Curriculum Vitae

JANE AZIZKHAN-CLIFFORD

Personal Data

Current Address: Department of Biochemistry and Molecular Biology
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Education

1978 Ph.D, Developmental and Cell Biology, University of Maryland, College Park, MD
Dissertation Research, National Cancer Institute, NIH, Bethesda. MD
1974 M.Sc., Developmental Biology, University of Maryland, College Park, MD
1972 B.S., Biology, Dickinson College, Carlisle, PA

Postbaccalaureate Training

1974 - 1978 Graduate Student, Department of Zoology, University of Maryland; Doctoral dissertation research: Gene expression and cell differentiation; thesis research performed in the Laboratory of Molecular Biology, National Cancer Institute. Dissertation Advisor: Dr. K. Vincent Speeg.

1972 - 1974 Graduate Student, Department of Zoology, University of Maryland; Master's thesis research: Transplantation immunology and immunocompetence. Thesis Advisor: Dr. Gordon Ramm (deceased).

Postgraduate Training

1978 - 1980 Postdoctoral Fellow, Departments of Biochemistry and Surgery, Harvard Medical School, Children's Hospital Medical Center. Mentors: Dr. Michael Klagsbrun (Biochemistry) and Dr. Judah Folkman (Surgery). Training in endothelial cell and growth factor biology, protein biochemistry and purification.

1980 - 1983 Postdoctoral Fellow, Department of Biochemistry, University of Virginia School of Medicine. Mentor: Dr. Joyce Hamlin. Training in molecular biology studying gene amplification, DNA replication, drug resistance, and gene transcription.

Academic Appointments

1983 - 1985 Research Assistant Professor, Department of Biology, Johns Hopkins University

1985 - 1991 Assistant Professor, Department of Pediatrics, University of North Carolina at Chapel Hill; Member, Curriculum in Genetics and Lineberger Cancer Research Center
Assistant Professor, Department of Pharmacology, 1987-1991
Member, Curriculum in Toxicology, 1989-1991

1991 - 1994 Associate Professor, Departments of Pharmacology and Pediatrics, University of North Carolina at Chapel Hill
Member, Lineberger Comprehensive Cancer Center, Curriculum in Genetics, and Curriculum in Toxicology

1993 - 2000 Full Member, Roswell Park Cancer Institute, Department of Experimental Therapeutics; Professor, Roswell Graduate Division of the State University of New York at Buffalo

2000 – Professor and Chair, Department of Biochemistry and Molecular Biology, Drexel University College of Medicine (formerly MCP Hahnemann University), Philadelphia, PA

Special Honors, Awards, Citations, Etc.

1972 B.S., Honors in Biology
1972 National Science Foundation Undergraduate Research Grant
1974 - 1977 Predoctoral Fellowship, National Institutes of Health
1975 - 1977 University Fellowship, Graduate School, University of Maryland
1980 - 1983 National Research Service Award
1986 - 1988 March of Dimes, Basil O'Connor Starter Scholar Award
1987 - 1990 American Cancer Society Junior Faculty Research Award
2001 - 2002 Executive Leadership in Academic Medicine (ELAM) Program
2003 - Adjunct Faculty, ELAM Program

Professional Societies:

Sigma Xi
American Association for Cancer Research
American Society for Microbiology
American Association for the Advancement of Science

Committees:

University of North Carolina

1985 - 1994 Member, Program in Molecular Biology & Biotechnology
1986 - 1987 Faculty Search Committee, Department of Pediatrics
1987 Faculty Search Committee, Department of Radiation Therapy
1987 Committee Member 10th Annual Lineberger Cancer Research Center Symposium on Cancer Cell Biology
1987 - 1988 Graduate Admissions Committee, Curriculum in Genetics
1987 - 1989 Lineberger Cancer Research Center Building Committee
1987 - 1990 University Faculty Council
1988 Chair, Lineberger Postdoctoral Symposium
1988 - 1989 Chairman, Graduate Admissions Committee, Curriculum in Genetics
1990 Committee to Evaluate the Curriculum in Genetics
1990 Search Committee, Director, Curriculum in Genetics
1990 - 1993 Oral Examination Committee, Department of Pharmacology
1990 - 1993 Graduate Admissions Committee, Department of Pharmacology
1991 Proposal Review Committee, NIH Instrumentation Proposals
1991 - 1993 Dissertation Examination Committee, Curriculum in Toxicology
1991 - 1993 Proposal Review Committee, American Cancer Society, Institutional Grant

1992 Chairman and Organizer, 16th Annual Lineberger Cancer Research Center Symposium, "Transcriptional Control of Cell Growth and Oncogenesis"

Roswell Park Cancer Institute

1993 - 1995 Student Seminar Committee
1993 - 2000 Institute Seminar Committee
1994 - 1995 Chairman, Student Seminar Committee
1994 - 1997 Council of the Association of Scientists
1994 - 2000 Grace Cancer Drug Center Resource Committee
1995 - 1998 Graduate Student Advisory Committee, Program in Exp. Therapeutics
1995 - 1998 Graduate Admissions Committee, Program in Experimental Therapeutics
1997 - 2000 Advisory Committee to the Senior Vice President for Research
1997 - 2000 Scientific Advisory Committee to the Roswell Park Alliance Foundation
1997 - 2000 Senior Advisory Committee to the VP for Scientific Affairs
1998 - 2000 Student Preliminary Exam Committee, Program in Exp. Therapeutics
1998 - 2000 Council of the Association of Scientists
1998, 2000 Chair, Search Committee for Chairman, Department of Cancer Genetics
1998 - 2000 Roswell Park Graduate Divisional Committee
1999 - 2000 Strategic Leadership Council
1998 - 2000 Grace Cancer Drug Center Steering Committee, Program Leader, “New Leads”

Drexel University College of Medicine

2000 - Present Director, MD-PhD Program
2000 - 2004 Dean’s Advisory Committee
2000 – Present Executive Committee of the Faculty
2000 – Present Biomedical Graduate Education Committee
2000 – Present Research Committee
2000 – 2007 Educational Coordinating Committee
2000 – 2007 IFM Steering Committee
2000 – 2007 Chair, Year 1-2 Subcommittee of the Educational Coordinating Committee
2001, 2002 Chair, Review Committee for Tobacco Formula Funds
2001 – Present Women in Academic Medicine Committee
2001 – Present Special Electives Committee
2001 – Present Director, Medical Student Research
2001 – Present Director, Fourth Year Research Pathway
2001 – 2004 Strategic Planning Committee
2001 Task Force for Basic Science Curricula Review
2003 – 2005 LCME Self-Study Committee
2004 – 2005 Chair, Governance Subcommittee of the LCME Review Committee
2004 – Present Director, Drexel Univ. Coll. Of Medicine-Fox Chase Cancer Center Joint Graduate Training Program
2004 – 2007 Finance, Planning and Development Committee
2004 – 2005 Search Committee, Vice Dean for Research
2005 – 2006 Chair, Search Committee for Chair of Pharmacology
2005 – Present Search Committee, Chair of ENT
2005 – 2006 Search Committee, Chair of Anesthesia
2005 – 2006 Search Committee, Chair of Emergency Medicine
2005, 2006 Chair, Research Strategic Plan Committee
2006 – Present Biomedical Graduate Program Committee
2007 Ad hoc Committee to Review Post-baccalaureate and Professional Studies
2007 - 2008 Vice Chair, Executive Committee of the Faculty

Professional Service:

1985 - Present	Reviewer for Molecular & Cellular Biology Reviewer for Journal of Biological Chemistry Reviewer for Cancer Research Reviewer for International Cancer Research Reviewer for Proceedings of the National Academy of Sciences Reviewer for Nucleic Acids Research Reviewer for Molecular Pharmacology Reviewer for European Journal of Biochemistry Reviewer for Oncogene Reviewer for Journal of Virology
2004 – 2009	Editorial Board, Journal of Virology
1985 - 1993	Grant Reviewer for the North Carolina Biotechnology Center Academic Research Initiation Grant Proposals
1988 - Present	Grant Reviewer for the National Science Foundation Grant reviewer for the Veteran's Administration
1995	Member, Breast Cancer Initiative, Molecular Biology Study Section
1996	Member, Breast Cancer Initiative, Experimental Therapeutics
1997	Member, Breast Cancer Initiative, Experimental Therapeutics Study Section
1997, Fall	Member, ad hoc, Experimental Therapeutics I Study Section
1997 – 2003	Permanent Member, Experimental Therapeutics I Study Section
2000 – Present	Member, Franklin Institute Committee on Science and the Arts, Life Sciences
2000 – Present	Marian Spencer Faye Award Selection Committee
2009	Chair, Marian Spencer Faye Award Selection Committee

Teaching Responsibility:

Lectures:

Fall, 1986	Pharmacology 205, Inhibitors of Nucleic Acid and Protein Synthesis, three hours, 7 students Fundamentals of Oncology, two hours, 35 students
Fall, 1987	Pharmacology 205, three hours, 8 students Fundamentals of Cancer Biology, two hours, 25 students Department of Pharmacology Research Seminar
Spring, 1987	Department of Pediatrics Research Seminar
Fall, 1988	Genetics 275, Genetic Systems, three hours per week, Course director, 16 students Fundamentals of Cancer Biology, two hours, 25 students
Fall, 1988	Pharmacology 205, Molecular Therapeutics, three hours, 8 students Fundamentals of Cancer Biology, two hours, 25 students
Fall, 1989	Department of Pharmacology Research Seminar Molecular Therapeutics, three hours, 7 students

Fall, 1990	Molecular Therapeutics, Course director Pharmacology Tutorial in Molecular Biology, three hours, 9 students
Fall, 1991 - 1993	Molecular Therapeutics, Course Director
Summer, 1993	Instructor and Organizer, Carolina Workshop "Regulation of Gene Expression"
Fall, 1993 - 1999	Regulatory Mechanisms, five-six hours lectures, 22-30 students
Fall, 1994 - 1999	Biochemical Oncology, five hours lectures, 28-30 students
Spring, 1996	Course Director, Cell and Molecular Biology Seminar, 20 students
Fall, 2001-	Medical Biochemistry, Transcription and Translation (5 hours), 1st year Med. Students, 250 students
Fall, 2000 -	Graduate Molecular Biology CORE, Transcription (4 hours), 25-50 students
Spring 2001 – 2005	Graduate CORE, Director Cell Cycle Module (10 hours), 25-50 students
Spring 2001 -	Lecture, Ethics in Research (4 hours), 20 students
Spring 2001-	Advanced Cell Biology, Transcriptional Control Mechanisms (3 hours), 6-10 students
Spring 2005-	Biochemical Approaches (4 hours), 3-6 students
Spring, 2002-	Course Director, Cell Cycle Module, Graduate Core Curriculum, 25 students
Fall, 2005 -	Course Director (new course) Cancer Biology, 15 students

Grants Funded (P.I. J. Azizkhan-Clifford):

AGENCY	TITLE	AMOUNT (Direct Costs)	PERIOD
American Cancer Society Institutional	Regulation of Transcription of the Amplified Dihydrofolate Reductase Gene	$7,500	11/01/85 - 10/30/87
Univ. Research Council	Control of Dihydrofolate Reductase Gene Transcription	$1,500	04/15/86 - 04/15/88
Medical Faculty Research Grant	Regulation of Dihydrofolate Reductase Gene Transcription	$2,000	03/01/86 - 03/01/87
Medical Faculty Research Grant	Role of Somatomedins in Cell Differentiation	$2,000	05/01/86 - 04/30/87
N.C. Biotech-nology Center	Identification of DNA Binding Proteins that Regulate Dihydro-folate Reductase Gene Transcription	$20,000	05/01/86 - 04/30/87

March of Dimes Basil O'Connor Starter Scholar Award	Regulation of Dihydrofolate Reductase Gene Transcription by DNA Binding Proteins	$76,000	09/01/86 - 05/31/88
American Cancer Society Research Grant	Control of Dihydrofolate Reductase Gene Transcription in Chinese Hamster Ovary Cells	$190,000	01/01/87 - 06/30/89
American Cancer Society Junior Faculty Research Award	Regulation of Dihydrofolate Reductase Gene Transcription by DNA Binding Proteins	$105,000	01/01/87 - 12/31/89
Medical Faculty Research Grant	Regulation of Expression from Viral Gene Promoters in Methotrexate-Resistant Cells	$3,000	06/01/88 - 05/31/89
American Cancer Society Research Grant	Identification of Sequence Elements and Regulatory Factors in Dihydrofolate Reductase Gene Transcription	$238,000	07/01/89 – 12/31/91
March of Dimes Research Grant	Sequences and Factors Involved in Cytomegalovirus Immediate Early Gene Expression in Methotrexate-Resistant Cells	$80,000	06/01/89 - 05/31/91
March of Dimes Research Grant	Mechanisms of Induction of Cellular Growth-Regulated Genes in Response to Cytomegalovirus Infection	$70,000	07/01/91 - 06/30/93
North Carolina Institute of Nutrition	Molecular Dissection of a Growth Control Gene	$4,000	07/01/91 - 06/30/92
NIH	Effects of Antineoplastic Agents on Gene Expression	$277,887	06/01/92 - 05/31/95
March of Dimes	Activation of Cellular Transcription Factors by Cytomegalovirus Infection	$86,000	07/01/93 - 06/30/95
American Cancer Society Research Grant	Transcriptional Control of a GC-Box-Containing, TATAA-Less, Growth-Regulated Promoter	$315,000	01/01/93 - 12/31/95
Taisho Pharmaceuticals (Research Agreement)	p53 Study	$30,000	11/01/94 - 09/30/00
American Cancer Society Research	E2F/Sp1 Interaction and Transcriptional Regulation of Growth-Related Genes	$315,000	06/01/96 -12/31/98
NIH RO1CA71019	HCMV, Cell Growth State and	$865,000	05/01/97 - 04/30/03

	Transcription Factor E2F		
American Cancer Society Research Grant	E2F/Sp1 Interaction and Transcriptional Regulation of Growth-Related Genes	$267,000	01/01/99 - 12/31/00
NIH RO1CA81486	E2F/Sp1 Synergy in Cell Cycle-Regulated Transcription	$1,000,000	09/01/00 – 08/31/06
DOD-BCRP W81XWH-04-1-0732	Role of Ca2+ in Homologous Recombination and Response to DNA Damage in Breast Cancer	$75,000	6/25/04 – 6/24/05
Institute of Women's Health And Leadership, DUCOM	Role of Sp1 and BRCA1 in DNA Repair	$20,000	1/1/05 – 12/31/05
WW Smith	Characterization of the Role of the Transcription Factor Sp1 in the DNA Damage Response	$75,455	7/1/07 – 6/30/08
Tobacco Formula Funds	Novel Approaches to the treatment of progesterone receptor negative breast cancer	$28,919	1/1/07 – 12/31/09
W.M. Keck Foundation	Keck Institute of Nanoscale Tools for Medicine, Project Leader Project 4: Fluid delivery,	$2,000,000 Total award—4 projects	8/1/07 – 7/31/10

Participation in Training Grants and Training Programs

University of North Carolina

Accreditation Council for Graduate Medical Education approved Training Program in Pediatric Hematology/Oncology -- Participation as a research training laboratory for fellows

NIH, Training Grant of the Lineberger Comprehensive Cancer Center -- Training Preceptor

NIH, Training Grant in Genetics -- Training Preceptor

RPCI

NIH, Cancer Education Program Training Grant-- Training Preceptor

NIH, Pharmacology Training Grant -- Training Preceptor

NIH, Training grant in Surgical Oncology -- Training Preceptor

Drexel University

NIH, Training Grant, Fox Chase Cancer Center—Training Preceptor

Laboratory Research Personnel:

University of North Carolina

1985 - 1986	Preceptor, Marsha Davenport, MD, Fellow, Dept. of Pediatrics, Endocrinology
1987 - 1990	Preceptor, Andrew Swick, PhD, Postdoctoral Fellow
1987 - 1990	Dissertation Advisor, Michael Blake, MD, PhD 1990, Curriculum in Genetics
1987 - 1989	Christopher McKinney, Medical Student, Class of 89, Holderness Fellow
1988 - 1990	Christine Schmitt, Undergraduate Honors Research Project, Class of 1990, Duke University
1989 - 1992	Preceptor, Robert Jambou, PhD, Postdoctoral Fellow (NRSA recipient)
1989 - 1993	Dissertation Advisor, Michael Wade, PhD 1993, Curriculum in Genetics
1990 - 1992	Preceptor, Helen Eastman, PhD , Postdoctoral Fellow (NRSA recipient)
1990 - 1993	Dissertation Advisor, Michael Margolis, DDS, PhD 1993, Department of Pharmacology
1990 - 1994	Preceptor, David Jensen, PhD, Postdoctoral Fellow
1991 - 1993	Dissertation Advisor, Albert Zimmerman, PhD, Department of Pharmacology
1991 - 1995	Dissertation Advisor, Andrew Pierce, PhD, 1994, Curriculum in Genetics (NSF Fellowship recipient)
1992 - 1993	Preceptor, Michael Noble, Undergraduate Honors Research, Dept. of Biology
1992 - 1993	Preceptor, Sabina Cauci, PhD, Visiting Fellow

Roswell Park Cancer Institute

1993 - 1994	Preceptor, Michael Wade, PhD, Postdoctoral Fellow
1993 - 1995	Dissertation Advisor, Shiaw-Yih Lin, PhD, Department of Experimental Therapeutics
1993 - 1998	Preceptor, Sanja Pajovic, PhD, Postdoctoral Fellow
1994 - 1997	Preceptor, Dusan Kostic, PhD, Postdoctoral Fellow
1994 - 1998	Dissertation Advisor, Emily Wong, M.D.,PhD, 1998, Program in Cell and Molecular Biology
1995 – 2002	Dissertation Advisor, Yung Hsu, PhD, Department of Biophysics, SUNY Buffalo
1995 - 2000	Preceptor, Adrian Black, PhD, Postdoctoral Fellow
1996 - 1998	Thesis Advisor, Kevin Neeson, M.S., RPCI, Natural Sciences
1997 – 2004	Dissertation Advisor, Christopher Himmelheber, PhD, Department of Molecular Pharmacology and Cancer Therapeutics
1998 - 2000	Preceptor, Li Hong, MD, PhD, Post-doctoral Fellow
1998 - 2000	Preceptor, Mary Spengler, PhD, Post-doctoral Fellow
1997 – 2003	Dissertation Advisor, Li Wu Guo, PhD, Department of Molecular Pharmacology and Cancer Therapeutics
1997 – 2004	Dissertation Advisor, Jonathan Berkowitz, M.D.,PhD, Department of Molecular Pharmacology and Cancer Therapeutics
1998 – 2005	Dissertation Advisor, Andrew Ippolito, PhD, Program in Cell and Molecular Biology

Drexel University College of Medicine

2000 - 2005	Dissertation Advisor, Beatrix Olofsson, PhD, Program in Cell and Molecular Biology, MD/PhD Program
2000 – 2005	Preceptor, Chung Kim, PhD, Post-doctoral Fellow
2004 - 2009	Preceptor, Crystal Kelly, PhD Candidate, Program in Cell and Molecular Biology, MD/PhD Program
2004 -	Preceptor, Bez Torabi, PhD Candidate, Program in Cell and Molecular Biology,
2004 - 2005	Preceptor, Ji Yoon Kim, M.S., Medical Sciences Program
2005 - 2006	Preceptor, Elena Sorokina, PhD, Post-doctoral Fellow
2005 - 2007	Jayashree Mitra, PhD, Research Assistant Professor
2006 – 2009	Dissertation Co-advisor, Sameer Kalghatgi, PhD Candidate, Department of Electrical and Computer Engineering, Drexel University College of Engineering
2006 – 2008	Preceptor, Garrett Bassett, M.S., Medical Sciences Program

2007 – 2009 Pooja Talati, Undergraduate Honors Research
2008 -- Kate Beishline, PhD Candidate, Biochemistry Program
2007 – 2009 Ekaterina Cerchar, MD, Post-doctoral Fellow
2009 -- Dissertation Co-advisor, John Alameda, PhD Candidate, Department of Electrical and Computer Engineering, Drexel University College of Engineering

Laboratory Research Rotations (Temporary Supervision):

1986, Summer Christopher McKinney, Med. Student, Class of 89, Cancer Education Program
1987, Summer Leigh Haley, Medical Student, Class of 90, Cancer Education Program
1987, Summer Jennifer Smith, Medical Student, Class of 90, Cancer Education Program
1987, Fall Barbara Lipes, Graduate Student, Pharmacology
1988, Spring Dr. Brent Weston, Senior Resident, Dept. of Pediatrics
1988, Summer Derk Schultz, Graduate Student, Pharmacology
1988, Summer Scott Childress, Biotechnology Program, Undergraduate Research Fellowship
1988, Fall Brian Kiser, Graduate Student, Curriculum in Genetics
1989, Spring Allen Comer, Graduate Student, Curriculum in Genetics
1989, Fall Bonnie Frediani, Graduate Student, Curriculum in Genetics
1990, Summer Michael Blake, PhD, Medical Student, Class of 93, Holderness Fellow
1991, Spring Andrew Pierce, Graduate Student, Curriculum in Genetics
1991, Summer Albert Zimmerman, Graduate Student, Department of Pharmacology
1992, Spring Timothy Finco, Graduate Student, Curriculum in Genetics
1992, Summer Frank Rude, DDS, Graduate Student, Curriculum in Genetics
1993, Spring Jane Chen, Graduate Student, RPCI, Program in Biochemistry
1996, Spring Chuck Dimitroff, RPCI, Program in Experimental Therapeutics
1996, Summer Stephanie Leslie, RPCI, Program in Experimental Therapeutics
1996, Fall Galina Fitzpatrick, RPCI, Program in Experimental Therapeutics
1997, Spring Christine White, RPCI, Program in Experimental Therapeutics
1997, Summer Jonathan Berkowitz, MSTP Student
1998, Fall Concordio Anacleto, Program in Experimental Therapeutics
1998, Spring Andrew Ippolito, RPCI, Program in Cell and Molecular Biology

Drexel University College of Medicine
2000, Fall Beatrix Olofsson, MD/PhD Student
2001, Summer Grace Tan, Graduate Student, Program in Molecular and Cell Biology
2002, Summer Jessica Summers, Medical Student Summer Research Program
2002, Summer Kevin Cassidy, Summer Undergraduate Research Program
2001, Summer Ayesha Ashraf, Visiting Medical Student
2003, Summer Vladamir Valakh, Medical Student Summer Research Program
2003, Summer Crystal Kelly, Medical Student Summer Research Program
2003, Spring Shukryyah Mitchell, Undergraduate Research, Philadelphia University
2004, Spring Mierav Zaks-Ziberman, DUCOM, Biochemistry Program
2004, Summer Harry Goett, Medical Student Summer Research Program
2004, Summer Bez Torabi, Graduate Student, Molecular and Cell Biology Program
2004, Spring Kelli Turner, Graduate Student, Molecular and Cell Biology Program
2005, Fall Ferit Tuzer, Graduate Student, Biochemistry Program
2007, Summer Gregory Botta, MD/PhD Candidate, Molecular and Cellular Biology Program
2007, Fall Kate Beishline, Graduate Student, Biochemistry Program
2008, Spring Siddhartha Rawat, Graduate Student, Molecular and Cell Biology Program
2008, Summer Jen Winans, Graduate Student, Molecular and Cell Biology Program
2008, Fall Ryan Eberwine, Graduate Student, Molecular and Cell Biology Program

Dissertation Committees:

1986 - 1990	Nancy Kleckner, Department of Pharmacology, Ph.D., May, 1990
1986 - 1991	Leslie Petch, Department of Pharmacology, PhD, May 1991
1986 - 1990	Kathleen Rogers, Dept of Microbiology and Immunology, M.S., May 1990
1988 - 1993	Denis Thompson, Curriculum in Genetics
1988 - 1993	Adrienne Brown, Department of Microbiology and Immunology
1988 - 1992	Nina Elshiekh, Department of Micro. and Immunology, PhD, December 1992
1988 - 1995	Barbara Lipes, Department of Pharmacology
1989 - 1993	Allen Comer, Curriculum in Genetics
1989 - 1990	Brian Kiser, Curriculum in Genetics, withdrew Spring 1990
1989 - 1992	Don Johnston, Curriculum in Genetics, PhD, May 1992
1990 - 1992	Youngchu Choi, Department of Biochemistry, PhD December 1992
1989 - 1992	Frank Furnari, Department of Micro. and Immunology, PhD December 1992
1990 - 1993	Amer Beg, Department of Biology
1990 - 1992	John O'Bryan, Curriculum in Genetics, PhD, May 1992
1991 - 1995	Delores Grant, Department of Pathology, PhD May, 1995
1992 - 1995	John Welch, RPCI, Program in Exp. Therapeutics, PhD, August 1995
1993 - 1994	David Montesanti, RPCI, Program in Biochemistry
1995 - 1997	Helena Walsh, RPCI, Program in Exp. Therapeutics, M.S. December, 1997
1995 - 1999	Jianxiong Chu, RPCI, Program in Experimental Therapeutics
1996 - 1999	Chuck Dimitroff, RPCI, Program in Experimental Therapeutics
1996 - 2000	Stephanie Leslie, RPCI, Program in Experimental Therapeutics
1997 - 2000	Galina Fitzpatrick, RPCI, Program in Cell and Molecular Biology
1998 - 2002	Christine White, RPCI, Program in Experimental Therapeutics, PhD, May 2002
2001 – 2005	Grace Tan, Drexel University College of Medicine (DUCOM), Mol. Cell Biol. Program
2000 - 2005	Jun (Tracy) Yin, PhD, DUCOM, Molecular and Cell Biology Program
2000 - 2004	Carter Davidson, PhD, DUCOM, Molecular Pathology Program
2001 - 2005	Lyndi Rice, PhD, DUCOM, Molecular and Cell Biology Program
2001 - 2007	Paula DeSilva, DUCOM, Molecular and Cell Biology Program
2001 - 2007	J.P. Vermitsky, DUCOM, Molecular and Cell Biology Program
2004 - 2007	Stephanie Horvat, DUCOM, Biochemistry Program, M.S. Candidate
2005 - Present	Jocelyn Nolt, DUCOM, Molecular and Cell Biology Program
2005 - Present	Keneshia Turner, DUCOM, Molecular and Cell Biology Program
2006 - Present	Alyssa Kennedy, DUCOM, Molecular and Cell Biology Program
2006 - Present	Rebecca Lizzano, DUCOM, Molecular and Cell Biology Program, M.S. Candidate
2006 - Present	Hollie Flick, DUCOM, Biochemistry Program
2007 - Present	Adam Leman, DUCOM, Molecular and Cell Biology Program
2007 - Present	Angela Richardson, DUCOM, Molecular and Cell Biology Program

Peer Reviewed Publications:

Speeg, K.V., **Azizkhan, J.C**. and Stromberg, K. Stimulation by methotrexate of human chorionic gonadotropin and placental alkaline phosphatase in cultured choriocarcinoma cells. Cancer Research 36 4669-4675, 1976.

Speeg, K.V., **Azizkhan, J.C,** and Stromberg, K. Characteristics of alkaline phosphatase in cultured choriocarcinoma cells. Expl. Cell Res. 105:199-205, 1977.

Speeg, K.V., **Azizkhan, J.C.**, and Stromberg, K. Modulation studies of alkaline phosphatase on human choriocarcinoma cells. Scand. J. Immunol. 8:527-532, 1978.

Azizkhan, J.C., Speeg, K.V., Stromberg, K., and Goode, M.D. Stimulation of human chorionic gonadotropin synthesis in the Jar line of choriocarcinoma cells by inhibitors of DNA synthesis. Cancer Research 39:1952-1959, 1979.

Stromberg, K., **Azizkhan, J.C.**, and Speeg, K.V. Isolation of functional human trophoblast cells and their partial characterization in primary cell culture. In Vitro 14:631-638, 1979.

Azizkhan, J.C. and Klagsbrun, M. Chondrocytes contain a growth factor that is localized in the nucleus and is associated with chromatin. Proc. Natl. Acad. Sci., USA 77:2762-2766, 1980.

Azizkhan, R.G., **Azizkhan, J.C.**, Zetter, B. and Folkman, J. Mast cell heparin stimulates migration of capillary endothelial cells in vitro. J. Exp. Med. 152:931-944, 1980.

Azizkhan, R.G., **Azizkhan, J.C.**, Rochman, E., Darling, R.C., III, Klagsbrun, M., and Folkman, J. An avascular subpopulation of chondrosarcoma exhibits limited growth *in vivo* and is unable to stimulate capillary endothelial cells *in vitro*. Surgical Forum 32:424-426, 1981.

Azizkhan, J.C., Sullivan, R., Azizkhan, R.G., Zetter, B., and Klagsbrun, M. Stimulation of increased capillary endothelial cell motility by chondrosarcoma-derived factors. Cancer Res. 43:3281-3286, 1983.

Milbrandt, J.M., **Azizkhan, J.C.**, Greisen, K., and Hamlin, J.L. Organization of the Chinese hamster ovary dihydrofolate reductase gene identified by phenotype rescue. Mol. Cell. Biol. 3:1266-1273, 1983.

Milbrandt, J.M., **Azizkhan, J.C.**, and Hamlin, J.L. Amplification of a cloned dihydrofolate reductase gene after transfer into a dihydrofolate reductase deficient cell. Mol. Cell. Biol. 3:1274-1282, 1983.

Messina, J.L., Hamlin, J., **Azizkhan, J.C.**, and Larner, J. The effects of insulin and concanavalin A on the accumulation of a specific mRNA in hepatoma cells. Bioch. Biophys. Res. Comm. 133(3):1168-1174, 1985.

Azizkhan, J.C., Vaughn, J., Christy, R.J., and Hamlin, J.L. Nuclease hypersensitivity and nucleotide sequence of the hamster dihydrofolate reductase gene promoter. Biochemistry, 25:6628-6636, 1986.

Davenport, M., D'Ercole, J., **Azizkhan, J.C.**, and Lund, P. K. Somatomedin C/Insulin like growth factor I (IGF-I) and insulin-like growth factor II (IGF-II) mRNAs during lung development in the rat. Experimental Lung Research 14:607-618, 1988.

Blake, M.C. and **Azizkhan, J.C.** Transcription factor E2F is required for efficient expression of the hamster dihydrofolate reductase gene *in vitro* and *in vivo.* Mol. Cell. Biol. 9(11):4994-5002, 1989.

Swick, A.G., Blake, M.C., Kahn, J.W., and **Azizkhan, J.C.** Functional analysis of GC element binding and transcription in the hamster dihydrofolate reductase gene promoter. Nucleic Acids Research 17:9291-9304, 1989.

Blasband, A.J., Rogers, K.T., Chen, X., **Azizkhan, J.C**., and Lee, D.C. Characterization of the rat transforming growth factor α gene and identification of promoter sequences. Mol. Cell. Biol 10(5):2111-2121, 1990.

Blake, M.C., Jambou, R.C., Swick, A.G., Kahn, J.W. and **Azizkhan, J.C.** Transcriptional initiation is controlled by upstream GC-box interactions in a TATAA-less promoter. Mol. Cell. Biol. 10:6632-6641, 1990.

Zeleznik-Le, N.J., **Azizkhan, J.C.**, and Ting, J. P.-Y. Affinity-purified CCAAT box binding protein (YEBP) functionally regulates the expression of a human class II MHC gene and the herpes simplex virus thymidine kinase gene. Proc. Natl. Acad. Sci., USA 88:1873-1877, 1991.

Hiebert, S.W., Blake, M.C., **Azizkhan, J.C.**, and Nevins, J.R. Role of E2F transcription factor in E1A-mediated trans-activation of cellular genes. J. Virol. 65:3547-3552, 1991

Baldwin, A., **Azizkhan, J.C.**, Jensen, D., and Coodly, L. Induction of NF-κB DNA binding activity by serum growth factor treatment of quiescent 3T3 cells. Mol. Cell. Biol. 11:4943-4951, 1991.

Eastman, H.B., Swick, A.G., Schmitt, M.C., and **Azizkhan, J.C.** Stimulation of Dihydrofolate Reductase Promoter Activity by Antimetabolic Drugs. Proc. Nat. Acad. Sci., USA 88:857-8576, 1991.

Chen, X., **Azizkhan, J.C**., and Lee, D.C. The binding of transcription factor Sp1 to multiple sites is required for maximal expression from the rat TGF-α promoter. Oncogene 7:1805-1815, 1992

Wade, M., Kowalik, T.F., Mudryj, M., Huang, E.-S., and **Azizkhan, J.C.** E2F mediates DHFR promoter activation and multiprotein complex formation by human cytomegalovirus infection. Mol. Cell. Biol. 12:4364-74, 1992.

Pierce, A., Jambou, R.C., Jensen, D.E., and **Azizkhan, J.C.** A conserved DNA structural control element modulates transcription of a mammalian gene. Nucleic Acids Res. 20:6583-6587, 1992.

Bauer, J., Margolis, M., Schreiner, C., Edgell, C.-J., **Azizkhan, J.**, Lazarowski, E., and Juliano, R.L. In vitro model of angiogenesis using endothelium-derived permanent cell lines: Contributions of induced gene expression, G-proteins, and integrins. J. of Cell. Physiol. 153:437-449, 1992.

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Research Interests

My laboratory has a long standing interest in regulation of gene expression and cell proliferation as they relate to cancer. Our work has focused on the transcriptional regulation of genes that lack a TATA element in their promoter, which was once thought to be a canonical feature. Genes regulated by these so-called TATA-less promoters include genes involved in regulation of many metabolic processes, DNA replication, DNA repair, and apoptosis, as well as growth factors and their receptors, oncogenes and tumor suppressors. Promoters for these genes are GC-rich and most contain multiple sites that bind the transcription factor Sp1. We and others demonstrated that in TATA-less promoters, Sp1 functions to control transcription initiation and recruit the general transcription machinery through protein-protein interactions with a component of the TBP-containing general transcription factor, TFIID. Although considered a "general" transcription factor, regulation of transcription of a large number of genes in response to a wide array of signals has been ascribed to Sp1. Sp1 is post-translationally modified by phosphorylation, acetylation, O-linked glycosylation, sumoylation, ubiquitylation, and methylation. These modifications affect not only DNA binding, but also Sp1 activity and interactions with other factors. Our work has largely focused on regulation of Sp1 activity through modulation of phosphorylation, with some work and significant interests related to acetylation, sumoylation and glycosylation.

Several years ago, a graduate student in the lab discovered that Sp1 is significantly phosphorylated in response to DNA damage. Sp1 is phosphorylated by several different kinases at one or more of its 96 Ser residues. Clearly, phosphorylation at different sites by different kinases differentially modulates its activity in response to different signals. Much of our current work is focused on phosphorylation in response to DNA damage and the role of Sp1 in the cellular response to damage. Eleven of the 96 Ser residues in Sp1 are SQ sequences clustered in the glutamine-rich transactivation domains; S/TQ cluster domains (SCDs) are characteristic of proteins phosphorylated by ATM/ATR in response to DNA damage. We have found that Sp1 is phosphorylated by ATM on several Ser residues in response to reactive oxygen species (ROS) generated by DNA damage and that its phosphorylation is involved in the increased sensitivity to DNA damage observed in cells depleted of Sp1. Phosphorylation on S101 is required for additional phosphorylation, i.e. its phosphorylation primes for additional phosphorylation, and we have made an antibody that specifically detects Sp1 phosphorylated on S101 in cells subjected to DNA damage. We have shown by immunofluorescence/confocal microscopy and chromatin immunoprecipitation that phospho-Sp1 is localized to sites of DNA damage and that its phosphorylation is dependent on the presence of Nbs1, a key component of the MRN complex that recruits ATM to DSB sites. We have also shown that Sp1 is phosphorylated in response to UV, and although S101 is phosphorylated by ATM (and not by ATR) after UV, phosphorylation at S101 is not a priming phosphorylation. We are also studying the role of Sp1 in the induction of apoptosis after DNA damage. Sp1 is preferentially degraded by caspases at higher levels of damage, particularly after UV. Degradation of Sp1 is associated with induction of apoptosis, and blocking caspase-mediated cleavage (by mutation of the specific aspartic acid cleaved by caspase) protects cells from damage-induced apoptosis.

Having demonstrated that mutation of S101 precludes additional phosphorylation in response to DNA damage, we would like to understand at a biochemical level how the phosphorylation of this residue apparently primes the protein for additional phosphorylation and how phosphorylation affects its activity in the DNA damage response and in transcription. Microarray studies are underway to look at Sp1-dependent changes in gene expression in response to DNA damage

Current studies are directed at demonstrating the mechanism whereby Sp1 modulates the cellular response to DNA damage, including studies of: activation/recruitment of

downstream effectors to DNA damage sites, checkpoint activation, chromatin remodeling, DNA repair, apoptosis induction, and transcription modulation. We are also trying to develop our phospho-specific antibody, which is a very sensitive indicator of DNA damage, as a marker that could be used to guide treatment of patients with radiation or chemotherapy and/or to detect environmental exposure to DNA damage. This is particularly significant because 20% of people do not express H2AX, the only damage marker in current use. We are developing our antibody, γ $Sp1^{101}$ as a diagnostic tool to measure DNA damage in peripheral blood of patients subjected to irradiation and/or chemotherapy.

There are several studies underway and planned to establish the clinical significance of our findings. These include identification of Sp1 mutations in tumors. Sp1 overexpression has been reported in several cancers and some studies have suggested that overexpression is an indicator of poor prognosis; however, there are no reports of specific mutations in Sp1 in tumors.

Sp1 has also been implicated in neurodegenerative diseases, particularly Alzheimer's and Huntingtin's disease; however no one has figured out how it is involved (regulates tau, APP and COX-2; stimulated by IL1β (inflammation). Sp1 is acetylated as well as phosphorylated in response to ROS and blocking its acetylation has been linked to the neuroprotective effect of compounds like TSA. Sp1 is increased in AD brains. We are performing experiments to explore the mechanism by which Sp1 is neuroprotective.

Sp1 was the first transcription factor shown to be O-glycosylated; however, the sites of glycosylation in response to specific signals have not been thoroughly mapped and the functional significance of glycosylation remains a mystery. We are exploring the function of Sp1 glycosylation by mapping sites of O-glycosylation, and the effect of agents that block glycosylation on Sp1-dependent functions.

Other projects: In collaboration with Gary Friedman and Yuri Gogotsi (College of Engineering), we are studying the effects of non-thermal plasma on cells. Plasma is comprised of electrically charged molecules, electrons as well as some highly active neutral molecules (electronically excited atoms and radicals) that can be produced through application of a strong electric field. In this work we employ electrodes with a dielectric barrier to produce plasma whose average temperature is close to room temperature. We have shown that when applied to a solution, non-thermal plasma results in the generation of reactive oxygen species in a dose-dependent and highly controllable manner (even in single cells). The goal is to develop cold plasma for utilization in sterilization of surfaces, particularly wounds (if selectivity between effects on bacteria and cells can be achieved) and to induce apoptosis in cancer cells by local administration. We are characterizing the reactive oxygen species that are produced and their effects on DNA.