

VARUN KUMAR

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APPOINTMENTS / EMPLOYMENT

Position	Date	Institution
Assistant Professor- (Ophthalmology and Pharmacological Sciences)	01/01/2022- Present	Icahn School of Medicine- Mount Sinai, New York City, NY, USA
Instructor/ Research Investigator/ Faculty	03/01/2020-12/31/2021	Schepens Eye Research Institute (SERI), Massachusetts Eye and Ear, Department of Ophthalmology, Harvard Medical School, Boston, USA

GAPS IN EMPLOYMENT

Not applicable

EDUCATION

<u>Year</u>	<u>Degrees (Honors)</u>	<u>Field of Study (Thesis advisor for research degrees)</u>	<u>Institution</u>
2005-2008	BSc	Zoology	Hans Raj College, University of Delhi, India
2008-2010	MSc	Biotechnology	Devi Ahilya University, Madhya Pradesh, India
2011-2016	PhD	Neuroscience (Advisor: Wen-Hai Chou)	Kent State University, Ohio, USA

POSTDOCTORAL TRAINING

<u>Year</u>	<u>Title</u>	<u>Field of Study (Thesis advisor for research degrees)</u>	<u>Institution</u>
2016-2018	Postdoctoral Research Fellow	Ophthalmology (Advisor: Jeffrey L. Goldberg and Yaping Joyce Liao)	Stanford University, CA, USA

2018-2020	Postdoctoral Research Fellow	Ophthalmology (Advisor: Ula V. Jurkunas)	Harvard University, MA, USA
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CERTIFICATION

Not applicable

LICENSE

Not applicable

HONORS / AWARDS

- 2021 Awarded Santel, Inc./ ARVO foundation award for abstract” Loss of NQO1 generates genotoxic byproducts and causes increased female susceptibility to UVA in Fuchs dystrophy” by ARVO.
- 2020 Awarded ARVO Travel Award for the abstract “Loss of NQO1 exacerbates female Susceptibility the development of Fuchs dystrophy in response to ultraviolet light by The Association of Research in Vision and Ophthalmology (ARVO).
- 2018 Received two-year Postdoctoral Research Fellowship by American Heart Association for the Project “Glial Endoplasmic Reticulum Stress in Pathophysiology and Treatment of Diabetes and Ischemic Optic Neuropathy”
- 2014 Received Research Award on the topic “Role of PKC epsilon in Ischemia Induced Neurodegeneration” by Graduate Student Senate, Kent State University, USA.
- 2013 Received Doctoral poster presentation for outstanding achievement in research and presentation during the 28th Annual Graduate Research Symposium, Kent State University, USA.
- 2011 Shortlisted for Korean Government scholarship Plan, offered by Korean Government Under Biotechnology PhD program and Conducted by Department of Higher education, Ministry of Human Resource Development, Government of India (One of twenty shortlisted candidates across India).
- 2011 Shortlisted for Commonwealth scholarship/ fellowship Plan, offered by United Kingdom under Biotechnology Ph.D. program, and conducted by Department of Higher Education, Ministry of Human Resource Development, Government of India (One of the twenty shortlisted candidates across India).
- 2011 Qualified Graduate Aptitude Test in Engineering for M.S (Life Sciences) with All India Rank- 430 (Score- 460/600),

Conducted by Indian Institute of Technology, Madras, Under Ministry of Human Resource Development, Government of India.

- 2010 Shortlisted for Development Biology PhD Program at University of Cambridge, U.K, funded by Welcome Trust.
- 2010 Qualified Graduate Aptitude Test in Engineering for M.S Program with All India Rank -161 [(Score-517/600) Percentile- 98.45], conducted by Indian Institute of Technology Guwahati, under Ministry of Human Resource Development, Government of India.
- 2009 Qualified Junior Research Fellowship for Ph.D. Program with All India Rank-147, Conducted by Council of Scientific and Industrial Research, under Ministry of Science and Technology, Government of India.
- 2009 Qualified All India National Eligibility Test with All India Rank-125, for PhD Program, conducted by Council of Scientific and Industrial Research (CSIR), New Delhi Under Ministry of Science and Technology, Government of India.
- 2008 Selected for M.S. Program (Biotechnology) by All India Combined Biotechnology Entrance Examination with All India Rank 255 and received a Monthly Stipend by Department of Biotechnology, Government of India.

PATENTS

Not applicable

OTHER PROFESSIONAL ROLES

Professional societies

- 2011- 2016 Society for Neuroscience (SfN), USA
- 2016- Present American Heart Association (AHA), USA
- 2016- Present Association for Research in Vision and Ophthalmology (ARVO), USA

Editorial Activities

Ad hoc Reviewer

- 2016- Present Journal of the Neurological Sciences
- 2016- Present Current Advances in Ophthalmology
- 2017- Present Neural Regeneration Research

Editorial Board Member

2016- Present Current Advances in Ophthalmology

Judge at Scientific Poster/ Oral Competitions

04/01/2016 Judge for poster competitions at Graduate Research Symposium
Kent State University, Ohio, USA.

08/01/2017 Judge for Oral presentation at Stanford Summer Research Program
symposium, Stanford University, California, USA.

RESEARCH PROFILE

I am trained as a biomedical research scientist in the field of neuroscience and ophthalmology. My doctoral research involved the pathogenesis of ischemia-induced neurodegeneration with respect to mitochondria. My doctoral studies suggested that (1) Deletion of PKC epsilon reduces neurodegeneration after global cerebral ischemia. (2) This neurodegeneration is regulated by a transcription factor (ATF2, Activation Transcription Factor 2) (3) ATF2 translocate to mitochondria and its translocation is regulated via its phosphorylation by PKC epsilon. (4) Another PKC isozyme analogous to PKC epsilon is PKC delta, which contributes to ischemia induced neurodegeneration in our study. During my postdoctoral studies under Drs. Jeffrey L. Goldberg, Yaping Joyce Liao, Ula V Jurkunas and as Instructor, I investigated the role of endoplasmic reticulum, mitochondria and oxidative stress in diseases such as ischemic optic neuropathy, diabetes retinopathy and Fuchs endothelial corneal dystrophy (FECD). My postdoctoral studies suggested that (1) Retinal ganglion cells and oligodendrocytes are selectively vulnerable to ER stress in ischemic optic neuropathy. (2) Imbalance of oxidant-antioxidant system (Loss of NQO1) causes corneal endothelial cell loss in FECD. (3) There is a loss of mitochondrial quality control in FECD which is governed by mitophagy. We are currently investigating the interaction of one stress (ER stress) with another (oxidative or mitochondria stress), which will open new avenues for the drug discovery. At Mount Sinai, I will continue my research involving ER-mitochondrial crosstalk in FECD.

CLINICAL PROFILE

Not applicable

IMPACT

My research will help us understand the basic mechanisms of intracellular stress (ER and mitochondrial stress) in many diseases, which will open new targets for the drug discovery.

GRANTS, CONTRACTS, FOUNDATION SUPPORT

PAST GRANTS

<u>List Funding Source, Project Title and Number</u>	<u>Role in Project</u>	<u>Dates</u>	<u>Direct Costs</u>	<u>Supplemental Info</u>
<p><u>Grant title:</u> Glia ER stress in Pathophysiology and Treatment of Diabetes and Ischemic Optic Neuropathy.</p> <p><u>Funding agency:</u></p> <p>American Heart Association Postdoctoral Fellowship (18POPST34030385)</p>	Principal Investigator	2018-2020	\$120,000	N/A
<p><u>Grant title:</u> Role of Protein Kinase C epsilon in Ischemia-induced-Neurodegeneration</p> <p><u>Funding agency:</u></p> <p>Research Grant Award, Kent State University, USA</p>	Principal Investigator	2014-2015	\$ 1,000	N/A

PRESENT GRANTS

<u>List Funding Source, Project Title and Number</u>	<u>Role in Project</u>	<u>Dates</u>	<u>Direct Costs</u>	<u>Supplemental Info</u>
<p><u>Grant title:</u> Understanding Endoplasmic Reticulum-Mitochondria crosstalk in Corneal endothelium cells</p> <p><u>Funding agency:</u></p> <p>K99/R00-National Eye Institute (NEI) Pathway to Independence</p>	Principal Investigator	2020-2025	\$9,55,000	N/A

<p><i><u>Grant title:</u></i> Role of estrogen metabolizing enzyme, CYP1B1 in mitophagy in Fuchs Endothelium Corneal Dystrophy (FECD).</p> <p><i><u>Funding agency:</u></i> Eversight- making vision a reality</p>	Principal Investigator	2021-2022	\$ 20,000	N/A
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PENDING GRANTS

<u>List Funding Source, Project Title and Number</u>	<u>Role in Project</u>	<u>Dates</u>	<u>Direct Costs</u>	<u>Supplemental Info</u>
<p><i><u>Grant title:</u></i> Understanding the Role of Oxidative and Endoplasmic Reticulum Stress in the Retina after Stroke</p> <p><i><u>Funding agency:</u></i> American Heart Association (Career Development Award)</p>	Principal Investigator	2022-2025	\$231,000	N/A

CLINICAL TRIAL PARTICIPATION

Not applicable

TRAINEES

TEACHING ACTIVITIES

Name	Level of Trainee	Role in Training & Inclusive Dates of Training	Training Venue	Trainees' Current Status / Employment
James Whaley	Undergraduate	Lab Research (2010-2013)	Kent State University, Ohio, USA	Medical Student
Melissa Lynch	Undergraduate	Lab Research (2012-2013)	Kent State University, Ohio, USA	Not Known

Samantha Stefl	Undergraduate	Lab Research (2012-2013)	Kent State University, Ohio, USA	Not Known
Jacob Klamut	Undergraduate	Lab Research (2012-2013)	Kent State University, Ohio, USA	Not Known
Brandon Davis	Undergraduate	Lab Research (2012-2014)	Kent State University, Ohio, USA	Not Known
Scott Smith	Undergraduate	Lab Research (2012-2014)	Kent State University, Ohio, USA	Not Known
Isabella da Cruz Franco	Undergraduate	Lab Research (2014-2015)	Kent State University, Ohio, USA	Master's Student
Supreet Sandu	Undergraduate	Lab Research (2014-2015)	Kent State University, Ohio, USA	Not Known
Vivek Iyer	Undergraduate	Lab Research (2014-2015)	Kent State University, Ohio, USA	Not Known
Anthony Nathan	Undergraduate	Lab Research (2016-2018)	Stanford University	Medical Student
Layla Almutairi	Graduate student	Lab Research (2015-2016)	Kent State University, Ohio, USA	Not Known
Alexandra Camargo	Undergraduate Student	Lab Research (2016-2018)	Stanford University	Medical Student
Kathy Heng	Graduate Student	Lab Research (2016-2018)	Stanford University	Graduate Student (Stanford University)
Angela Oh	Medical School, UCLA	Lab Research (2016-2018)	Stanford University	Resident, UCLA
Hanna Hui	Undergraduate Student, BU	Lab Research (2018-2020)	Harvard University	Physical Assistant, MGH
Annie Miall	Undergraduate Student, Harvard University	Lab Research (2019-2021)	Harvard University	Medical Student
Raymond Jeff Wong	Research Assistant	Lab Research (2020-2021)	Harvard University	Medical Student
Neha Arun Deshpande	Lab Manager	Lab Research (2018-2021)	Harvard University	Lab manager

ADMINISTRATIVE LEADERSHIP APPOINTMENTS

Not applicable

PUBLICATIONS

During my doctoral study under Dr. Wen-Hai Chou, my research investigation involved the pathogenesis of ischemia-induced neurodegeneration with respect to mitochondria. Global cerebral ischemia that accompanies cardiac arrest is a major cause of mortality and results in neurodegeneration. Protein Kinase C (PKC) family members contribute to neurodegeneration. However, the mechanism of action remains unknown for different PKC isozymes. My doctoral studies suggested that (1) Deletion of PKC epsilon reduces neurodegeneration after global cerebral ischemia. (2) This neurodegeneration is regulated by a transcription factor (ATF2, Activation Transcription Factor 2) (3) ATF2 translocate to mitochondria and its translocation is regulated via its phosphorylation by PKC epsilon. (4) Another PKC isozyme analogous to PKC epsilon is PKC delta, which contributes to ischemia induced neurodegeneration in our study. These discoveries are significant because they give insight into the pathogenesis of neurodegeneration and provide new avenues for drug discovery.

Kumar V., Weng Y-C., Geldenhuys WJ., Wang D., Han X., Messing RO., Chou WH. Generation and characterization of ATP Analog-Specific Protein Kinase C delta. **J Biol Chem.** 2015 Jan 23;290(4):1936-51. PubMed PMID: 25505183.

Kumar V., Weng YC., Wu YC., Huang YT., Liu TH., Kristian T., Liu YL., Tsou HH., Chou WH. Genetic inhibition of PKC ϵ attenuates neurodegeneration after global cerebral ischemic in male mice. **J Neurosci Res.** 2019 Apr;97(4):444-455. PubMed PMID: 30488977.

Kumar V., Weng YC., Wu YC., Huang YT., Chou WH. PKC ϵ phosphorylation regulates the mitochondrial translocation of ATF2 in ischemia-induced neurodegeneration. **BMC Neurosci.** 2018 Nov 29;19(1):76. PubMed PMID: 30497386.

Chou WH., Wang G., **Kumar V.**, Weng YC. Lipocalin 2 in Stroke. **Neuro.** 2015 Aug;2(1):38-41. PubMed PMID: 30542675.

During my postdoctoral studies under Drs. Jeffrey L. Goldberg, Yaping Joyce Liao, Ula V Jurkunas and as Instructor, I investigated the role of endoplasmic reticulum, mitochondria and oxidative stress in diseases such as ischemic optic neuropathy, diabetes retinopathy and Fuchs endothelial corneal dystrophy. In many retinal and corneal diseases, oxidative and ER stress contribute to its pathogenesis. However, it is unclear how these stress factors crosstalk with each other and contribute to vulnerability of certain cell types. My postdoctoral studies suggested that (1) Retinal ganglion cells and oligodendrocytes are selectively vulnerable to ER stress in ischemic optic neuropathy. (2) Imbalance of oxidant-antioxidant system (Loss of NQO1) causes corneal endothelial cell loss in Fuchs endothelial corneal dystrophy (FECD). (3) There is a loss of mitochondrial quality control in FECD which is governed by mitophagy. We are currently investigating the interaction of one stress (ER stress) with another (oxidative or mitochondria stress), which will open new avenues for the drug discovery.

Kumar V., Mesentier Louro LA., Oh AJ., Heng K., Shariati MA., Huang H., Hu Y., Liao YJ. Increased ER stress after Experimental Ischemic Optic Neuropathy and Improved RGC and Oligodendrocyte Survival after Treatment with Chemical Chaperon. **Invest Ophthalmol Vis Sci.** 2019 May 1;60(6):1953-1966. PubMed PMID: 31060051.

Kumar V., Understanding Retinal Changes After Stroke. **Open J Ophthalmol.** 2017 Nov;7(4):281-292. PubMed PMID: 30956896.

Kumar V., Eye is the Window to Brain Pathology. **Curr Adv Ophthalmol.** 2018 Aug;1(1):3-4. PubMed PMID: 31123726.

Kumar V., Endoplasmic Reticulum-Mitochondrial Crosstalk in Neurodegenerative and Eye Diseases. **Neurology (ECronicon).** 2019 Sep;11(9):864-873. PubMed Central PMCID: PMC6746603.

Kumar V., Mesentier-Louro LA, Shariati MA., Goldberg JL., Liao YJ., Dual specific phosphatase 14 deletion rescues retinal ganglion cells and optic nerve axons after experimental anterior ischemic optic neuropathy, Current Eye Research, 2020 Oct 27; PMID: 33107352.

Ali Shariati M., **Kumar V.**, Yang T., Chakraborty C., Barres BA., Longo FM., Liao YJ. A Small Molecule TrkB Neurotrophin Receptor Partial Agonist as Possible Treatment for Experimental Nonarteritic Anterior Ischemic Optic Neuropathy. **Curr Eye Res.** 2018 Dec;43(12):1489-1499. PubMed PMID: 30273053.

Miyai T, Vasanth S, Melangath G, Deshpande N, Kumar V, Benischke AS, Chen Y, Price MO, Price FW Jr, Jurkunas UV. Activation of PINK1-Parkin-Mediated Mitophagy Degrades Mitochondrial Quality Control Proteins in Fuchs Endothelial Corneal Dystrophy. *Am J Pathol.* 2019 Jun 27; PubMed PMID: 31361992.

Miyajima T., Melangath G., Zhu S., Deshpande N., Vasanth S., Mondal B., **Kumar V.**, Chen Y., Price FW Jr., Rogan E., Zahid Muhammad. Loss of NQO1 generates genotoxic estrogen-DNA adducts in Fuchs Endothelial Corneal Dystrophy. **Free Radic Biol Med.** 2019 Dec 17;147:69-79. PubMed PMID: 31857234.

Liu C., Miyajima T., Melangath G., Miyai T., Vasanth S., Zahid M., Deshpande N., **Kumar V.**, OngTone S., Zhu S., Vojnovic D., Chen Y., Rogan E., Jurkunas UV. Ultraviolet-A light induces DNA damage and estrogen-DNA adducts in Fuchs endothelial corneal dystrophy: Why Females are more affected. **Proc Natl Acad Sci. U SA.** 2020 Jan 7;117(1):573-583. PubMed PMID: 31852820.

Messentier-Louro LA., Sharaiti MA., Dalal R., Carmargo A., **Kumar V.**, Shamskhou EA., Liao YJ., Short-term hypoxia led to rapid loss of optic nerve oligodendrocytes and differential neuronal and glial response **Exp Eye Res.** 2020 Feb 4;193:107957 PMID: 32032627.

White TL., Deshpande., **Kumar V.**, Gauthier., Jurkunas UV., Cell cycle re-entry and arrest in G2/M phase induces senescence and fibrosis in Fuchs Endothelial Corneal Dystrophy. Free Radical Biology and Medicine 2021, Jan 6; PMID: 33418109.

Kumar V., Jurkunas UV., Mitochondrial Dysfunctional and Mitophagy in Fuchs Endothelial Corneal Dystrophy. *Cells* 2021 Jul 26; 10 (8);1888; PMID: 3440658.

INVITED LECTURES/PRESENTATIONS

Regional

2014	Kumar V. , Weng Y-C, Chou WH., Role of PKC epsilon In Ischemia Induced Neurodegeneration, The Second Annual Neuroscience Symposium, Kent State University, Ohio, USA.
2014	Kumar V. , Weng Y-C., Geldenhuys WJ., Wang D., Han X., Messing RO., Chou W.H., Generation and characterization of ATP Analog-Specific Protein Kinase C delta, Student Chapters of the American Chemical Society, Kent State University, Ohio, USA.
2014	Kumar V. , Weng Y-C., Geldenhuys WJ., Wang D., Han X., Messing RO., Chou WH., Generation and characterization of ATP Analog-Specific Protein Kinase C Delta, Graduate Research Symposium, Kent State University, Ohio, USA.
2017	Kumar V. , Goldberg JL., Liao JY., Significant ERK1/2 phosphorylation but no change in dual specificity phosphatase 14 after acute ischemic optic neuropathy, Stanford Bio-X poster Presentation, Stanford University, California, USA.
2017	Kumar V., Goldberg JL., Liao JY., Significant ERK1/2 phosphorylation but no change in dual specificity phosphatase 14 after acute ischemic optic neuropathy, Stanford Neuroscience, Research Presentation, Stanford University, California, USA.

National

2013	Kumar V. , Weng Y-C., Geldenhuys WJ., Wang D., Han X., Messing RO., Chou WH., Generation and characterization of ATP Analog-Specific Protein Kinase C Delta, Society for Neuroscience (SfN).
2015	Kumar V. , Wang G., Weng Y-C., Chou WH. Characterization of novel inhibitors Analog- Specific Protein Kinase C delta, Society for Neuroscience (SfN).
2018	Kumar V. , Shariati A., Heng K., Oh A., Louro AL., Liao YJ., Assessment of Endoplasmic Reticulum Stress Response after Diabetic Ischemic Optic Neuropathy, Association for Research in Vision and Ophthalmology (ARVO).
2019	Louro AL., Camargo A., Shariati A., Nathan A., Dalal R., Kumar V. , Dardet ME., Perez VD.,Yaping YJ., The stressed optic nerve: gliopathy in hypoxic and potential for therapy, Association for Research in Vision and Ophthalmology (ARVO).
2020	Kumar V. , Despande N., Melangath G., Zhu Shan., Jurkunas UV., Loss of NQO1 exacerbates female susceptibility to the development of Fuchs dystrophy in response to ultraviolet light, ARVO
2021	Kumar V., Despande Neha., Hui Hanna., Zahid Muhammad., Rogan, Elenor G.,Jurkunas UV., Loss of NQO1 generates estrogen byproducts and causes female susceptibility to UVA in Fuchs dystrophy