Emory University School of Medicine
Curriculum Vitae

1. Name: Rebecca Susan Arnold, MS, PhD

2. Office Address:
1365 Clifton Rd NE
Building B Room 4337
Atlanta, GA 30322
Telephone: 404-778-4939 Fax: 404-778-5016

3. E-mail Address: rsarnol@emory.edu

4. Citizenship: US Citizen

5. Current Titles and Affiliations:

Academic Appointments:

Assistant Professor-Research Track, Department of Urology
Emory University School of Medicine
2006-present

6. Previous Academic Appointments:

Assistant Professor-Research Track, Department of Pathology and Laboratory Medicine
Emory University School of Medicine
2001-2006

Assistant Professor-Research Track, Department of Biochemistry
Emory University School of Medicine
1999-2001

7. Education:

1987 B.S. in Chemistry, Southern Illinois University, Edwardsville
1988 M.S. in Chemistry, Southern Illinois University, Edwardsville
1993 Ph.D. in Chemistry (Biochemistry), Indiana University, Bloomington

8. Postgraduate Training:

Postdoctoral Fellow, Department of Biochemistry, Simon Fraser University, Burnaby, B.C. Canada, Mentor, Rosemary Cornell Ph.D., 1994-1996
Postdoctoral Fellow, Department of Biochemistry, Emory University School of Medicine, Mentor J. David Lambeth, M.D., Ph.D. 1997-1999

9. Honors and Awards:

Outstanding Undergraduate in Chemistry (Anheuser Busch)	1987
Chemistry Merit Award (Indiana University)	1990
American Diabetes Association Fellowship (Indiana Affiliate)	1990
National Research Service Award	1990

National Institute of Health Training Grant Fellowship 1990-1993
Juvenile Diabetes Foundation International Summer Fellowship 1991
Henry R. Mahler Memorial Award (Indiana University) 1991
National Research Service Award-National Institute of Health 1997
Individual National Research Service Award-National Institute of Health 1998-2000

10. Society Memberships

Society for Basic Urologic Research 2013-present
American Society for Biochemistry and Molecular Biology 2000-2011

11. Organization of Local Conferences:
Monthly Research Presentations at Urology Grand Rounds 2013-present

12. Research Focus:
My research has focused on 1) reactive oxygen in cancer, 2) mitochondrial DNA mutations in prostate cancer and their relationship to bone metastasis, 3) racial disparities in prostate cancer, and 4) development of a diagnostic test for clear cell renal cell carcinoma.

13. Active Research Support:

SBIR (Gaul)
Sophia Bioscience, Inc./NIH
$31,150
"Development of Novel Targeted Therapy for Prostate Cancer"
Role: Collaborator (25 % Effort). Dr. Arnold as a research scientist will help design and conduct the proposed mouse studies. The overall objective is the investigation of the therapeutic efficacy of lead compounds in mouse models of prostate cancer.

GAP1 Unique TMAs 07/01/13-06/30/15
Movember Foundation (Australia)
Principle Investigator: John Petros, M.D.
The goal of this award is to fund multiple centers (US and foreign) in the creation of unique tissue microarrays made from specimens from prostate cancer patients for whom multiple specimens are available from an individual patient. This will include primary tissue plus metastasis or pre- and post-treatments tissues from the same patient. This will generate a unique resource for the development and testing of new biomarkers of disease progression and treatment resistance.
Role: Collaborative Team Member

7 U01 CA113913-09 (Sanda) 03/29/2005-06/30/2015
NIH $477,371
Harvard/Michigan/Cornell Prostate Cancer Biomarker Clinical Validation Center
This study will combine efforts at 5 sites towards assembly of a clinical cohort to evaluate biomarkers for prostate cancer early detection.
Bethesda, MD

Internal Support $50,000 04/01/14-03/31/15
Winship Cancer Institute Bridge Funding
Principle Investigator: John Petros, M.D.

The bridge funds will be used to generate additional preliminary data for the resubmission of VA Merit Grant. The overarching goal of this VA Merit grant is to determine the mechanism(s) by which aspirin is an effective chemopreventative drug in some patients but not others with a focus on mtDNA mutations found in prostate cancer patients. Given the critical importance of nitric oxide signaling in cancer biology and the concentration-dependent effects on cancer cells with low concentrations being stimulatory and high concentrations being inhibitory, we find it compelling that aspirin's effect is modulated by mtDNA missense mutations in a gene (COI) known to be a risk modulator of clinical prostate cancer and inhibited by NO. The clinical hypothesis is that an individual's mitochondrial genotype may make them more or less suitable for aspirin chemoprevention. The compelling unmet clinical need is that aspirin currently is considered too risky for use in the general population due to the side effects of gastrointestinal ulcers and bleeding and hemorrhagic stroke despite being proven effective in the chemoprevention of colon cancer, prostate cancer and possibly breast cancer (and others). Should our hypothesis be upheld then patient individualized aspirin chemoprevention could be recommended based on mitochondrial genotype.

Internal Support $50,000 06/01/14-08/31/15
Emory University School of Medicine Bridge Funding
Principle Investigator: John Petros, M.D.
The bridge funds will be used to generate additional preliminary data for the resubmission of an NIH RO1 grant. The broad overarching theme of the application is that mitochondrial DNA (mtDNA) mutations exert their cancer promoting effects in part by modulation of nitric oxide (NO) synthesis. We further propose that cancer- associated mtDNA mutations induce both increased NO production and alterations of key cell signaling pathways of central importance to cancer. Finally, we suggest that these derangements can be modulated by targeting NO production and/or detoxification. We and others have demonstrated that both inherited and somatically acquired mtDNA mutations are associated with the development of prostate cancer. It is now evident that one particular gene encoded by the mitochondrial DNA (cytochrome c oxidase subunit 1, or "COI") is particularly relevant prostate cancer. Over 24% of prostate cancer patients harbor a missense mutation of the COI gene. This application proposes the detailed analysis of one such mutation (and wild type control) as a proof of principle relevant to the proposed overall theme. By the study of this mutation we will test our hypothesis that a single mtDNA can cause increased NO production and a complex array of signaling events that increase proliferation, decrease apoptosis and promote tumorigenesis.
Role: Co-Investigator

14. Completed Research Support:

"Prostate Cancer Bone Metastasis: Biology and Targeting"
Principle Investigator: Lelund Chung
Project 3 Director: John Petros
Project 3 Co-Director: Rebecca Arnold
Agency: Cedars Sinai Me Center/NIH
Period: July 31, 2003 to August 1, 2014
The objective of the overall program was to develop novel diagnostic, prognostic and treatment modalities based on a mechanistic understanding of prostate tumor and bone stroma interactions. The major goal of Project 3 was to understand how prostate cancer mtDNA mutations affect stromal-epithelial interactions and metastasis.

"Mitochondrial Genetics in Prostate Cancer Health Disparity"
Principle Investigator: John Petros, M.D.

Co-Investigator: Rebecca Arnold
Agency: NIH/NCI
Period: September 16, 2011 to August 31, 2014
The major goal of this project was to determine the inherited mitochondrial DNA mutations in blacks and whites with prostate cancer by high-throughput DNA sequencing and to determine drug sensitivity in cancer cells that harbor these mutations.

"Mitochondrial DNA Mutations in Prostate Tumorigenesis and Stromal-Epithelial Interactions"
Agency: Department of Veteran's Affairs
Period: October 1, 2008-September 30, 2012
Principle Investigator: John Petros, M.D.
Co-Investigator: Rebecca S. Arnold, Ph.D.
The overall objective of this project is to define mtDNA variation in prostate cancer, its relationship to bone metastasis, and the mechanism by which mtDNA promotes prostate cancer growth in the bone microenvironment.

"Nox1 in Prostate Tumor Growth"
Principle Investigator: Rebecca S. Arnold
Agency: American Cancer Society Institutional Research Grant Program: Administered through the Winship Cancer Center
Period: March 1, 2003 to February 29, 2004
Major goal: This project supported the ongoing research of overexpression of hNox1 in the mouse prostate.

"Mitogenic Oxidases and Prostate Cancer"
Principal Investigator of Center Grant: John Petros, M.D.
Project 3 Director: Rebecca Arnold, Ph.D.
Project Co-Director: J. David Lambeth
Agency: Department of Defense, Army Prostate Center Grant
Type: DAMND17-00-1-0080
Period: March 1, 2000-February 28, 2003
Major goal: This project investigated the role of Nox family enzymes and of reactive oxygen in prostate cancer.

"Reactive Oxygen is a Major Factor Regulating Cell Division and Angiogenesis in Breast Cancer"
Principle Investigator: Rebecca S. Arnold
Agency: U.S. Army, Department of Defense
Type: DAMD17-00-1-0620 Period: September 1, 2000-August 31, 2001
Major goal: This project investigated the role of Nox family enzymes and of reactive oxygen in breast cancer.

15. Pending Research Support

DOD
Breast Cancer Research Program
Breakthrough Award
PI: John Petros
$546,001
Mitochondrial DNA Mutations and the Reverse Warburg Effect
Role: Co-Investigator (20 % effort)

VA Merit
PI: John Petros
$546,001
Novel Prostate Cancer Bone Metastasis Specific Gene Mutation
Role: Co-Investigator (30 % effort)

16. Submitted/Unfunded

DOD
Hypothesis Development Award
$75,000
Principle Investigator: John Petros
"Loss of Caveolin-1 in Prostate Cancer Associated Stroma"
Role: Co-Investigator (5% Effort). The major goal of this project is to correlate the levels of methylation of Caveolin-1 in prostate cancer epithelial cells and the surrounding stromal cells with protein levels.

DOD
Hypothesis Development Award
$75,000
Principle Investigator: John Petros
"When a life has been touched by cancer, will it be shorter or longer?"
Role: Co-Investigator (5 % Effort). The major goal of this project is to study a body's immune system during cancer development to explore the hypothesis that once a body has experienced the process of cancer development and survived, it is equipped and strengthened against a second attack.

VA Merit
$600,000
Principle Investigator: John Petros
"Mechanism of cancer prevention by aspirin, nitric oxide and mitochondrial genetics."
Role: Co-Investigator (40 % effort). The overarching goal of this application is to determine the mechanism(s) by which aspirin is an effective chemopreventative drug in some patients but not others. Given the critical importance of nitric oxide signaling in cancer biology and the concentration-dependent effects on cancer cells with low concentrations being stimulatory and high concentrations being inhibitory, we find it compelling that aspirin's effect is modulated by mtDNA missense mutations in a gene (COI) known to be a risk modulator of clinical prostate cancer and inhibited by NO.

National Institutes of Health (scored in 17th percentile))
R01 $ 1,000,000
Mechanism of Action of Aspirin as Chemopreventative Drug
Principle Investigator: John Petros
Co-Investigator: Rebecca Arnold
Our broad overarching goal is to understand interplay between aspirin, a uniquely effective cancer chemopreventative drug, mitochondrial DNA mutations, and the generation of nitric oxide in order to design more effective therapeutic treatment for patient use. We present preliminary data that inherited mutations in mtDNA for COI are associated with increased prostate cancer risk and one such mutation results in increased nitric oxide levels.

National Institutes of Health
R01 (Provocative Question) 2011
Principle Investigator: John Petros
Co-Investigator: Rebecca Arnold (50% effort)
Mechanism of Action of Aspirin as Chemopreventative Drug

NIH Trans-NIH Recovery Act Research Support 2009
Principle Investigator: John Petros
Co-Investigator: Rebecca Arnold (20% effort)
Racial Differences in Prostate Cancer: Mitochondrial Genetics

NIH Trans-NIH Recovery Act Research Support 2009
Principle Investigator: John Petros
Co-Investigator: Rebecca Arnold (20% effort)
Large-Scale, High-Throughput Mitochondrial DNA Sequencing and Outcomes in Prostate Cancer

National Institutes of Health
R01 2008
Principle Investigator: John Petros
Co-Investigator: Rebecca Arnold (40% effort)
Mitochondrial DNA Mutations: Identifying Individuals at Increased Risk of Developing Prostate Cancer

National Institutes of Health
R01 2008
Principle Investigator: John Petros
Co-Investigator: Rebecca Arnold (50% effort)
Human Beta Defensin-1, Tumor Supressor

DOD Idea Grant 2007
Principle Investigator: Rebecca Arnold (30% effort)
The Role of Nox1 in the Development and Progression of Prostate Cancer in the TRAMP Mouse Model

National Institutes of Health
RO1 2005
Principle Investigator: Rebecca Arnold (75% effort)
Nox1 in Prostate Cancer

URC – Emory 2004
Principle Investigator: Rebecca Arnold
Reactive Oxygen Generated by Nox1 in the TRAMP Model of Prostate Cancer

17. Formal Teaching:

Summer 2005-Fall 2009	Adjunct Professor (part time) – Georgia Perimeter College	
Courses Taught:	Survey of Chemistry I, Survey of Chemistry I Lab,	
	Survey of Chemistry II, Survey of Chemistry II Lab,	
	Principles of Chemistry II, Principles of Chemistry II Lab	

18. Supervisory Teaching:

Fall 2011/Spring 2012	Mentor to Emory University Undergraduate Student Shilpa Sreedharan Biology 499R
Fall 2012/Spring 2013	Mentor to Emory University Undergraduate Student Edward Kalkreuter Biology 499R
Spring 2013/Summer 2013	Mentor to Emory University Medical Student/Discovery Program Fei Lian
Fall 2013/present	Mentor to Emory University Undergraduate Student Alexa Dantzeler Biology 499R

19. Seminar Invitations

July 2013: Urology Grand Rounds, Emory University, "Utilization of VHL to Develop a ccRCC Screening Test"
March 2005: Oxidative Stress and Disease, Gordon Research Conference, "The Role of Nox1 and Reactive Oxygen in Prostate Cancer"
June 2004: Louisiana State University School of Medicine, "The Role of Nox1 and Reactive Oxygen in Prostate Cancer"

20. Bibliography

1. Lian F, Sreedharan S, Arnold RS, Master VA, Ogan K, Pattaras JG, Roberts DL, Petros JA. Von Hippel-Lindau exonic methylation analysis using MALDI-TOF mass spectrometry. J Urol. 2014 Apr 1. pii: S0022-5347(14)03197-8. doi: 10.1016/j.juro.2014.03.108. [Epub ahead of print]. PMID: 24803718.

2. Sreedharan S, Petros JA, Master VA, Ogan K, Pattaras JG, Roberts DL, Lian F, Arnold RS. Aquaporin-1 protein levels elevated in fresh urine of renal cell carcinoma patients: potential use for screening and classification of incidental renal lesions. Dis Markers. 2014;2014:135649. doi: 10.1155/2014/135649. Epub 2014 Apr 6. PMID: 24803718

3. Burton LJ, Barnett P, Smith B, Arnold RS, Hudson T, Kundu K, Murthy N, Odero-Marah VA. Muscadine grape skin extract reverts snail-mediated epithelial mesenchymal transition via superoxide species in human prostate cancer cells. BMC Complement Altern Med. 2014 Mar 12;14:97. doi: 10.1186/1472-6882-14-97.

4. Arnold RS, Sun Q, Sun, CQ, Richards JC, O'Hearn S, Osunkoya AO, Wallace DC, Petros JA. "An inherited heteroplasmic mutation in mitochondrial gene COI in a patient with prostate cancer alters reactive oxygen, reactive nitrogen and proliferation. Biomed Research International. 2013. Volume 2013, Article ID 239257, PMID : 23509693.

5. Scott TA, Arnold RS, Petros JA. Mitochondrial Cytochrome c Oxidase Subunit 1 Sequence Variation in Prostate Cancer. Scientifica. 2012. Volume 2012, Article ID 701810, 7 pages. (http://www.scientifica.com/2012/701810/)

6. Arnold RS, Makarova NV, Osunkoya AO, Suppiah S, Scott TA, Johnson NA, Bhosle SM, Liotta D, Hunter E, Marshall FF, Ly H, Molinaro RJ, Blackwell JL, Petros JA. XMRV infection in patients with prostate cancer: novel serologic assay and correlation with PCR and FISH. Urology. 2010 Apr;75(4):755-61. PMID: 20371060

7. Barnett P, Arnold RS, Mezencev R, Chung LW, Zayzafoon M, Odero-Marah V. Snail-mediated regulation of reactive oxygen species in ARCaP human prostate cancer cells. Biochem Biophys Res Commun. 2011 Jan 7;404(1):34-9. Epub 2010 Nov 17. PMID:21093414

8. Bhosle S, Suppiah S, Molinaro R, Liang Y, Arnold R, Diehl W, Makarova N, Blackwell J, Petros J, Liotta D, Hunter E, Ly H. Evaluation of Cellular Determinants Required for In Vitro Xenotropic Murine Leukemia Virus-Related Virus Entry into Human Prostate Cancer and Noncancerous Cells. J Virol. 2010 Jul;84(13):6288-6296. PMCID: PMC2903252

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11. Czarnecka AM, Krawczyk T, Zdrozny M, Lubiński J, Arnold RS, Kukwa W, Scińska A, Golik P, Bartnik E, Petros JA. Mitochondrial NADH-dehydrogenase subunit 3 (ND3) polymorphism (A10398G) and sporadic breast cancer in Poland. Breast Cancer Res Treat. 2010 Jun;121(2):511-8. PMID: 19266278

12. Arnold RS, Sun CQ, Richards JC, Grigoriev G, Coleman IM, Nelson PS, Hsieh CL, Lee JK, Xu Z, Rogatko A, Osunkoya AO, Zayzafoon M, Chung L, Petros JA., Mitochondrial DNA mutation stimulates prostate cancer growth in bone stromal environment. Prostate. 2009 Jan 1;69(1):1-11. PMCID: PMC2753601

13. Arnold RS, He J, Remo A, Ritsick D, Yin-Goen Q, Lambeth JD, Datta MW, Young AW, Petros JA. Nox1 expression determines cellular reactive oxygen and reversibly modulates c-fos induced growth factor, interleukin-8, bax and cav-1. Am J Pathol. 2007 Dec;171(6):2021-32. PMCID: PMC2111124.

14. Govindarajan B, Sligh JE, Vincent BJ, Li M, Canter JA, Nickoloff BJ, Rodenburg RJ, Smeitink JA, Oberley L, Zhang Y, Slingerland J, Arnold RS, Lambeth JD, Cohen C, Hilenski L, Griendling K, Martinez-Diez M, Cuezva JM, Arbiser JL. Overexpression of Akt converts radial growth melanoma to vertical growth melanoma. (2007) J Clin Invest. 117:719-29.

15. Shigemura K, Sung SY, Kubo H, Arnold RS, Fujisawa M, Gotoh A, Zhau HE, Chung LW. Reactive oxygen species mediate androgen receptor- and serum starvation-elicited downstream signaling of ADAM9 expression in human prostate cancer cells. Prostate. 2007 May 15;67(7):722-31.PMID: 17342749

16. Sung SY, Kubo H, Shigemura K, Arnold RS, Logani S, Wang R, Konaka H, Nakagawa M, Mousses S, Amin M, Anderson C, Johnstone P, Petros JA, Marshall FF, Zhau HE, Chung LW. Oxidative Stress Induces ADAM9 Protein Expression in Human Prostate Cancer Cells. (2006) Cancer Res. 66:9519-26.

17. Govindarajan B, Shah A, Cohen C, Arnold RS, Schechner J, Chung J, Mercurio AM, Alani R, Ryu B, Fan CY, Cuezva JM, Martinez M, Arbiser JL. 2005. Malignant transformation

of human cells by constitutive expression of platelet derived growth factor-BB (PDGF-BB). (2005) J Biol Chem. 280:13936-43.

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22. Arbiser JL, Petros J, Klafter R, Govindajaran B, McLaughlin ER, Brown LF, Cohen C, Moses M, Kilroy S, Arnold RS, Lambeth JD. Reactive oxygen generated by Nox1 triggers the angiogenic switch. Proc Natl Acad Sci U S A. 2002 Jan 22;99(2):715-20. PMCID: PMC117371

23. Arnold RS, Shi J, Murad E, Whalen AM, Sun CQ, Polavarapu R, Parthasarathy S, Petros JA, Lambeth JD. Hydrogen peroxide mediates the cell growth and transformation caused by the mitogenic oxidase Nox1. Proc Natl Acad Sci U S A. 2001 May 8;98(10):5550-5. PMCID: PMC33250

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27. Lopez, I., Arnold, R. S., and Lambeth, J. D. Cloning and initial characterization of a human phospholipase D2 (hPLD2): ADP-ribosylation factor regulates hPLD2 (1998) J. Biol. Chem. 273, 12846-12852.

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21. Manuscripts in Preparation or Under Review:

Arnold RS, Rogatko A, Osunkoya AO, Morrissey C, True L, Petros JA. A Bone Metastasis-Specific Prostate Cancer Mitochondrial DNA Mutation. Submitted to The Prostate.

Sun, Q, Sun CQ, Arnold RS, Petros JA. A mtDNA Mutation Influences the Apoptotic Effect of Statin's on Prostate Cancer. Submitted to Journal of Urology.

Karlsson I, Zhou X, Thomas R, Smith AT, Bonner MY, Li X, Chen G, Bowen JP, Watkins EB, Ogretmen B, Zhang J, Arnold RS, Arbiser JL. Context Dependent Activity of Solenopsin A and Analogs: Implications for Ceramide Biology. Submitted to Vascular Cell.

Sun CQ, Arnold RS, Hsieh C.-L., Lian F, Dorin J, Petros JA. Further Evidence that Human Beta Defensin-1 is an Anti-tumor Peptide. Manuscript in preparation.

Arnold RS, Moreno C, Petros JA. Whole mitochondrial genome sequencing of prostate cancer patients and samples reveals race specific and race independent markers of risk and progression. Manuscript in preparation.

Noguez JH, Sreedharan S, Arnold RS, Master VA, Ogan K, Pattaras JG, Roberts DL Ritchie JC, Petros JA. Development and testing of a novel ELISA for urinary Aquaporin-1: diagnostic test for renal cell carcinoma. Manuscript in preparation.

Noguez JH, Sreedharan S, Lian F, Arnold RS, Master VA, Ogan K, Pattaras JG, Roberts DL Ritchie JC, Petros JA. Urine levels of Aquaporin-1 in benign and malignant disorders of the kidney. Manuscript in preparation.

Bonner MY, Karlsson I, Rodolfo M, Arnold RS, Vergani E, Arbiser JL. Honokiol Bis-Dichloroacetate (Honokiol DCA) Demonstrates Activity in Vemurafenib-Resistant Melanoma in Vivo. Manuscript in preparation.