

## Y. Albert Pan

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Associate Professor

Fralin Biomedical Research Institute at Virginia Tech Carilion  
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Google Scholar profile: <https://scholar.google.com/citations?user=su2jzHwAAAAJ&hl=en>

### **Education**

#### **Washington University School of Medicine, St. Louis, MO**

Ph.D. Neural Development, 2005

#### **National Taiwan University, Taipei, Taiwan**

B.S. Zoology, 2000

Dean's list graduate

### **Positions and Employment**

#### **Virginia Tech, Roanoke, VA (2017-present)**

*Associate Professor and Commonwealth Research Commercialization Fund Eminent Research Scholar in Developmental Neuroscience*, Center for Neurobiology Research, Fralin Biomedical Research Institute at Virginia Tech Carilion

*Associate Professor*, Department of Biomedical Sciences and Pathobiology, Virginia-Maryland College of Veterinary Medicine

*Associate Professor*, Department of Psychiatry and Behavioral Medicine, Virginia Tech Carilion School of Medicine

#### **Medical College of Georgia, Augusta University, Augusta, GA (2013-2017)**

*Assistant Professor*, Department of Neuroscience and Regenerative Medicine, Department of Neurology

*Co-Director*, Department of Neuroscience and Regenerative Medicine Microscopy Facility

*Co-Director*, Transgenic Zebrafish Core Laboratory

*Affiliate*, James & Jean Culver Vision Discovery Institute

### **Research Training**

#### **Harvard University, Cambridge, MA**

*Postdoctoral Fellow*, Department of Molecular and Cellular Biology, Supervisor: Dr. Alexander Schier. 2006-2013

*Postdoctoral Fellow*, Center for Brain Science, Supervisor: Dr. Joshua Sanes. 2005

#### **Washington University School of Medicine, St. Louis, MO**

*Graduate Student*, Department of Anatomy and Neurobiology, Supervisor: Dr. Joshua Sanes. 2000-2005

### **Teaching Experience**

#### **Virginia Tech, Roanoke, VA**

*Lecturer*, Virginia Tech Carilion School of Medicine Block IV: Biology of Nervous System (9064, 2020-present)

*Lecturer*, Fundamentals in Molecular Brain Science (TBMH5014, Spring 2018-present)

*Lecturer*, Translational Neurobiology Summer Undergraduate Research Fellowship (*neuroSURF*, summer 2018-present)

### **Augusta University, Augusta, GA**

*Supervisor*, Undergraduate Research (BIOL2990C, Spring 2016)

*Small-Group Facilitator and Faculty Lead*, MEDI-Phase-1 Medical Neuroscience Module (MEDI5174, Spring 2015, 2016)

*Small-Group Facilitator*, MEDI-Phase-1 Head Neck and Special Senses Module (MEDI5169, Spring 2016)

*Lecturer*, Fundamentals of Vision Science (ANAT8030, Spring 2014, 2016)

*Lecturer*, Molecular Medicine Journal Club (MOL9040, Spring 2014)

*Lecturer*, Intro to Faculty Research (COGS8040, Fall 2013, 2014)

### **Harvard University, Cambridge, MA**

*Teaching Assistant*, Microbial Sciences Initiative (MSI) Microscopy Workshop, 2011

### **Marine Biological Laboratory, Woods Hole, MA.**

*Teaching Assistant*, Zebrafish Development and Genetics Course, 2009

### **Washington University, St. Louis, MO**

*Teaching Assistant*, Principles of Neuroscience (BIO 3411), 2001

### **Students Mentored**

#### Ph.D. student

**Alyssa Brunal** - Virginia Tech, Ph.D. student, 2017-2020 (currently Account Executive at LifeSci Communications, Inc).

**Kristin Ates** – Augusta University, M.D./Ph.D student, 2015-2019

#### Medical student

**Amy Chen** – Virginia Tech Carilion School of Medicine, M.D. student, 2019-present

**Natalie Dixon** – Augusta University, M.D. student, 2016

**Christopher Kuang** – Augusta University, M.D. student, 2015

**Tom Freundlich** – Harvard University, M.D. student from Paris-Descartes Medical School, 2010-2011

#### Master's student

**Rachel Roberts** – Augusta University, M.S. student, 2015-2017

#### Undergraduate student

**Erik Akbar** - Virginia Tech, undergraduate student, *neuroSURF* fellow, 2019

**Alana Hull** - Virginia Tech, undergraduate student, *neuroSURF* fellow, 2018

**Caroline Smith** – Augusta University, undergraduate student from Mercer University, 2016

**Avirale Sharma** – Augusta University, undergraduate student, 2015-2016

**Cindy Wang** – Harvard University, undergraduate student, 2009-2010 (graduated with Ph.D. from University of California, Berkeley)

#### High school student

**Martha Chen** - Roanoke Valley Governor's School, high school student, 2018

### **Postdoctoral Fellow Mentored**

**Kareem Clark** – Virginia Tech, 2017-present

**Stanislav Kler, Ph.D** – Augusta University, 2014-2017; Virginia Tech, 2017-2019

**Manxiu "Michelle" Ma, Ph.D.** – Augusta University, 2014-2017; Virginia Tech, 2017-2020

**Tong Wang, Ph.D.**– Augusta University, 2014-2017

### **Ongoing Research Support**

Internal Research Competition Grant (Pan) 07/01/2020 – 6/30/2021

Virginia-Maryland College of Veterinary Medicine, Virginia Tech

*Microglia Deficiency Associated Neurophysiological and Transcriptomic Changes in the Hypothalamus Stress Response System*

This project will test the hypothesis that microglia influence the stress response system by modulating the activity and transcriptional profile of CRH neurons. Completion of this project will provide insights into the mechanisms that allow microglia to shape the functionality of the stress response and establish a strong basis for future external funding.

Role: PI

Award Amount: \$20,000

S10 OD026838 (Fox) 08/20/2020 – 08/19/2021

NIH-OD

*Serial Block Face Scanning Electron Microscope*

Goal: This proposal seeks to fill an existing need for a Serial Block Face Scanning Electron Microscope as a necessary component of our NIH- and NSF- funded research projects. Currently, no SBFSEM instrument is present at or near Virginia Tech, leading to outsourcing of the generation of SBFSEM datasets to a third party.

Role: Major User

### **Completed Research Support**

R01 EY024844 (Pan) 08/14-06/20\*

NEI/NIH

*Mapping Neural Circuits with Transsynaptic Virus*

The goal of this project is to develop virus-based tools to identify and investigate zebrafish neural circuitry important for visual perception. These tools will enable rapid and systematic characterization of neural circuits underlying essential visual behaviors and provide insights to how circuit structure and function affect human disease.

Role: PI

Award Amount: \$250,000 direct cost/year (\*no-cost extension for 07/19-06/20)

ER14S-001-LS (Pan) 07/17 – 06/18

Center for Innovative Technology

Recruitment of an Eminent Researcher in Translational Neurobiology

This extramural research support will be used to purchase equipment, renovate lab space, and support laboratory personnel and start-up operations for Dr. Pan at Virginia Tech.

Role: PI

Award Amount: \$250,000 direct cost/year

R21 GM119016 (Pan, Gonsalvez) 05/16-04/18

Office of the Director/NIH

*Using Cell, Fly, and Zebrafish Models to Understand FAM109A Gene Function in Undiagnosed Disease*  
The goal of this project is to develop cell and animal models of an undiagnosed human disease caused by mutation in the FAM109A gene. This project is in support of the NIH Undiagnosed Disease Network.

Role: Co-PI

Award Amount: \$125,000 direct cost/year

## **Honors**

2010 First place, Marine Biological Laboratory (MBL) Photomicrography Contest  
2009 Image of Distinction, Nikon Small World Photomicrography Competition  
2008 Fourth place, Olympus Bioscapes Digital Imaging Competition  
2007 Ruth L. Kirschstein National Research Service Awards for Individual Postdoctoral Fellow  
2005 Finalist, Upstate Young Cell Signaler Award  
2004 Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral Fellow  
2001 Honorable Mention, National Science Foundation Graduate Fellowship

## **Conference Talks**

**"Developmental regulation of the hypothalamic-pituitary stress pathway by *dscaml1*,"** CSHL Zebrafish Neural Circuits and Behavior Meeting, Cold Spring Harbor, Cold Spring Harbor, NY, Nov. 2019.

**"Neuronal connectivity analysis of wild-type and mutant zebrafish with transsynaptic virus and 3D brain mapping"** The 4th Imaging Structure and Function in the Zebrafish Brain Conference, Max Planck Institute of Neurobiology, Martinsried, Germany, Dec. 2016

**"Structural and functional mapping of zebrafish visual circuits with transsynaptic virus and calcium imaging."** 6th Strategic Conference of Zebrafish Investigators, Pacific Grove, CA, Jan. 2015

**"Brainbow: Tools and Applications."** Recombinase-Based Genome Editing and Lineage Tracing Workshop, 11th International Conference on Zebrafish Development and Genetics, Madison, WI, Jun. 2014

**"Viral tools for mapping the zebrafish brain"** Emerging Techniques in Neural Circuit Analysis Workshop, 11th International Conference on Zebrafish Development and Genetics, Madison, WI, Jun. 2014

**"Multicolor and viral tools for mapping the zebrafish brain"** UGA DevBio Fall Symposium, Athens, GA, USA, Oct. 2013

**"ZebraBow: multispectral cell labeling for lineage analysis and neural circuit tracing in zebrafish."** 1st Zebrafish for Personalized/Precision Medicine Conference, Toronto, Canada, Oct. 2013

**"ZebraBow: multispectral cell labeling for lineage analysis and neural circuit tracing in zebrafish."** Plenary session, 10th International Conference on Zebrafish Development and Genetics, Madison, WI, Jun. 2012

**"Potential for Brainbow imaging in elucidating connectivity changes in neurodegenerative diseases,"** Workshop on Connectivity Changes in Early Huntington's Disease, The CHDI (Cure Huntington's Disease Initiative) Foundation, New York, NY, Mar. 2012

**"Specific Axon Arborization Patterns of *Trpa1* Sensory Neurons in Zebrafish,"** The 18<sup>th</sup> CDB Meeting: Common Themes and New Concepts in Sensory Formation, RIKEN Center for Developmental Biology (CDB), Kobe, Japan, Apr. 2009

**"SAD kinases, targets of LKB1, are required for neuronal migration and polarization,"** Annual Cell Signaling Symposium on "Implications of the LKB1 and AMPK Systems", Dundee, Scotland, Jun. 2005

## Invited Seminars

**"Bedside to Fishside: Modeling Endocytic and Craniofacial Deficits of Undiagnosed Human Disease in Zebrafish"** Pathology Grand Rounds, Department of Pathology and Laboratory Medicine, Penn State Health Milton S. Hershey Medical Center, Hershey, PA, May 2019

**"Development of Visuomotor Behaviors and Brain-Wide Connectivity in Zebrafish"** Department of Pathology and Laboratory Medicine, Penn State Health Milton S. Hershey Medical Center, Hershey, PA, May 2019

**"Development of Visuomotor Behaviors and Brain-Wide Connectivity in Zebrafish"** Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA, Mar. 2018

**"Development of visuomotor behaviors and brain-wide connectivity in zebrafish"** Research Institute of Molecular Pathology (IMP), Vienna, Austria, Dec. 2016

**"Development of visuomotor behaviors and brain-wide connectivity in zebrafish"** Virginia Tech Carilion Research Institute, Roanoke, VA, Nov. 2016

**"Neuronal connectivity analysis of wild-type and mutant zebrafish with transsynaptic virus and 3D brain mapping"** HHMI Janelia Farm Research Campus, Ashburn, VA, Jun. 2016

**"Understanding brain functions and neuronal connectivity disorders in a tiny fish."** Albert Einstein School of Medicine, Department of Developmental & Molecular Biology, New York, NY, Mar. 2015

**"Understanding brain functions and neuronal connectivity disorders in a tiny fish."** University of South Carolina, Aiken, Department of Biology and Geology, Aiken, SC, Feb. 2015

**"Understanding brain functions and human disorders in a tiny fish."** Georgia State University, Department of Biology, Atlanta, GA, Nov. 2014

**"Understanding brain functions and human disorders in a tiny fish."** Georgia Southern University, Department of Biology, Statesboro, GA, Oct. 2014

**"ZebraBow: multispectral cell labeling for lineage analysis and neural circuit tracing in zebrafish."** Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany, Apr. 2013

## Service

### **Professional Membership**

American Association for the Advancement of Science (AAAS) (since 1999), Society for Neuroscience (since 2002)

### **Journal Review**

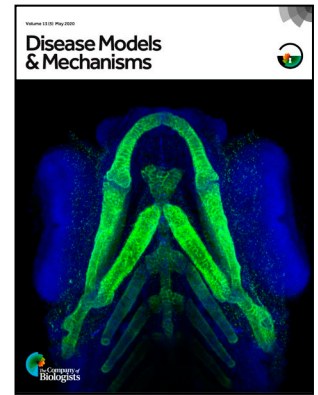
*Neuron, Development, Frontiers in Neural Circuits, Frontiers in Neuroanatomy, Neuroscience Letters, JoVE (Journal of Visualized Experiments), Journal of Neuroscience Research, Scientific Reports, Proceedings of the Royal Society of London B, Investigative Ophthalmology and Visual Science, Bio-Protocol, Methods, Protein & Cell, Cell and Molecular Life Sciences*

### **Grant Review**

2020 NIH Neuroscience, Vision, and Low Vision Technologies (BNVT) Study Section (*ad hoc*)  
2020, 2021 NIH BRAIN Initiative: NRSA Postdoctoral Fellowship (T32) Study Section (*ad hoc*)  
2018, 2020 NIH BRAIN Initiative: Targeted BRAIN Circuits Projects Study Section (*ad hoc*)  
2017 Friedrich Wilhelm Bessel Research Award, Alexander von Humboldt Foundation  
2016, 2018 NIH Neural Differentiation, Plasticity, Regeneration, and Rhythmicity (NDPR) study section (*ad hoc*)  
2014 Murdoch Charitable Trust College Research Program for Life Sciences (*ad hoc*)

**Publications**

1. Brunal, A. A., Clarl, K. C., Ma, M., Woods, I. G., & **Pan, Y. A.** (2021). Effects of constitutive and acute Connexin 36 deficiency on brain-wide susceptibility to PTZ-induced neuronal hyperactivity. *Front Mol Neurosci*, 13(239). doi: 10.3389/fnmol.2020.587978
2. Ates, K. M., Wang, T., Moreland, T., Veeranan-Karmegam, R., Ma, M., Jeter, C., Anand, P., Wenzel, W., Kim, H. G., Wolfe, L. A., Stephen, J., Adams, D. R., Markello, T., Tiffit, C. J., Settlege, R., Gahl, W. A., Gonsalvez, G. B., Malicdan, M. C., Flanagan-Steet, H., & **Pan, Y. A.** (2020). Deficiency in the endocytic adaptor proteins PHETA1/2 impairs renal and craniofacial development. *Dis Model Mech*, 13(5). doi:10.1242/dmm.041913 (Cover Article) <https://www.ncbi.nlm.nih.gov/pubmed/32152089>
3. Ma, M., Ramirez, A. D., Wang, T., Roberts, R. L., Harmon, K. E., Schoppik, D., Sharma, A., Kuang, C., Goei, S. L., Gagnon, J. A., Zimmerman, S., Tsai, S. Q., Reyon, D., Joung, J. K., Aksay, E. R. F., Schier, A. F., & **Pan, Y. A.** (2020). Zebrafish dscaml1 Deficiency Impairs Retinal Patterning and Oculomotor Function. *J Neurosci*, 40(1), 143-158. doi:10.1523/JNEUROSCI.1783-19.2019 <https://www.ncbi.nlm.nih.gov/pubmed/31685652>
4. Ma, M., Kler, S., & **Pan, Y. A.** (2019). Structural Neural Connectivity Analysis in Zebrafish With Restricted Anterograde Transneuronal Viral Labeling and Quantitative Brain Mapping. *Front Neural Circuits*, 13(85), 85. doi:10.3389/fncir.2019.00085 <https://www.ncbi.nlm.nih.gov/pubmed/32038180>
5. Brockway, N. L., Cook, Z. T., O'Gallagher, M. J., Tobias, Z. J. C., Gedi, M., Carey, K. M., Unni, V. K., **Pan, Y. A.**, Metz, M. R., & Weissman, T. A. (2019). Multicolor lineage tracing using in vivo time-lapse imaging reveals coordinated death of clonally related cells in the developing vertebrate brain. *Dev Biol*, 453(2), 130-140. doi:10.1016/j.ydbio.2019.05.006 <https://www.ncbi.nlm.nih.gov/pubmed/31102591>
6. Nakanishi, K., Niida, H., Tabata, H., Ito, T., Hori, Y., Hattori, M., Johmura, Y., Yamada, C., Ueda, T., Takeuchi, K., Yamada, K., Nagata, K. I., Wakamatsu, N., Kishi, M., **Pan, Y. A.**, Ugawa, S., Shimada, S., Sanes, J. R., Higashi, Y., Nakanishi, M. Isozyme-Specific Role of SAD-A in Neuronal Migration During Development of Cerebral Cortex. *Cereb Cortex*. 2018 Oct 11. doi: 10.1093/cercor/bhy253. [Epub ahead of print]. <https://www.ncbi.nlm.nih.gov/pubmed/30307479>
7. Khayrullin, A., Smith, L., Mistry, D., Dukes, A., **Pan, Y. A.**, Hamrick, M. W. (2016). Chronic alcohol exposure induces muscle atrophy (myopathy) in zebrafish and alters the expression of microRNAs targeting the Notch pathway in skeletal muscle. *Biochemical and Biophysical Research Communications*. 2016 Oct 21;479(3): 590–595. <https://www.ncbi.nlm.nih.gov/pubmed/27671199>
8. Beier, K. T.\*, Mundell, N. A.\*, **Pan, Y. A.\***, Cepko, C. L. (2015). Anterograde or Retrograde Transsynaptic Circuit Tracing in Vertebrates with Vesicular Stomatitis Virus Vectors. *Current Protocols in Neuroscience*. 2016 Jan 4;74:1.26.1-1.26.27. (\*equal contributions) <https://www.ncbi.nlm.nih.gov/pubmed/26729030>
9. Mundell, N. A.\*, Beier, K. T.\*, **Pan, Y. A.\***, Lapan, S. W., Aytürk, A. G., Berezovskii, V. K., Wark, A. R., Drokhlyansky, E., Bielecki, J., Born, R. T., Schier, A. F., and Cepko, C.L. (2015) Vesicular stomatitis virus enables gene transfer and transsynaptic tracing in a wide range of organisms. *Journal*



*of Comparative Neurology*, doi: 10.1002/cne.23761. (\*co-first authors)  
<http://www.ncbi.nlm.nih.gov/pubmed/25688551>

10. Weissman, T. A.\* and **Pan, Y. A.\*** (2015) Brainbow: New resources and emerging biological applications for multicolor genetic labeling and analysis. *Genetics*, 199(2):293-306. (cover article) (co-corresponding authors) (review)  
<http://www.genetics.org/content/199/2/293.short>
11. Nie, J., Liu, X., Lilley, B. N., Zhang, H., **Pan, Y. A.**, Kimball, S. R., Zhang, J., Zhang, W., Wang, L., Jefferson, L. S., Sanes, J. R., Han, X. and Shi, Y. (2013). SAD-A Kinase Controls Islet  $\beta$ -Cell Size and Function as a Mediator of mTORC1 Signaling. *PNAS*, 110(34):13857-62.  
<http://www.pnas.org/cgi/pmidlookup?view=long&pmid=23922392>
12. Lilley, B. N., **Pan, Y. A.**, and Sanes, J. R. (2013). SAD kinases sculpt axonal arbors of sensory neurons through long and short-term responses to neurotrophin signals. *Neuron*, 79, 39-53.  
<http://www.sciencedirect.com/science/article/pii/S0896627313004376>
13. **Pan, Y. A.\***, Freundlich, T., Weissman, T. A., Schoppik, D., Wang, X. C., Zimmerman, S., Ciruna, B., Sanes, J. R., Lichtman, J. W. and Schier, A. F.\* (2013). Zebrawow: multispectral cell labeling for cell tracing and lineage analysis in zebrafish. *Development* 140, 2835-46. (cover article) (co-corresponding authors) <http://dev.biologists.org/content/140/13/2835.abstract>
14. Nie, J., Lilley, B. N., **Pan, Y. A.**, Faruque, O., Liu, X., Zhang, W., Sanes, J. R., Han, X. and Shi, Y. (2013). SAD-A Potentiates Glucose-Stimulated Insulin Secretion as a Mediator of Glucagon-Like Peptide 1 Response in Pancreatic beta Cells. *Mol Cell Biol* 33, 2527-34.  
<http://mcb.asm.org/content/33/13/2527.abstract>
15. **Pan, Y. A.**, Caron, S. J., and Schier, A. F. (2012). BAPTI and BAPTISM birthdating of neurons in zebrafish. *Cold Spring Harb Protoc* 2012 Jan 1;2012(1). pii: pdb.prot067520. <http://cshprotocols.cshlp.org/content/2012/1/pdb.prot067520.long>
16. **Pan, Y.A.\***, Choy, M., Prober, D. A., and Schier, A. F.\* (2012). Robo2 determines subtype-specific axonal projections of trigeminal sensory neurons. *Development* 139, 591-600. (co-corresponding authors) <http://dev.biologists.org/content/139/3/591.long>
17. **Pan, Y. A.**, Livet, J., Sanes, J. R., Lichtman, J. W. and Schier, A. F. (2011). Multicolor Brainbow imaging in zebrafish. *Cold Spring Harb Protoc* 2011 Jan 1;2011(1):pdb.prot5546. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3082469/?tool=pubmed>
18. Barnes, A. P., Lilley, B. N., **Pan, Y. A.**, Plummer, L. J., Powell, A. W., Raines, A. N., Sanes, J. R. and Polleux, F. (2007). LKB1 and SAD kinases define a pathway required for the polarization of cortical neurons. *Cell* 129, 549-63. <http://www.cell.com/retrieve/pii/S0092867407003911>
19. Kishi, M.\*, **Pan, Y. A.\***, Crump, J. G. and Sanes, J. R. (2005). Mammalian SAD kinases are required for neuronal polarization. *Science* 307, 929-32. (\*co-first authors)  
<http://www.sciencemag.org/content/307/5711/929.abstract>
20. **Pan, Y. A.** and Sanes, J. R. (2004). Non-invasive visualization of epidermal responses to injury using a fluorescent transgenic reporter. *J Invest Dermatol* 123, 888-91.  
<http://www.nature.com/jid/journal/v123/n5/full/5602542a.html>
21. **Pan, Y. A.**, Misgeld, T., Lichtman, J. W. and Sanes, J. R. (2003). Effects of neurotoxic and neuroprotective agents on peripheral nerve regeneration assayed by time-lapse imaging in vivo. *J Neurosci* 23, 11479-88. (cover article) <http://www.jneurosci.org/content/23/36/11479.long>

