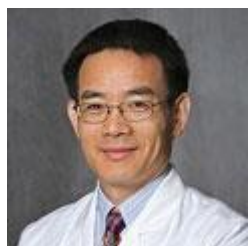


Meharry Cancer Summer Undergraduate Research Program

Mentor Project Descriptions/Research Project Areas

A. Basic/Translational Research



Zhengbang Chen, Ph.D.

The research in Dr. Zhengbang Chen's laboratory focuses on dysregulated signaling pathways in prostate cancer. His group has published several important discoveries on SKP2, androgen receptor (AR), ARF and MET essential oncogenic signaling in prostate cancer. Students in his laboratory will use cultured cells and animal models to explore molecular signaling pathways that influence prostate cancer growth and progression.

Recent Publications:

1: Cunningham D, Zhang Q, Liu S, Parajuli KR, Nie Q, Ma L, Zhang A, Chen Z, You Z. Interleukin-17 promotes metastasis in an immunocompetent orthotopic mouse of prostate cancer. *Am J Clin Exp Urol*. 2018 Jun 15;6(3):114-122.

2: Nangami GN, Sakwe AM, Izban MG, Rana T, Lammers PE, Thomas P, Chen Z, Ochieng J. Fetuin-A (alpha 2HS glycoprotein) modulates growth, motility, invasion, and senescence in high-grade astrocytomas. *Cancer Med*. 2016 Dec;5(12):3532-3543.

3: Lu W, Liu S, Li B, Xie Y, Izban MG, Ballard BR, Sathyanarayana SA, Adunyah SE, Matusik RJ, Chen Z. SKP2 loss destabilizes EZH2 by promoting TRAF6-mediated ubiquitination to suppress prostate cancer. *Oncogene*. 2017 Mar;36(10):1364-1373.

4: Xie Y, Lu W, Liu S, Yang Q, Goodwin JS, Sathyanarayana SA, Pratap S, Chen Z. MMP7 interacts with ARF in nucleus to potentiate tumor microenvironments for prostate cancer progression in vivo. *Oncotarget*. 2016 Jul 26;7(30):47609-47619.



Salil Das, D.Sc.

The research in Dr. Das' laboratory focuses on molecular mechanisms of pulmonary diseases, including acute respiratory distress syndrome (ARDS), chronic obstructive pulmonary disease (COPD), emphysema, lung injury, lung fibrosis and lung cancer induced by direct and environmental smoke and mustard gas, a chemical warfare agent. His group also studies the role of environment and diet, and molecular mechanisms associated with the pathology of breast cancer. Students working within the Das laboratory will use animal models and cell lines to study molecular mechanisms associated with environmental causes of breast and lung cancer.

Recent Publications:

- 1: Gopal SH, Das SK. Role of Lactoferrin in the Carcinogenesis of Triple-Negative Breast Cancer. *J Cancer Clin Trials*. 2016 Aug;1(3). pii: e105.
- 2: Roy SS, Mukherjee S, Das SK. Effects of intratracheal exposure of 2-chloroethyl ethyl sulfide (CEES) on the activation of CCAAT-enhancer-binding protein (C/EBP) and its protection by antioxidant liposome. *J Biochem Mol Toxicol*. 2017 May;31(5). doi: 10.1002/jbt.21882.
- 3: Roy SS, Mukherjee S, Ballard BR, Das SK. Protection Against Dimethylbenz[a]Anthracene-Induced Breast Cancer in Female Rats by α -Lactalbumin. *Int J Cancer Oncol*. 2016;3(1):1-6.
- 4: Ratna A, Das SK. Endothelin: Ominous Player in Breast Cancer. *J Cancer Clin Trials*. 2016 Feb;1(1). pii: e102.



Jamaine Davis, Ph.D.

The Davis laboratory uses an interdisciplinary approach (biochemistry/biophysics, bioinformatics, cell and structural biology) to elucidate mechanisms of genomic maintenance and regulation in breast cancer. Their challenge is to understand how genomic and proteomic variations affect health, disease and drug response. To address this, the lab seeks to define how dysregulated protein-protein interaction networks obtained from bioinformatics (patient data) influence disease. They also model these observations in cell systems to determine the best course of therapy for breast cancer patients. Students working with Dr. Davis and his team will use *in vitro* models of breast cancer to study the structure and function of proteins involved in DNA damage repair.

Recent Publications:

- 1: McIntosh DJ, Walters TS, Arinze IJ, Davis J. Arkadia (RING Finger Protein 111) Mediates Sumoylation-Dependent Stabilization of Nrf2 Through K48-Linked Ubiquitination. *Cell Physiol Biochem*. 2018;46(1):418-430.
- 2: Bhaumik P, Davis J, Tropea JE, Cherry S, Johnson PF, Miller M. Structural insights into interactions of C/EBP transcriptional activators with the Taz2 domain of p300. *Acta Crystallogr D Biol Crystallogr*. 2014 Jul; 70(Pt 7):1914-21.
- 3: Davis J, Wang J, Tropea JE, Zhang D, Dauter Z, Waugh DS, Wlodawer A. Novel fold of VirA, a type III secretion system effector protein from *Shigella flexneri*. *Protein Sci*. 2008 Dec; 17(12):2167-73.
- 4: Uppsten M, Davis J, Rubin H, Uhlin U. Crystal structure of the biologically active form of class Ib ribonucleotide reductase small subunit from *Mycobacterium tuberculosis*. *FEBS Lett*. 2004 Jul 02; 569(1-3):117-22.



Dana Marshall, Ph.D.

Dr. Dana Marshall's research focuses on identifying factors that contribute to the disparity in mortality between African-American males and their Caucasian counterparts. Her work includes the acquisition of clinical and demographic information from individuals treated for oral cancer at Nashville General Hospital at Meharry and in the Meharry Oncology Clinics. Patient tissues are evaluated molecularly for HPV as well as for other molecular clues predictive of outcome. She also works with cell lines, characterizing the role of Alpha2-HS glycoprotein (AHS2G) in enhancing metastatic properties of oral squamous cell carcinoma cells while also characterizing isoforms of human AHS2G using mass spectrometry.

Recent Publications:

1: Appah EO, Ballard BR, Izban MG, Jolin C, Lammers PE, Parrish DD Jr, Marshall DR. A rapidly growing human papillomavirus-positive oral tongue squamous cell carcinoma in a 21-year old female: A case report. *Oncol Lett.* 2018 May;15(5):7702-7706.

2: Nangami G, Koumangoye R, Shawn Goodwin J, Sakwe AM, Marshall D, Higginbotham J, Ochieng J. Fetuin-A associates with histones intracellularly and shuttles them to exosomes to promote focal adhesion assembly resulting in rapid adhesion and spreading in breast carcinoma cells. *Exp Cell Res.* 2014 Nov 1;328(2):388-400.

3: Mandape SN, Marshall DR, Dent LL, Pratap S. Draft Genome Sequence of Multidrug-Resistant *Acinetobacter baumannii* Strain MMC4, Isolated from a Patient in Tennessee. *Genome Announc.* 2014 Feb 20;2(1). pii: e00051-14.

4: Thompson PD, Sakwe A, Koumangoye R, Yarbrough WG, Ochieng J, Marshall DR. Alpha-2 Heremans Schmid Glycoprotein (AHS2G) modulates signaling pathways in head and neck squamous cell carcinoma cell line SQ20B. *Exp Cell Res.* 2014 Feb 15;321(2):123-32



Robert Matusik, Ph.D.

Dr. Robert Matusik's laboratory has been engaged in studies of various aspects of molecular genetics and transgenic mouse models of prostate cancer. His laboratory discovered that the androgen regulated probasin promoter directs prostate-specific gene expression in the mouse and has been involved in developing numerous mouse models for prostatic disease. Their work has also identified the protein Forkhead Box A1 (FoxA1) as an important androgen receptor (AR) co-regulator and shown that the NF-kappaB pathway plays a major role to induce AR full length and AR variants during prostate cancer failure of hormonal therapy. Students working in Dr. Matusik's laboratory will use cell lines and animal models to explore regulation of the AR signaling pathway in prostate cancers.

Recent Publications

- 1: Grabowska MM, Matusik RJ. Therapy-induced small-cell disease: from mouse to man and back. *Nat Rev Urol.* 2018 Nov;15(11):662-663.
- 2: Nandana S, Tripathi M, Duan P, Chu CY, Mishra R, Liu C, Jin R, Yamashita H, Zayzafoon M, Bhowmick NA, Zhau HE, Matusik RJ, Chung LW. Bone Metastasis of Prostate Cancer Can Be Therapeutically Targeted at the TBX2-WNT Signaling Axis. *Cancer Res.* 2017 Mar 15;77(6):1331-1344.
- 3: Lu W, Liu S, Li B, Xie Y, Izban MG, Ballard BR, Sathyanarayana SA, Adunyah SE, Matusik RJ, Chen Z. SKP2 loss destabilizes EZH2 by promoting TRAF6-mediated ubiquitination to suppress prostate cancer. *Oncogene.* 2017 Mar;36(10):1364-1373.
- 4: Grabowska MM, Kelly SM, Reese AL, Cates JM, Case TC, Zhang J, DeGraff DJ, Strand DW, Miller NL, Clark PE, Hayward SW, Gronostajski RM, Anderson PD, Matusik RJ. Nfib Regulates Transcriptional Networks That Control the Development of Prostatic Hyperplasia. *Endocrinology.* 2016 Mar;157(3):1094-109.



Aramandla Ramesh, Ph.D. The laboratory of Dr. Aramandla Ramesh uses *in vivo* (rats and mice) and *in vitro* (sub-cellular preparations and cell cultures) models to elucidate how chemical metabolism drives toxicity and carcinogenesis. Students working in Dr. Ramesh's laboratory will use rodent models and cell lines to examine the ability of one group of

environmental toxicants, polycyclic aromatic hydrocarbons (PAHs), to influence the development of colon cancer.

Recent Publications:

- 1: Archibong AE, Rideout ML, Harris KJ, Ramesh A. OXIDATIVE STRESS IN REPRODUCTIVE TOXICOLOGY. *Curr Opin Toxicol.* 2018 Feb;7:95-101.
- 2: Huderson AC, Rekha Devi PV, Niaz MS, Adunyah SE, Ramesh A. Alteration of benzo(a)pyrene biotransformation by resveratrol in Apc (Min/+) mouse model of colon carcinogenesis. *Invest New Drugs.* 2018 Jun 22. doi:10.1007/s10637-018-0622-9. [Epub ahead of print]
- 3: Harris KL, Pulliam SR, Okoro E, Guo Z, Washington MK, Adunyah SE, Amos-Landgraf JM, Ramesh A. Western diet enhances benzo(a)pyrene-induced colon tumorigenesis in a polyposis in rat coli (PIRC) rat model of colon cancer. *Oncotarget.* 2016 May 17;7(20):28947-60.
- 4: Banks LD, Amoah P, Niaz MS, Washington MK, Adunyah SE, Ramesh A. Olive oil prevents benzo(a)pyrene [B(a)P]-induced colon carcinogenesis through altered B(a)P metabolism and decreased oxidative damage in Apc(Min) mouse model. *J Nutr Biochem.* 2016 Feb;28:37-50.



Ann Richmond, Ph.D.

The laboratory of Dr. Ann Richmond investigates the intracellular signals that are important in the tumor microenvironment and in the premetastatic niche to reduce the establishment of metastatic lesions. They have worked for several years to investigate the role of inflammatory mediators in cancer progression and mechanisms for controlling the negative impact of inflammatory mediators using basic cancer biology principals that can be translated to the clinic. Students working in Dr. Richmond's laboratory will be able to use cell lines, animal models, and in vitro and in vivo imaging techniques to characterize the mechanism by which small molecular inhibitors regulate growth and progression of melanomas and other types of cancer.

Recent Publications:

- 1: Yang J, Kumar A, Vilgelm AE, Chen SC, Ayers GD, Novitskiy SV, Joyce S, Richmond A. Loss of CXCR4 in Myeloid Cells Enhances Antitumor Immunity and Reduces Melanoma Growth through NK Cell and FASL Mechanisms. *Cancer Immunol Res.* 2018 Oct;6(10):1186-1198.
- 2: Rogers M, Sobolik T, Schaffer DK, Samson PC, Johnson AC, Owens P, Codreanu SG, Sherrod SD, McLean JA, Wikswo JP, Richmond A. Engineered microfluidic bioreactor for examining the three-dimensional breast tumor microenvironment. *Biomicrofluidics.* 2018 May 7;12(3):034102.
- 3: Daniels AB, Froehler MT, Pierce JM, Nunnally AH, Calcutt MW, Bridges TM, LaNeve DC, Williams PE, Boyd KL, Reyzer ML, Lindsley CW, Friedman DL, Richmond A. Pharmacokinetics, Tissue Localization, Toxicity, and Treatment Efficacy in the First Small Animal (Rabbit) Model of Intra-Arterial Chemotherapy for Retinoblastoma. *Invest Ophthalmol Vis Sci.* 2018 Jan 1;59(1):446-454.
- 4: Vilgelm AE, Cobb P, Malikayil K, Flaherty D, Andrew Johnson C, Raman D, Saleh N, Higgins B, Vara BA, Johnston JN, Johnson DB, Kelley MC, Chen SC, Ayers GD, Richmond A. MDM2 Antagonists Counteract Drug-Induced DNA Damage. *EBioMedicine.* 2017 Oct;24:43-55.



Amos Sakwe, Ph.D.

Dr. Sakwe's research focuses on the molecular basis of cancer progression, metastasis and chemoresistance. His laboratory uses molecular and cell biology, and biochemical techniques as well as animal models of breast cancer to study the role of calcium binding and calcium activated proteins in breast cancer progression and metastasis. The laboratory is also interested in drug discovery techniques to identify drugs that attenuate the progression of breast cancer. Students working in the Sawke laboratory will use human cell lines and other *in vitro* models to study breast cancer progression and metastasis.

Recent Publications:

- 1: Ochieng J, Nangami G, Sakwe A, Rana T, Ingram S, Goodwin JS, Moyo C, Lammers P, Adunyah SE. Extracellular histones are the ligands for the uptake of exosomes and hydroxyapatite-nanoparticles by tumor cells via syndecan-4. *FEBS Lett.* 2018 Oct;592(19):3274-3285.
- 2: Wang L, Widatalla SE, Whalen DS, Ochieng J, Sakwe AM. Association of calcium sensing receptor polymorphisms at rs1801725 with circulating calcium in breast cancer patients. *BMC Cancer.* 2017 Aug 2;17(1):511.
- 3: Nangami GN, Sakwe AM, Izban MG, Rana T, Lammers PE, Thomas P, Chen Z, Ochieng J. Fetuin-A (alpha 2HS glycoprotein) modulates growth, motility, invasion, and senescence in high-grade astrocytomas. *Cancer Med.* 2016 Dec;5(12):3532-3543.
- 4: Koumangoye RB, Nangami GN, Thompson PD, Agboto VK, Ochieng J, Sakwe AM. Reduced annexin A6 expression promotes the degradation of activated epidermal growth factor receptor and sensitizes invasive breast cancer cells to EGFR-targeted tyrosine kinase inhibitors. *Mol Cancer.* 2013 Dec 19;12(1):167.



Anil Shanker, Ph.D.

The central focus of Dr. Anil Shanker's laboratory is to understand the molecular mechanisms of intratumoral functional cross-talk between T lymphocytes and natural killer (NK) cells. They are also invested in dissecting the mechanisms of immunomodulation by the proteasome inhibitor bortezomib, Notch ligands, and neurotransmitters in adoptive T cell/NK cell transfer settings in an effort to optimize lymphocyte effector function for cancer therapy. His laboratory is also interested in identifying common functional immune signatures and specifying Notch and lymphocyte repertoires in racial and ethnic minorities that could correlate with strong anti-tumor responses. Students working in Dr. Shanker's laboratory will use *in vitro* and *in vivo* models of cancer to explore these different aspects of cancer immunology.

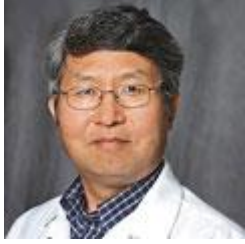
Recent Publications:

1: Shanker A, Thounaojam MC, Mishra MK, Dikov MM. Innate-Adaptive Immune Crosstalk 2016. *J Immunol Res.* 2017;2017:3503207.

2: Uzhachenko R, Boyd K, Olivares-Villagomez D, Zhu Y, Goodwin JS, Rana T, Shanker A, Tan WJ, Bondar T, Medzhitov R, Ivanova AV. Mitochondrial protein Fus1/Tusc2 in premature aging and age-related : critical roles of calcium and energy homeostasis. *Aging (Albany NY).* 2017 Mar 26;9(3):627-649.

3: Pellom ST Jr, Singhal A, Shanker A. Prospects of combining adoptive cell immunotherapy with bortezomib. *Immunotherapy.* 2017 Mar;9(4):305-308.

4: Pellom ST Jr, Dudimah DF, Thounaojam MC, Uzhachenko RV, Singhal A, Richmond A, Shanker A. Bortezomib augments lymphocyte stimulatory cytokine signaling in the tumor microenvironment to sustain CD8+T cell antitumor function. *Oncotarget.* 2017 Jan 31;8(5):8604-8621.



Deok-Soo Son, D.V.M., Ph.D.

The laboratory of Dr. Son examines the role of proinflammatory chemokines on the progression of ovarian cancer and the link between obesity and breast cancer. Students working in this laboratory will have an opportunity to study chemokine networks in models of human ovarian cancer in order to determine which chemokines can be used as biomarkers and therapeutic targets. In a second project, the Son lab has identified a proinflammatory chemokine profile linking obesity and breast cancer. Students working on this project will perform experiments designed to define the roles of obesity-promoted proinflammatory chemokines on the progression of breast cancer.

Recent Publications:

- 1: Ignacio RMC, Lee ES, Wilson AJ, Beeghly-Fadiel A, Whalen MM, Son DS. Chemokine Network and Overall Survival in TP53 Wild-Type and Mutant Ovarian Cancer. *Immune Netw.* 2018 Aug 13;18(4):e29.
- 2: Ignacio RMC, Gibbs CR, Lee ES, Son DS. The TGF α -EGFR-Akt signaling axis plays a role in enhancing proinflammatory chemokines in triple-negative breast cancer cells. *Oncotarget.* 2018 Jun 29;9(50):29286-29303.
- 3: Johnson J Jr, Pajarillo E, Karki P, Kim J, Son DS, Aschner M, Lee E. Valproic acid attenuates manganese-induced reduction in expression of GLT-1 and GLAST with concomitant changes in murine dopaminergic neurotoxicity. *Neurotoxicology.* 2018 Jul;67:112-120.
- 4: Ignacio RMC, Dong YL, Kabir SM, Choi H, Lee ES, Wilson AJ, Beeghly-Fadiel A, Whalen MM, Son DS. CXCR2 is a negative regulator of p21 in p53-dependent and independent manner via Akt-mediated Mdm2 in ovarian cancer. *Oncotarget.* 2018 Jan 15;9(11):9751-9765.



LaMonica Stewart, Ph.D.

Dr. Stewart's laboratory studies signaling pathways activated by the peroxisome proliferator activated receptor (PPAR γ). Her laboratory also studies interactions between the androgen receptor signaling pathway and PPAR γ in human prostate cancer cells. Students working in Dr. Stewart's laboratory will use human prostate cancer cell lines to explore how PPAR γ agonists and the anti-diabetic drug metformin regulate prostate cancer growth and progression.

Recent Publications:

- 1: Olokpa E, Moss PE, Stewart LV. Crosstalk between the Androgen Receptor and PPAR Gamma Signaling Pathways in the Prostate. *PPAR Res.* 2017; 2017:9456020.
- 2: Olokpa E, Bolden A, Stewart LV. The Androgen Receptor Regulates PPAR γ Expression and Activity in Human Prostate Cancer Cells. *J Cell Physiol.* 2016 Dec;231(12):2664-72.
- 3: Bolden A, Bernard L, Jones D, Akinyeke T, Stewart LV. The PPAR Gamma Agonist Troglitazone Regulates Erk 1/2 Phosphorylation via a PPAR γ -Independent, MEK-Dependent Pathway in Human Prostate Cancer Cells. *PPAR Res.* 2012; 2012:929052.
- 4: Akinyeke TO, Stewart LV. Troglitazone suppresses c-Myc levels in human prostate cancer cells via a PPAR γ -independent mechanism. *Cancer Biol Ther.* 2011 Jun 15; 11(12):1046-58.

B. Clinical/Community-Based Research



Maureen Sanderson, M.P.H., R.D., Ph.D. Dr. Maureen Sanderson has a background in cancer epidemiology, with specific training and expertise in breast cancer, prostate cancer, human papillomavirus (HPV) related cancers, lung cancer, and cancer survivorship. Much of her research has been conducted as community based participatory research. Students who work with Dr. Sanderson will design, conduct, and interpret epidemiologic studies that focus on the causes of and means of preventing cancer.

Recent publications:

- 1: Sanderson M, Aldrich MC, Levine RS, Kilbourne B, Cai Q, Blot WJ. Neighbourhood deprivation and lung cancer risk: a nested case-control study in the USA. *BMJ Open*. 2018 Sep 10;8(9):e021059.
- 2: Patel K, Inman W, Giske J, Johnson O, Brown E, Kanu M, Theriot R, Sanderson M, Hull P, Hargreaves M. A Community-Driven Intervention for Improving Biospecimen Donation in African American Communities. *J Racial Ethn Health Disparities*. 2018 Feb;5(1):15-23.
- 3: Sanderson M, Canedo JR, Khabele D, Fadden MK, Harris C, Beard K, Burrell M, Pinkerton H, Jackson C, Mayo-Gamble T, Hargreaves MK, Hull PC. Pragmatic trial of an intervention to increase human papillomavirus vaccination in safety-net clinics. *BMC Public Health*. 2017 Feb 2;17(1):158.
- 4: Canedo JR, Miller ST, Schlundt D, Fadden MK, Sanderson M. Racial/Ethnic Disparities in Diabetes Quality of Care: the Role of Healthcare Access and Socioeconomic Status. *J Racial Ethn Health Disparities*. 2018 Feb;5(1):7-14.



Flora Ukoli, M.D., M.P.H. The research of Dr. Flora Ukoli focuses on developing culturally appropriate prostate cancer education interventions particularly for low-income and low-education populations that will improve the level of knowledge about prostate cancer and positively impact attitude to early detection. A second area of interest is to investigate dietary exposures that might contribute in some way to the high prostate cancer risk and burden observed in African-Americans. Students working with Dr. Ukoli will have the opportunity to perform community-based participatory research and epidemiological studies to determine the effect of diet and gene-environment interactions on prostate cancer risk.

Recent Publications:

- 1: Williams JR, Yeh VM, Bruce MA, Szetela C, Ukoli F, Wilkins CH, Kripalani S. Precision Medicine: Familiarity, Perceived Health Drivers, and Genetic Testing Considerations Across Health Literacy Levels in a Diverse Sample. *J Genet Couns.* 2018 Aug 13. doi: 10.1007/s10897-018-0291-z. [Epub ahead of print]
- 2: Zhou YE, Buchowski MS, Liu J, Schlundt DG, Ukoli FA, Blot WJ, Hargreaves MK. Plasma Lycopene Is Associated with Pizza and Pasta Consumption in Middle-Aged and Older African American and White Adults in the Southeastern USA in a Cross-Sectional Study. *PLoS One.* 2016 Sep 1;11(9):e0161918.
- 3: Sanderson M, Fowke JH, Lipworth L, Han X, Ukoli F, Coker AL, Blot WJ, Hargreaves MK. Diabetes and prostate cancer screening in black and white men. *Cancer Causes Control.* 2013 Oct;24(10):1893-9.
- 4: Ukoli FA, Patel K, Hargreaves M, Beard K, Moton PJ, Bragg R, Beech D, Davis R. A tailored prostate cancer education intervention for low-income African Americans: impact on knowledge and screening. *J Health Care Poor Underserved.* 2013 Feb;24(1):311-31.