

Curriculum vitae

of

S. Priya Narayanan, Ph.D.
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RANK: ASSOCIATE PROFESSOR

BUSINESS ADDRESS:

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EDUCATION & TRAINING

1990-1993: BS, University of Kerala, Kerala, India

1993-1995: MS, University of Kerala, Trivandrum, India

1996-2000: PhD, National Dairy Research Institute (NDRI), Indian Council for Agricultural Research, Karnal, India

2001-2002: Research Associate (Project), Dairy Technology, NDRI, India

2002-2003: Certificate in Computer Science/Bioinformatics, Kent State University, OH

2003-2009: Postdoctoral Fellow, Department of Neurosciences, Cleveland Clinic, Cleveland OH

PROFESSIONAL EXPERIENCE AND OTHER APPOINTMENTS

2009-2010: Senior Postdoctoral Fellow, Vascular Biology Center, Medical College of Georgia, Augusta, GA

2011-2014: Assistant Research Scientist, Department of Cell Biology and Anatomy and Vascular Biology Center, Georgia Regents University, Augusta, GA

2014-2018: Assistant Professor, Department of Occupational Therapy, College of Allied Health Sciences, Augusta University, Augusta, GA
Aug 2018: Associate Professor, UGA College of Pharmacy, Augusta Campus, Augusta, GA
2009-current: Member, Augusta University Culver Vision Discovery Institute
2010-current: Research Biologist (WOC), VA Medical Center, Augusta, GA
2014-current: Adjunct member, Vascular Biology Center, Augusta University

AWARDS/HONORS

1996-1998: Junior Research Fellowship by the University Grants Council/Council of Scientific and Industrial Research, New Delhi, India
1998: Qualified the National Eligibility Test of Indian Council of Agricultural Research for lectureship, New Delhi, India
1998-2000: Senior Research Fellowship grant by the University Grants Council/Council of Scientific and Industrial Research, New Delhi, India
2003: Letter of appreciation from the Ohio House of Representatives 125th general assembly on being named to the Dean's list of the Kent State University
2005: Young Investigator Enhancement Award, American Society for Neurochemistry
2012: National Eye Institute (NEI)/ Association for Research in Vision and Ophthalmology (ARVO) Travel Award
2012: STaR (Southern Translational Education and Research) Young Investigator Award
2019-2021: Eligibility award for VA Non-Clinician Investigator

SCIENTIFIC AND PROFESSIONAL SOCIETIES

ARVO (The Association for Research in Vision and Ophthalmology)
American Heart Association
American Society for Biochemistry and Molecular Biology (ASBMB)
American Society for Pharmacology and Experimental Therapeutics (ASPET)

Society for Neuroscience

Life member, Society of Biological Chemists (India)

TEACHING EXPERINCE

2014 Fall-2015 Summer

- CAHS 6501 Research project 2014 (Instructor)
- CAHS 6524 Project development Fall 2014 (course director)
- CAHS-7523-A Research Project Summer 2015 (Course director)
- CAHS-6503-WEB Research Process Summer 2015 (Instructor)

2015 Fall-2016 Summer

- CAHS-8503-M Research Process; Fall 2015 (Instructor)
- CAHS 6501 Research project; Fall 2015 (Research mentor)
- CAHS-6524 Project Development fall 2015 (Research mentor)
- CAHS-6503-WEB Research Process Summer 2016 (Instructor)
- CAHS-7523-A Research Project Summer 2016 (Course director)

2016 Fall-2017 Summer

- CAHS-8503-M Research Process; Fall 2016 (Instructor)
- CAHS 6501 Research project; Fall 2016 (Research mentor)
- CAHS-6524 Project Development; Fall 2016 (Research mentor)
- CAHS-6503-WEB Research Process Summer 2017 (Instructor)
- CAHS-7523-A Research Project Summer 2017 (Course director)

2017 Fall-2018 Summer

- CAHS-8503-M Research Process; Fall 2017 (Instructor)
- CAHS-6524 Project Development; Fall 2017 (Research mentor)
- CAHS-8503-M Research Process; Fall 2018 (Instructor)
- CAHS-6524 Project Development; Fall 2018 (Research mentor)

2019 Spring

- Advanced Therapeutics II (Instructor)
- Introduction to Research in Clinical and Experimental Therapeutics (Instructor)
- Clinical Seminar (Instructor)
- Journal Club (Instructor)
- Doctoral Research (Mentor, Co-Mentor)

2019 Summer

- Doctoral Research (Mentor, Co-Mentor)

2019 Fall

- Methods in Experimental Therapeutics (Course Co-Ordinator)
- Journal Club (Course Co-Ordinator)
- Introduction to Research in Clinical and Experimental Therapeutics (Instructor)
- Doctoral Research (Mentor, Co-Mentor)
- Masters Research (Mentor)

2020 Spring

- Advanced Therapeutics II (Course Co-Ordinator)
- Introduction to Research in Clinical and Experimental Therapeutics (Instructor)
- Clinical Seminar (Instructor)
- Journal Club (Course Co-Ordinator)
- Ethical issues in research (Instructor)
- Grantsmanship (Instructor)
- Doctoral Research (Mentor, Co-Mentor)
- Masters Research (Mentor)

2020 Summer

- Doctoral Research (Mentor, Co-Mentor)
- Masters Research (Mentor)

2020 Fall

- Methods in Experimental Therapeutics (Course Co-Ordinator)
- Journal Club (Course Co-Ordinator)
- Introduction to Research in Clinical and Experimental Therapeutics (Instructor)
- Doctoral Research (Mentor, Co-Mentor)
- Masters Research (Mentor)

OTHER PROFESSIONAL SERVICES

2013-2016: Augusta University Culver VDI Retreat organizer

2013-Current: Peer Reviewer (UK Diabetes, Fight for Sight UK, Wellcome Trust/Department of Biotechnology-India Alliance)

2014-2017: PhD student thesis committee member

2014-Current: Poster judge (Augusta University Graduate research day)

2014-Present: Augusta University Culver VDI pilot grant reviewer

2015-current: Poster judge VA research day (VA medical Center, Augusta)

2015: PhD Thesis Reader for Anil Bhatta (Department of Pharmacology)

2015: Research poster day organizer

2015: Faculty search committee (Department of Occupational Therapy)

2015-2016: Health informatics faculty search committee (College of Allied Health Sciences)

2016-2018: College of Allied Health Sciences PhD program committee

2016-2017: Associate Dean for research and innovation search committee (College of Allied Health Sciences)

2016-2018: Augusta University Faculty Development Committee member

2017: Team leader for American Heart Association fundraising (Department of Occupational Therapy)

2017: Committee member for the 2017 AU Individual Teaching Excellence Award

2017: Planning committee member, Southern Translational Education and Research (STaR) Conference.

2017-2018: AU Faculty Action Team member for the Great Colleges Survey

2018-Current: AHA Fellowship/Career Development Grant reviewer

2018: Session moderator, ARVO (Association for Research in Vision and Ophthalmology) international conference 2018, Honolulu, HI

2018-2019: CET Faculty search committee member

2018-2020: CET Masters Students' (three students) thesis committee member.

2020: NIH Reviewer, ZRG1 BDCN R (02) Special Emphasis Panel

AREAS OF RESEARCH INTERESTS:

- Mechanisms of neurovascular damage in diabetic retinopathy
- Molecular mechanisms causing visual dysfunction in Multiple Sclerosis
- Neuron-derived extracellular vesicles as mediators of retinal vascular damage
- Neuro-glial and vascular interactions in ischemic retinopathy models
- Micro particle (glia-derived) mediated neurovascular damage in ischemic retina

ABSTRACTS (selected):

1. F. Liu, A. B Saul, Z. Xu, C. D Palani, E. Shosha, R.B Caldwell, and S. P Narayanan. Treatment with polyamine oxidase inhibitor reduced neurodegeneration and improved retinal function in diabetic mice. Experimental Biology **2019** Annual meeting, Orlando, Florida.
2. C. D. Palani, F. Liu, Z. Xu, A. Fouda, R. B. Caldwell, and S. P. Narayanan. Deletion of Arginase 2 reduces neurodegeneration in a model of Multiple Sclerosis. Experimental Biology **2019** Annual meeting, Orlando, Florida.
3. E. Shosha, T. Lemtalsi, A. Y. Fouda, S. Haigh, D. Fulton, S. P. Narayanan, R. W Caldwell, and R. B. Caldwell. Arginase 2 Overexpression Aggravates Ischemic Injury in Retinal Vascular Endothelial Cells. Experimental Biology **2019** Annual meeting, Orlando, Florida.

4. A. Hunsinger, M. McRee, S. Pankonen, S. Thomas, M. Lanier and **S.P Narayanan**. Diabetic retinopathy and patient outcomes following occupational therapy interventions. Occupational Therapy Students Research Day (2018) Augusta, Georgia.
5. C.Patel, P. Pichavaram, M. Cervelli, R.B Caldwell, **S.P. Narayanan**. Overexpression of spermine oxidase in retinal neurons aggravates vascular injury in a model of retinopathy of prematurity. ARVO 2017 Annual meeting, Baltimore, Maryland, Washington.
6. R.B Caldwell, Z. Xu, **S.P Narayanan**, T. Lemtalsi, C. Patel, E. Shosha, R.W Caldwell. Arginase 2 deletion prevents optic nerve crush-induced retinal degeneration. ARVO 2017 Annual meeting, Baltimore, Maryland, Washington.
7. A. Fouda, Z. Xu, E. Shosha, R.W Caldwell, **S.P Narayanan**, R.B Caldwell. Protective Role of Arginase 1 in Retinal Ischemia Reperfusion Injury. ARVO 2017 Annual meeting, Baltimore, Maryland, Washington.
8. E. Shosha, A. Fouda, A.Ibrahim , M.A Al-Shabrawey, Z. Xu, T. Lemtalsi, R.W Caldwell, **S. P Narayanan**, Caldwell RB. Retinal Ischemia Reperfusion: Role of Arginase 2. ARVO 2017 Annual meeting, Baltimore, Maryland, Washington.
9. **S.P Narayanan**, A. Saul, Z. Xu, P. Pichavaram, Spermine Oxidase: a novel mediator of diabetes-induced retinal neurodegeneration. ARVO 2017 Annual meeting, Baltimore, Maryland, Washington.
10. P. Pichavaram, C. Patel, Z. Xu, E. Shosha, M. Cervelli, R.B Caldwell, **S.P Narayanan**. Overexpression of spermine oxidase increases neuronal death and glial activation in a model of retinal excitotoxicity. ARVO 2017 Annual meeting, Baltimore, Maryland, Washington.
11. M. Garrison, C. Grayson, C. Petras, J. Tyus, M. Lanier and **S.P Narayanan**. The most effective occupational therapy strategies for adults with diabetic retinopathy. Occupational Therapy Students Research Day (2017) Augusta, Georgia.
12. C. Patel, P. Pichavaram, Z. Xu, E. Shosha, R.B Caldwell, and **S.P Narayanan**, Inhibition of Polyamine Oxidase Reduces Excitotoxicity-mediated Retinal Neuro-inflammation. ARVO 2016 Annual meeting, Seattle, Washington.
13. Z. Xu, **S. P Narayanan**, C.Patel, E. Shosha, R. W Caldwell and R. B Caldwell. Deletion of Arginase 2 preserves retinal neurons during traumatic retinal injury. ARVO 2016 Annual meeting, Seattle, Washington.

14. E. Shosha, Z. Xu, H. Yokota, **S.P Narayanan** and R. B. Caldwell. Neurovascular Injury after Retinal Ischemia Reperfusion Insult: Contradicting roles of Arginase Enzyme Isoforms. ARVO 2016 Annual meeting, Seattle, Washington.
15. A. McNamara, D. Rashad, S. Richardson, J. Young and **S.P Narayanan**. Occupational Therapy and Low vision for adults with neurological deficits. Occupational Therapy Students Research Day (2016) Augusta, Georgia.
16. **S. P Narayanan**, C. Patel, Z. Xu, E. Shosha, J. Xing, and R.B Caldwell. Inhibition of polyamine oxidase reduces hyperoxia-mediated neurovascular injury in retina. Experimental Biology 2016 Annual meeting, San Diego, California.
17. **S. P Narayanan**, C. Patel, Z. Xu, J. Xing, M. Rojas and R.B Caldwell. Inhibition of Polyamine Oxidase Reduces Excitotoxicity-mediated Retinal Neuro-inflammation. Experimental Biology 2015 Annual meeting, Boston, Massachusetts.
18. Z. Xu, E. Shosha, J. Xing, **S. P. Narayanan**, T. Lemtalsi, R. W. Caldwell, R. B. Caldwell. Role of arginase 1 in mediating endothelial and macrophage cellular senescence in diabetic retinopathy. Experimental Biology 2015 Annual meeting, Boston, Massachusetts.
19. C. Patel, Z. Xu, J. Xing, T. Lemtalsi, R.B. Caldwell, **S.P. Narayanan**. Inhibition of polyamine oxidase reduces hyperoxia-mediated neuro-inflammation and vascular injury in retina. ARVO 2015 Annual meeting, Denver, Colorado.
20. E. Shosha, Z. Xu, T. Lemtalsi, **S. P Narayanan** and R.B Caldwell. Mechanisms of Neurovascular protection in Retinal Ischemia Reperfusion Injury: Role of Arginase. ARVO 2015 Annual meeting, Denver, Colorado.
21. **S. P Narayanan**, Z. Xu, R. W. Caldwell, R. B. Caldwell. Inhibition of polyamine oxidase reduces hyperoxia-mediated retinal neuro-vascular injury in a model of retinopathy of prematurity. ARVO 2014 Annual meeting, Orlando, Florida.
22. Z. Xu, E. Shosha, **S. P Narayanan**, H. Yokota, R. W. Caldwell, R.B. Caldwell. Arginase 2 deficiency prevents retinal neuronal loss and retinal degeneration after ischemia/refperfusion injury. ARVO 2014 Annual meeting, Orlando, Florida.
23. E. Shosha, T. Lemtalsi, Z. Xu, R. W Caldwell, R.B Caldwell, **S. P Narayanan**. Mechanistic Role of Arginase in Inducing Endothelial Cell Senescence in Diabetic Retinopathy. ARVO 2014 Annual meeting, Orlando, Florida.

24. **S. P. Narayanan**, Z. Xu, T. Lemtalsi, Z. Xu, K, R. W. Caldwell, R. B. Caldwell. Inhibition of polyamine oxidase reduces hyperoxia-mediated retinal neuro-vascular injury in a model of retinopathy of prematurity. ARVO 2013 Annual meeting, Seattle, Washington.
25. R. B. Caldwell, **S. P. Narayanan**, M. A. Rojas, T. Lemtalsi, Z. Xu, K. Jittiporn, E. Schenhals, R. W. Caldwell, D.J. Fulton. Overactive Arginase Causes Mitochondrial Dysfunction and Premature Endothelial Cell Senescence during Diabetic Retinopathy. ARVO 2013 Annual meeting, Seattle, Washington.
26. A. Shimouchi, H. Yokota, T. Nagaoka, S. Ono, H. Takumi, **S. P. Narayanan**, R. B. Caldwell, A. Yoshida. Water-dispersible hesperetin prevents ganglion cell loss in the retina after retinal ischemia reperfusion injury. ARVO 2013 Annual meeting, Seattle, Washington.
27. **S. P. Narayanan**, J. Suwanpradid, Z. Xu, T. Lemtalsi, N. Putluri, A. Sreekumar, R. W. Caldwell, R. B. Caldwell. Arginase2 Deficiency Reduces Hyperoxia-induced Retinal Neurodegeneration through the Regulation of Polyamine Metabolism. ARVO 2012 Annual meeting, Fort Lauderdale, FL.
28. W. Zhang, H. Liu, Z. Xu, H. Yokota, J. Wang, **S. P. Narayanan**, M. A. Rojas, M. Motamedi, R. W. Caldwell, R. B. Caldwell. Deficiency of CXCR3 Prevents Inflammation and Neuronal Damage in Retinal Ischemic Injury. ARVO 2012 Annual meeting, Fort Lauderdale, FL.
29. Z. Xu, H. Yokota, **S. P. Narayanan**, R. W. Caldwell, R. B. Caldwell. Deletion of Arginase 2 Prevents Retinal Ganglion Cell Loss and Blocks Formation of Acellular Capillaries after Ischemia/Reperfusion Injury. ARVO 2012 Annual meeting, Fort Lauderdale, FL.
30. J. Suwanpradid, Z. Xu, **S. P. Narayanan**, R. W. Caldwell, R. B. Caldwell. Arginase 2 Deficiency Limits Microglia/Macrophage Activation and Prevents Hyperoxia-induced Vascular Injury in the Mouse Retina. ARVO 2012 Annual meeting, Fort Lauderdale, FL.
31. C. Patel, W. Zhang, Z. Xu, **S. P. Narayanan**, N. Tsai, R. W. Caldwell, R. B. Caldwell. Activation of the Endothelin System in Models of Ischemic Retinopathy. ARVO 2012 Annual meeting, Fort Lauderdale, FL.
32. J. Yang, H. Yokota, M. A. Rojas, **S. P. Narayanan**, Z. Xu, M. A. Behzadian, R. B. Caldwell. 2011. Involvement of p38 MAP Kinase Activation and uPAR Expression in the Blood-retinal Barrier Breakdown in Retinal Ischemia-reperfusion. ARVO 2011 Annual meeting, Fort Lauderdale, FL.

33. **S. P. Narayanan**, J. Suwanpradid, A. Saul, Z. Xu, A. Still, T. Lemtalsi, R. W. Caldwell, R. B. Caldwell. 2011 Deletion of Arginase 2 Reduces Neurodegeneration and Improves Retinal Function in a Mouse Model of Retinopathy of Prematurity via P53 Dependant Pathway. ARVO 2010 Annual meeting, Fort Lauderdale, FL.
34. S. E. Brooks, W. Zhang, H. Yokota, Z. Xu, **S. P. Narayanan**, L. Yancey, A. Yoshida, D. M. Marcus, R. W. Caldwell, R. B. Caldwell. 2011. Dual Effects of Oxygen Supplement in Ischemia-driven Angiogenesis: Accelerating Repair while Preventing Pathology. ARVO 2011 Annual meeting, Fort Lauderdale, FL.
35. J. Suwanpradid, Z. Xu, **S. P. Narayanan**, W. R. Caldwell, R. B. Caldwell. 2011. Arginase 2 Mediates Vascular Injury through Peroxynitrite Formation in a Mouse Model of Oxygen-induced Retinopathy. ARVO 2011 Annual meeting, Fort Lauderdale, FL
36. H. Yokota, **S. P. Narayanan**, W. Zhang, Z. Xu, T. Lemtalsi, T. Nagaoka, A. Yoshida, R. W. Caldwell, R. B. Caldwell. Deletion of NADPH Oxidase 2 Prevents Ganglion Cell Loss in the Retina after Ischemia Reperfusion Injury. ARVO 2011 Annual meeting, Fort Lauderdale, FL.
37. **S.P. Narayanan**, J. Suwanpradid, Z. Xu, S.E. Brooks, R.W. Caldwell, R.B. Caldwell. **2010**. Arginase depletion modulates Akt and iNOS to reduce retinal degeneration in a mouse model of retinopathy of prematurity. ARVO 2010 Annual meeting, Fort Lauderdale, FL.
38. J. Suwanpradid, L. Yancey, W. Zhang , Z. Xu, **S.P. Narayanan**, S. Virmani, A. Patel, S.Brooks, R.W. Caldwell, R.B.Caldwell. **2010**. Arginase deletion protects the developing retinal vasculature from oxygen induced retinopathy. ARVO 2010 Annual meeting, Fort Lauderdale, FL.
39. H. Yokota, W. Zhang, L. Yancey, **S.P.Narayanan**, Z. Xu, R.W. Caldwell, R.B. Caldwell, S.E. Brooks. **2010** Oxygen supplement prevents retina neovascularization and accelerates normal vascular recovery in an ischemic retinopathy model. ARVO 2010 Annual meeting, Fort Lauderdale, FL.
40. **Narayanan S.P**, Feng W, Macklin WB. **2009**. Mammalian target of rapamycin regulates Akt-induced hypermyelination in the CNS. 40th Annual meeting for the Society for Neurochemistry, Charleston, SC
41. **Narayanan S.P**, Morse EN, Weinfurtner K, Yin X, Avila RL, Kirschner DA, Macklin WB. **2008**. Overexpression of Akt in oligodendrocytes mediates hypermyelination in the CNS

rather than cell survival. 39th Annual meeting for the Society for Neurochemistry, San Antonio, TX

42. **Narayanan S.P**, Morse EN, Yin X, Dutta R, Avila RL, Kirschner DA and Macklin WB. **2007**. Characterizing the regulatory components of oligodendrocyte development Akt over-expressing transgenic mice. 36th Annual meeting for the Society for Neurosciences, San Diego, CA
43. **Narayanan S.P**, Flores AI, and Macklin WB. 2005. Oligodendrocytes over-expressing Akt1: A new model to study signals regulating myelination. 34th Annual meeting for the Society for Neurosciences, Washington DC

PUBLICATIONS IN PEER-REVIEWED JOURNALS:

1. Candadai AA, Liu F, Fouda AY, Alfarhan AY, Palani CD, Xu Z, Caldwell RB, **Narayanan SP (2020)**. Deletion of Arginase 2 attenuates neuroinflammation in an experimental model of optic neuritis. Plos One (under revision).
2. Adil MS; Khulood D; **Narayanan SP**; Somanath PR **(2020)** GEO Database Analysis of Gene Expression Changes by SARS CoV-1, SARS CoV-2, Respiratory Syncytial Virus, and Influenza A Virus Infections. Heylion (under review)
3. Rudraraju MR, **Narayanan SP** and Somanath PR **(2020)**. Regulation of blood-retinal barrier cell-junctions in diabetic retinopathy. Pharmacol. Res 2020 Aug 1; 161:105115
4. Liu F, Saul AB, Pichavaram P, Xu Z, Rudraraju M, Somanath PR, R. B. Caldwell, **Narayanan SP (2020)**. Pharmacological inhibition of Spermine Oxidase reduced neurodegeneration and improved retinal function in diabetic mice. J. Clinic. Med 2020 Jan 25;9(2). pii: E340. doi: 10.3390/jcm9020340.
5. Fouda AY, Eldahshan W, **Narayanan SP**, Caldwell RW, Caldwell RB (2020). Arginase Pathway in Acute Retina and Brain Injury: Therapeutic Opportunities and Unexplored Avenues. Front Pharmacol. 2020 Mar 17; 11:277. doi: 10.3389/fphar.2020.00277.
6. Shosha E, Fouda AY, **Narayanan SP**, Caldwell RW, Caldwell RB (2020). Is the Arginase Pathway a Novel Therapeutic Avenue for Diabetic Retinopathy? J Clin Med. 2020 Feb 5;9(2). pii: E425. doi: 10.3390/jcm9020425.

7. Fouda AY, Xu Z, **Narayanan SP**, Caldwell RW, Caldwell RB (2020). Utility of LysM-cre and Cdh5-cre Driver Mice in Retinal and Brain Research: An Imaging Study Using tdTomato Reporter Mouse. *Invest Ophthalmol Vis Sci.* 2020 Mar 9;61(3):51. doi: 10.1167/iovs.61.3.51.
8. Palani CD, Fouda AY, Liu F, Xu Z, Mohamed E, Giri S, Smith SB, Caldwell RB, **Narayanan SP**. Deletion of Arginase 2 Ameliorates Retinal Neurodegeneration in a Mouse Model of Multiple Sclerosis. *Mol Neurobiol.* 2019 Jul 6; doi: 10.1007/s12035-019-01691-w. PMID: 31280447.
9. **Narayanan SP**, Shosha E, D Palani C. Spermine oxidase: A promising therapeutic target for neurodegeneration in diabetic retinopathy. *Pharmacol Res.* 2019 Sep; 147:104299. doi: 10.1016/j.phrs.2019.104299. Epub 2019 Jun 15. Review.PMID: 31207342.
10. P Pichavaram, C.D. Palani, C. Patel, Z Xu, E. Shosha, A.Y. Fouda, R.B. Caldwell and **S.P. Narayanan 2019**. Targeting polyamine oxidase to reduce excitotoxicity-induced retinal neurodegeneration. *Front. Neurosci.* 2019 Jan 10; 12:956. doi: 10.3389/fnins.2018.00956.
11. Z Xu, A.Y. Fouda, T. Lemtalsi, E. Shosha, C. Patel, RW Caldwell, **S.P. Narayanan**, Caldwell RB **2018**. Retinal neuroprotection from optic nerve trauma by deletion of arginase 2. *Front. Neurosci.* 2018 Dec 20; 12:970. doi: 10.3389/fnins.2018.00970.
12. A.Y. Fouda, Z Xu, E. Shosha, T. Lemtalsi, J Chen, HA Toque, R Tritz, X Cui, BK Stansfield, Y Huo, PC Rodriguez, SB Smith, RW Caldwell, **S.P. Narayanan**, Caldwell RB **2018**. Arginase 1 promotes retinal neurovascular protection from ischemia through suppression of macrophage inflammatory responses. *Cell Death Dis.* 2018 Sep 25;9(10):1001. doi: 10.1038/s41419-018-1051-6.
13. E Shosha*, Z Xu*, **S.P. Narayanan***, T Lemtalsi, AY Fouda, M Rojas, J Xing, D Fulton, RW Caldwell, RB Caldwell **2018**. Mechanisms of Diabetes-Induced Endothelial Cell Senescence: Role of Arginase 1. *Int J Mol Sci.* 2018 Apr 17;19(4). pii: E1215. doi: 10.3390/ijms19041215. (* co-first authors)
14. R.W Caldwell, P. Rodriguez, H.A Toque, **S.P Narayanan**, and R.B Caldwell **2018**. Arginase: An Ancient Enzyme Important in Modern Health and Disease. *Physiol Rev* 2018 Apr 1;98(2):641-665. doi: 10.1038/s41419-018-1051-6.
15. E. Shosha, Z. Xu, H. Yokota, R. W. Caldwell, R. B. Caldwell, **S.P Narayanan 2016**. Deletion of Arginase 2 prevents retinal ganglion cell loss and blocks formation acellular Capillaries

after Ischemia/Reperfusion Injury. *Cell Death and Disease* 2016 Nov 24; 7(11): e2483. doi: 10.1038/cddis.2016.295

16. C. Patel, Z. Xu, E. Shosha, J. Xing, R. Lucas, R.W. Caldwell R.B. Caldwell, **S.P Narayanan** **2016**. Treatment with polyamine oxidase inhibitor limits hyperoxia-induced retinal vascular injury in ischemic retinopathy. *BBA Molecular Basis of Disease* 2016 May 27; 1862(9):1628-1639. doi: 10.1016/j.bbadis.2016.05.020
17. R.B. Caldwell, H. A. Toque, **S. P Narayanan**, R. W Caldwell **2015**. Arginase: an old enzyme with new tricks. *Trends Pharmacol Sci.* 36(6):395-405.
18. A. Shimouchi, H. Yokota, S. Ono, C. Matsumoto, T. Tamai, H. Takumi, **S. P Narayanan**, S. Kimura, H. Kobayashi, R.B. Caldwell, T.Nagaoka, and A.Yoshida 2015. Neuroprotective effect of water-dispersible hesperetin in retinal ischemia reperfusion injury. *Japanese journal of ophthalmology.* 2016; 60(1):51-61.
19. Y. Ha, H. Liu, Z. Xu, H. Yokota, **S.P Narayanan**, T. Lemtalsi, S.B Smith, R. W. Caldwell, R.B Caldwell, W. Zhang 2015. Endoplasmic reticulum stress regulated CXCR3 pathway mediates inflammation and neuronal injury in acute glaucoma. *Cell death & disease.* 2015; 6: e1900.
20. H.H Sachs, K. K. Bercury, D. C. Popescu, **S. P Narayanan**, W. B. Macklin 2014. A new model of cuprizone-mediated demyelination. *ASN Neuro.* Sep 30; 6(5).
21. C. Patel, **S. P Narayanan**, W. Zhang, Z. Xu, Sukumari-Ramesh S, Dhandapani K, W. Caldwell, R.B.Caldwell **2014**. Activation of the endothelin system mediates pathological angiogenesis during ischemic retinopathy. *Am J Pathol Sep 6 (14) 00430-1.* doi: 10.1016
22. **S. P Narayanan***, Z. Xu, N. Putluri, A. Sreekumar, T. Lemtalsi, R. W. Caldwell, R.B. Caldwell. Arginase2 deficiency reduces hyperoxia-induced retinal neurodegeneration through the regulation of polyamine metabolism. *Cell Death Dis.* **2014** Feb 20;5:e1075 (* corresponding author)
23. **C. Patel ***, **M. Rojas***, **S. P Narayanan***, W. Zhang, Z. Xu, T. Lemtalsi, R. W. Caldwell, R.B. Caldwell. Arginase as a Mediator of Inflammation in Diabetic Retinopathy. *Front Immunology* **2011** Jul 3 ;(4):173. (* co-first authors).
24. **S. P Narayanan**, M. Rojas, J. Suwanpradid, H.T, R. W. Caldwell, R.B. Caldwell. Arginase in Retinopathy. *Prog Ret Eye Research* **2013** Sep; 36:260-80
25. H. Yokota, **S. P Narayanan**, W. Zhang, Z. Xu, L. Yancey, A. Yoshida, D.M Marcus, R.W

- Caldwell, R.B Caldwell, S.E Brooks. Hyperoxia therapy of pre-proliferative ischemic retinopathy in a mouse model. *Invest Ophthalmol Vis Sci.* **2011** Aug 11; 52(9):6384.
26. **S. P Narayanan**, J. Suwanpradid, A. Saul, Z. Xu, R. W Caldwell, R.B Caldwell. Arginase2 deletion reduces neuro-glial injury and improves retinal function in a model of retinopathy of prematurity, *PLoS ONE.* **2011**; 6(7): e22460.
27. W. Zhang, H. Yokota, Z. Xu, **S. P Narayanan**, L.Yancey, A. Yoshida, D.M Marcus, R.W Caldwell, R.B Caldwell, S.E Brooks. Hyperoxia therapy of pre-proliferative ischemic retinopathy in a mouse model. *Invest Ophthalmol Vis Sci.* **2011** Aug 11; 52(9):6384.
28. M. Yu, **S. P Narayanan**, F. Wang, E. Morse, W.B Macklin, N.S Peachey. Visual abnormalities associated with enhanced optic nerve myelination. *Brain Res.* **2011** Feb 16; 1374:36-42.
29. **S. P Narayanan**, A.I Flores AI, F. Wang and W.B Macklin. Akt signals through the mammalian target of rapamycin pathway to regulate CNS myelination. *J Neurosci.* **2009** May 27; 29(21): 6860-70.
30. **A.I Flores[#], S. P Narayanan[#] (#Co-First authors)**, E.N Morse, H.E Shick, X. Yin, G. Kidd, R.L Avila, D.A Kirschner, W.B Macklin. Constitutively active Akt induces enhanced myelination in the CNS. *J Neurosci.* **2008** Jul 9; 28(28):7174-83.
31. Fraizer G, Leahy R, **Priyadarshini S**, Graham K, Delacerda J, Diaz M. Suppression of prostate tumor cell growth in vivo by WT1, the Wilms' tumor suppressor gene. *Int J Oncol.* **2004** Mar; 24(3):461-71.
32. **Priyadarshini S**, Kansal VK. Biochemical characterization of buffalo (*Bubalus bubalis*) milk lysozyme. *J Dairy Res.* **2003** Nov; 70(4):467-71.
33. **Priyadarshini S**, Kansal VK. Purification, characterization, antibacterial activity and N-terminal sequencing of buffalo-milk lysozyme. *J Dairy Res.* **2002** Aug;69(3):419-31.
34. **Priyadarshini S** and Kansal, V.K. Lysozyme activity in buffalo milk: Effect of lactation period, parity, mastitis, season in India, pH and milk processing heat treatments. *Asia-Aust. J. Anim. Sci.* **2002.** 15: 895-899.

PUBLICATIONS (under preparation)

1. **S. P Narayanan** P. Pichavaram, C. Patel, Z. Xu, M. Cervelli, R. B Caldwell (2020). Overexpression of spermine oxidase increases excitotoxicity-induced neuro-inflammation in mouse retina.
2. Liu F, C. Patel, P. Pichavaram, M. Cervelli, R. B. Caldwell, **S. P Narayanan** (2021). Overexpression of spermine oxidase in retinal neurons aggravates vascular injury in a model of retinopathy of prematurity.

RESEARCH FUNDING (Current):

1. **5 R01 EY028569 Narayanan (PI) 05/01/2018 – 04/30/2023**

NIH/National Eye Institute

Title: Mechanisms of neurodegeneration in diabetic retinopathy: Role of spermine oxidase

Major Goal(s): The long-term goal is to investigate mechanisms by which spermine oxidase regulate neurodegeneration in diabetic retinopathy.

Role: Principal Investigator

2. **Intramural Grant Award (University of Georgia) (PI) 07/01/2020 – 06/30/2021**

UGA-COP Dean's Special Endowment Funds

Title: Spermine Oxidase inhibition as a therapeutic intervention for Multiple Sclerosis

Major Goal(s): Investigating the impact of inhibiting SMOX in the formation of acrolein-conjugates and oxidative damage in MS experimental models and ocular samples from patients. **Role:** Principal Investigator

Role: Co-Investigator

RESEARCH FUNDING (Pending):

1. **VA Merit Review Award** (April 2021- March 2025)

Resubmission (September 2020)

Title: Targeting Spermine Oxidase to prevent vision loss in Multiple Sclerosis.

Role: Principal Investigator

2. **International Progressive MS Alliance (April 2021-March 2022)**

Pre-application approved. Full application is invited for submission (September 2020).

Title: Spermine Oxidase as a therapeutic target for neurodegeneration in Multiple Sclerosis

Role: Principal Investigator

3. American Legion Research Funding award (July 2020-June 2021)

Title: Targeting spermine oxidase as a therapeutic intervention for Multiple Sclerosis

Role: Principal Investigator

RESEARCH FUNDING (Completed):

1. 5I01BX001233-01 RB Caldwell (PI) 10/01/2015 – 09/30/2019

VA Merit Review Award

Title: Mechanisms of Traumatic Retinopathy: Role of Arginase

Main goal(s): Test the hypothesis that traumatic retinal neurovascular injury is mediated by arginase-induced uncoupling of NOS and/or altered polyamine metabolism and to perform preclinical studies for prevention and treatment of traumatic retinal neurovascular injury

2. PP-1606-08778 Narayanan, (PI), Pilot grant award, 11/1/2016-1/31/2018

National Multiple Sclerosis Society (NMSS)

Title: Role of arginase in Multiple Sclerosis Mediated Retinal Neuronal Injury

Main goal(s): The proposed studies will evaluate the potential of targeting arginase signaling for treating MS mediated vision problems.

Role: Principal Investigator

3. ESA00036 Narayanan, (PI), Extramural Success Award (Augusta University), 10/1/2017- 9/30/2018

Title: Mechanisms of neurodegeneration in diabetic retinopathy: Role of Spermine Oxidase

Main goal(s): These studies will investigate the potential of targeting spermine oxidase pathway in diabetes induced retinal neurodegeneration.

Role: Principal Investigator

4. 5 R01 EY011766-15 Caldwell (PI) 03/01/2013 – 02/28/2018

NIH/National Eye Institute

Title: Cellular Mechanisms of Retinopathy: Role of Arginase

Major Goal(s): The long-term goal is to elucidate cellular mechanisms underlying retinal angiogenesis. Present focus is on the role of arginase activity in causing endothelial dysfunction and pathological angiogenesis.

Role: Co-Investigator

5. Pilot Project Narayanan (PI) 2/20/2017 – 06/30/2017

Augusta University Culver Vision Discovery Institute

Title: Polyamine oxidase as a therapeutic target for diabetic retinopathy

Major Goal(s): To investigate the therapeutic potential of inhibiting polyamine oxidase strategy for preventing neuronal injury in diabetic retinopathy.

Role: Principal Investigator

6. Pilot Project Narayanan (PI) 12/15/2014 – 06/30/2015

GRU Culver Vision Discovery Institute

Title: Role of arginase signaling in multiple sclerosis mediated retinal neuronal injury

Major Goal(s): To investigate the role of arginase pathway in MS associated neuronal injury.

Role: Principal Investigator

7. 11SDG7440088 Narayanan (PI) 07/01/2011 – 06/30/2015

American Heart Association – Scientist Development Grant

Title: Role of neuronal arginase on vascular protection during ischemic retinopathy

Major Goal(s): To study the impact of neuronal survival on vascular protection under ischemic conditions in the retina.

Role: Principal Investigator

8. Pilot Project Narayanan (PI) 12/30/2013 – 06/30/2014

GRU Culver Vision Discovery Institute

Title: Arginase/Polyamine pathway as a therapeutic target for vascular injury in ischemic retinopathy

Major Goal(s): To investigate the role of arginase/polyamine pathway in vascular injury during ischemic retinopathy.

Role: Principal Investigator

CURRENT TRAINEES:

Eissa Jafari, Pharm D	Graduate (MS) Student (October 2019-Current)
Moaddey Alfarhan, PharmD	Graduate (Ph.D.) Student (October 2018-Current)
Madhuri Rudraraju, PharmD	Graduate (Ph.D.) Student (October 2018-Current)
Amritha Candadai, B. Pharm	Graduate (MS) Student (October 2018-Current)

Fang Liu, PhD

Research Professional II (August 2018- current)

PAST TRAINEES:

Chithra Devi Palani, PhD

Postdoctoral Fellow (October 2017-Current)

E. Behren Bass, BS
Current)

Pharm D Student Research Trainee (October 2018-

Harika Sabbineni, PhD

Postdoctoral Fellow (October 2018-Current)

Prahalathan Pichavaram PhD

Postdoctoral fellow (2015-2017 May)

Chintan Patel PhD

Postdoctoral fellow (2014-2015)

Esraa Shosha

Graduate Research Assistant (2013-2017)

Sarah Thomas

MS student (2016-2018)

Mary Grace McRee

MS student (2016-2018)

Stephanie Pankonen

MS student (2016-2018)

Alexa Hunsinger

MS student (2016-2018)

Maclaine Garrison

MS student (2015-2017)

Carly Grayson

MS student (2015-2017)

Christy Petras

MS student (2015-2017)

Julie Tyus

MS student (2015-2017)

Amanada McNamara

MS student (2014-2016)

Diamond Rashad

MS student (2014-2016)

Sarah Richardson

MS student (2014-2016)

Joshua Young

MS student (2014-2016)

Tahira Lemtalsi

Research Technician (2011-2014)

Erica Schenhals

AU Summer STAR Student (2012)

Courtney Large

AU Summer STAR Student (2011)

Oliver Takach

AU Summer STAR Student (2010)

Amit Patel

AU medical student (2010)

Feng Wang

Research Technician (2007- 2009)

Emily N. Morse

Research Technician (2005-2007)

Kelley Weinfurter

Research Student (Summer 2006 & 2007)