Revitalization of Research in Kurdistan International Conference, Erbil, Kurdistan-Iraq. December 14-16, 2010. **(Invited)**

Scale-up Strategies for Animal Cell Culture with Emphasis on Bioreactors. May 22-June 6, 2010. North West University for Nationalities, Lanzhou, China **(Invited)**

Integrating Biotechnology Training, Services and Research at Utah State University. 2007. Kamal Rashid and Mark Signs. SIM Annual Meeting, Denver CO.

Biotechnology and Genomics at the Center for Integrated BioSystems. Utah State University. 2007. Nano Utah Conference. Salt Lake City, UT. **(Invited)**

The Academic Institution's Response to the Biotechnology Industry's Demand for a Well Trained Workforce. In: What Chemical Engineering Educators Need to know about Bio. AIChE Annual Meeting, Cincinnati, OH. November 2006 **(Invited)**

Bioprocess Research and Education for the California Bioscience Industry. Keck Graduate Institute, CA. May 2005. **(Invited)**

Impact of Biotechnology on Health Care. College of Pharmacy, University of Houston, TX. Jan. 20, 2005 **(Invited)**

Coordination Meeting for Institutions Offering Biosafety-Related training and Education Programs. Geneva, Switzerland, 4-6 October 2004 **(Invited)**

Agricultural Genomics: Who, What and Why. AAAS/PD June 15-18, 2004 Conference in Logan Utah **(Symposium Organizer)**

The Baculovirus and Insect Cell Culture Conference. February 24-27, 2003. Santa Fee, New Mexico **(Invited)**

Viral Vectors and Vaccines. : Process Development and Production issues. 9th Annual Meeting. Williamsburg Bioprocessing. Nov. 11-4, 2002. New Orleans, Louisiana. **(Invited, Chair a Session).**

Cell and Tissue Bioprocessing: Process Development and Production issues for Cellular Therapy and Tissue engineering. 7th annual Meeting. Williamsburg Bioprocessing. September 30-October 3, 2002. Santa Barbara, California. **(Invited, Chair a Session).**

Society for Industrial Microbiology National Meeting. **Organize and chair** a session and present a talk on "The Role of Academic Institutions in Preparing a Trained workforce ". August 2002. Philadelphia, Pennsylvania **(Invited).**

Pathway Summit. National Consortium on Health Science and Technology Education. May 2002. Chicago IL. **(Invited).** Develop and organize a biotechnology pathway for the health professionals

Biotechnology Commercialization Forum, Westminster College, Salt Lake City, Utah. December 2001. (*Organized*)

Biosecurity: A Panel Discussion. Utah State University. October 2001. (*Organized*).

Biotechnology Symposium for Utah High School Teachers. Utah State University. November 2001. (*Organized*)

Summer Biotechnology Academy for High School Students. August 2001, and 2002 (*Organized*).

Biotechnology Educational Programs at Academic Institutions: Importance of Collaboration with Industry. Presentation at BIO 2001 National Meeting in San Diego, CA. June 2001. (*Invited*)

The Baculovirus and Insect Cell Culture conference. San Antonio, Texas. Feb 26-March 1, 2001.

Biotechnology and Cell Culture Technology, Two seminars delivered at South Dakota School of Mines, Department of Chemistry and Chemical Engineering. Rapid City, South Dakota. Feb.20-22, 2001 (*Invited*).

Agricultural Genomic Conference, San Francisco, CA. Jan. 2001

Biotechnology Conservatory Seminar Organized by Monsanto. University of California-Davis. December 7, 2000. (*Invited*)

Biotechnology for Extension Agents, Utah State University. November 2000 (*Organized*).

Engaged Institutions Role in Biotechnology Education Conference, October 8-10, 2000 Iowa State University, Iowa.

FASEB MARC Program Evaluation Workshop 2000. September 15-17, 2000. Tucson, Arizona. Elected Member of the Advisory Board Committee. (*Invited*).

Mountain West Society of Toxicology. Eighteenth Annual Meeting. September 14-15, 2000. Snowbird, Utah.

FDA, Congress and Industry Leadership Meeting Organized by Utah Life Science Association. Huntsman Cancer Institute, University of Utah. Salt Lake City. Sept.11, 2000.

BIO 2000. The 14th International Biotechnology Industry Organization Meeting and Exhibition. Boston Convention Center. April 2000. Boston. MA.

Plenary Speaker: Biotechnology for the Next Millennium at the XXXI Scientific Congress of Inter-American University of Puerto Rico. Feb.11-12, 1999. San Juan, Puerto Rico *(Invited)*.

Virginia Bioventure Discussion Group/1998. Nov. 24 1998 Norfolk, Virginia. *(Invited)*.

BIO 98. The 12th International Biotechnology Industry Organization Meeting and Exhibition. New York Convention Center. June 14-19, 1998. NY.

Pennsylvania Biotechnology Association. Annual Meeting. Co-Chaired a session on "Swimming in International Waters". March 1998. Philadelphia, PA. *(Invited)*.

Impact of Biotechnology on Agriculture and Environment. A presentation at the Pennsylvania Biotechnology Associations 6th Annual Meeting. March 1997, Philadelphia, Pennsylvania. *(Invited)*.

Biotechnology in the 21st Century. A presentation at the Biotechnology Forum, Inter-American University of Puerto Rico, Metropolitan Campus. April 1997. *(Invited)*.

Bio 97. International Biotechnology Meeting and Exhibition, George R. Brown Convention Center, Houston, Texas. June 8-12, 1997.

BioEast 97. Preparing for the millennium: Biotech drug discovery, analysis, development and production. Washington Hilton Hotel, Washington D.C. January 7-10, 1997.

Modern cell culture and fermentation technologies. A series of one-day training programs conducted in collaboration with New Brunswick Scientific Co. Inc., in five Pacific Rim countries including: Korea, Malaysia, Philippines, Thailand, and Taiwan. June-July 1996. *(Invited)*.

Biotechnology and molecular medicine. Two lectures presented to the students of Science, Technology and Society, Penn State. Fall 1996. *(Invited)*.

Recombinant DNA and Cell Culture. Two lectures presented to the students in Agricultural and Biological Engineering, Penn State Fall 1996. *(Invited)*.

Exchange program development with Interamerican University on Puerto Rico. Site visit to the Metropolitan campus with Dr. Norman Freed, Associate Dean, Eberly College of Science, Penn State. April 1996.

The Impact of Biotechnology on the Environment. Spring Symposium on Technology, Lycoming College, Williamsport, Pennsylvania. Feb. 9-10, 1995. *(Invited)*.

Complex Organic Mixtures and Their Significance in Environmental Toxicology and Carcinogenesis. XVIII Congress of Scientific Research. Universidad Interamericana de Puerto Rico, Recino de Arecibo. San Juan, Puerto Rico. Fe. 24-25, 1994. *(Invited)*.

Biotechnology Programs at Penn State. Biotechnology Center, Utah State University, Logan, Utah. Dec. 18, 1994. *(Invited)*.

Animal Cell Culture Technology: A series of lectures and laboratory training programs presented to the students of Interamericana University of Puerto Rico. San Juan, Puerto Rico. Feb. 23, 1994. *(Invited)*.

Environmental Toxicology at Penn State. Food Science Interdepartmental Seminar series, The Pennsylvania State University. Oct. 1993. *(Invited)*.

Penn State Biotechnology Institute: An overview of the programs and activities.
Biotechnology Forum: The role of the university in preparing students for biotechnology. Inter-American University of Puerto Rico- Metropolitan Campus. March 1993. *(Invited)*.

Biotechnology in the Developing countries. A lecture presented to the faculty and graduate students in the Department of Agricultural Education and Extension, Penn State. Feb. 1992. *(Invited)*.

Introduction of Biotechnology Methodology to Animal Research in Egypt. A series of lectures and cell culture training programs presented at the University of Cairo, Egypt and University of Alexandria, Egypt. January 1992, July 1993, and July 1994. *(Invited)*.

Biotechnology Institute, Penn State. A presentation in the Symposium: Pennsylvania Biotechnology Centers- Showcase. American Institute of Chemical Engineers Summer National Meeting. Pittsburgh, Aug. 18-21, 1991. *(Invited)*.

7th International Symposium on Separation Science and Biotechnology. Jan.22-24. 1991 Bahia Mar Hotel & Yachting Center, Fort Lauderdale, Florida.

BioEast '91. Organized and sponsored by the leading industry and academic groups in bioprocessing, bioregulation, and biotherapeutics. Jan.6-9, 1991. Ramada Renaissance Tech world. Washington, D.C., Chaired a session on "Research Opportunities in Bioprocessing." *(Invited)*.

Bioprocess 90: An innovative business and technical conference on the bioprocess industry. Washington, D.C. Jan. 7-9 1990. Ramada Renaissance Tec world. Washington, D.C., Chaired a session on "Mammalian Cell Culture Technologies." *(Invited)*.

Cell Culture America: A Technical Seminar on Mammalian Cell Culture Technologies and Their Applications, Philadelphia, Pennsylvania. October 13, 1989.

Cell Culture Revolution Symposium, Philadelphia, Pennsylvania. July 12, 1989.

Bioseparations: Scale Up and Design Workshop, Biotechnology Institute, 1989.

Summer Symposium in Molecular Biology, Penn State, University Park, Pennsylvania. 1987; 1988; 1989; 1990; 1991; 1992; 1993; 1994; 1995; 1996; 1997; 1998; 1999. 2000 (*Directed from 1991-2000*).

Animal cell culture in biotechnology research. College of Agriculture Conference on Sharing Visions on Global Community. The Pennsylvania State University Nov. 1990. (*Invited*).

Biotechnology and its impact on the society. Two lectures presented to the students in Science, Technology and Society STS 200. At Penn State, October 1990. And March 1991. (*Invited*).

An overview of Penn State's Biotechnology Institute and the Bioprocessing Resource Center. Department of Petroleum and Natural Gas Engineering seminar, Penn State University. 1990. (*Invited*).

Residue mutagenicity studies with captan after application to apple trees. Sixth International Congress on Pesticide Chemistry, Ottawa, Canada. August 1986.

Short-term bacterial tests for detection of mutagenic pesticides and metabolites. Department of Entomology, the Pennsylvania State University. 1985.

American Chemical Society, National Meeting, St. Louis, Missouri. 1984.

The reverse mutation system of Salmonella typhimurium "Ames Test." College of Agriculture, University of Baghdad, Iraq. Fall 1980. (*Invited*).

Comparative mutagenicity assays with rat and woodchuck S9 preparations. National Meeting, American Chemical Society, Miami Beach, Florida. May 1985.

Structure-mutagenicity relationships of chalcones and their oxides in the Salmonella assay. National Meeting, American Chemical Society. Miami Beach, Florida. May 1985.

Effect of pesticides on mutation induction and human cancer. First International Congress on Growth in the Gulf Region and Protecting the Environment from Pollution," Doha, Qatar. May 1980.

Screening pesticides for mutagenic activity in Salmonella typhimurium mutants. 177th National Meeting, American Chemical Society, Chicago, Illinois. August 1977.

Entomological Society of America, National Meeting, Honolulu, Hawaii. 1976.

Evaluation of insecticides and other pesticides for mutagenic activity in bacterial tests systems. National Meeting, Entomological Society of America, Minneapolis, Minnesota. November 1974.