

Fikri Birey, PhD

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EDUCATION & EMPLOYMENT

- 2022 – **Assistant Professor (tenure-track)**, Department of Human Genetics, **Emory University**, Atlanta, GA.
2022 – **Faculty member of Emory graduate programs:** Neuroscience, Genetics and Molecular Biology
2015 – 2021 **Postdoctoral training** (*CHRI fellow, Dean's fellow, AES fellow, NIH K99/R00 awardee*). Department of Psychiatry and Behavioral Sciences, **Stanford University**, Stanford, CA.
2008 – 2014 **Graduate training** (*PhD in Genetics*). Program in Genetics, Departments of Pharmacological Sciences and Neurobiology & Behavior, **Stony Brook University**, Stony Brook, NY.
2004 – 2008 **Undergraduate training** (*BS in Biology with Honors, Minor in Philosophy, Fulbright Scholar*). Department of Molecular Biosciences, **University of Kansas**. Lawrence, KS.

RESEARCH TRAINING

- 2015 – 2021 **Postdoctoral research, Stanford University.** 3D *in vitro* cellular models of human brain development and disease. Advisor: Dr. Sergiu Pasca.
2010 – 2014 **Graduate research, Stony Brook University.** Neuro-glia interactions in rodent models of social stress. Dissertation: "The Loss of NG2+ Glia-Mediated CNS Homeostasis in the Pathophysiology of Depression". Advisor: Dr. Adan Aguirre.
2006 – 2008 **Undergraduate research, University of Kansas.** Genetic programs underlying flower symmetry. Honors thesis: "Diversification of the CYCLOIDEA-dependent flower symmetry developmental program". Advisor: Dr. Lena Hileman.
2006 – 2008 **Undergraduate research, University of Kansas.** Molecular phylogenetics of ray-finned fish. Advisor: Edward O. Wiley.

OTHER TRAINING

- 2017 **4D Advanced Microscopy of Brain Circuits Course.** University of California at Berkeley. Organizer: Zeiss Berkeley Brain Microscopy Innovation Center.
2016 **Using Single-Cell Genomics to Analyze Neurons, Glia, and Circuits Course.** Society for Neuroscience Meeting. Organizer: Steven McCarroll.

AWARDS & SCHOLARSHIPS

- 2017 **Cozzarelli Prize in Engineering and Applied Sciences**, Proceedings of the National Academy of Sciences (awarded for Cao *et al* 2016, *PNAS*)
2017 **Sammy Kuo Award for Excellence in Neuroscience Research** (honorable mention), Stanford University Neuroscience Institute
2013 **Graduate Student Organization Distinguished Travel Award**, Stony Brook University
2013 **A.T. Kearney Scholarship**, Falling Walls Lab, Berlin, Germany
2013 **ISN Meeting Travel Award**, International Society of Neurochemistry, Cancún, Mexico
2006 – 2008 **John L. Howieson Bioscholarship**, University of Kansas
2005 – 2008 **Honor Roll**, University of Kansas
2004 – 2008 **Fulbright Scholarship**, United States Department of State Bureau of Educational and Cultural Affairs

RESEARCH FUNDING

- 2023 – 2026 **SFARI 2022 Genomics of ASD: Pathways to Genetic Therapies Award.** Simons Foundation. *Uncovering molecular and cellular phenotypic convergence across high-risk autism gene variants using forebrain assembloids.* USD \$400,000
- 2019 – 2024 **K99/R00 NIH Pathway to Independence Award.** National Institute of Mental Health. *Investigating the role of TCF4 in human interneuron function and dysfunction.* USD \$88,424 / K99 year (K99 phase: 2019-2021). USD \$250,000 / R00 year (R00 phase: 2021-2024).
- 2018 – 2019 **AES Postdoctoral Research Fellowship.** American Epilepsy Society. *In vitro assembly of forebrain spheroids to study excitation/inhibition.* USD \$50,000.
- 2017 – 2018 **Dean's Postdoctoral Fellowship.** Stanford University School of Medicine. *Using Advanced Light Sheet Microscopy to Map Calcium Dynamics in Human Cortical Spheroids.* USD \$28,000.
- 2015 – 2016 **Child Health Research Institute Postdoctoral Award.** Stanford University School of Medicine. *A novel 3D neural culture platform to study cortical interneurons in neurodevelopmental disorders.* USD \$50,000.

PUBLICATIONS

Preprints

- 2023 Michno WM*, Puno A*, Li L, Everitt A, McCluskey K, **Birey F**, Htun S, Nagar D, Dai Y, Gurwitz E, Willsey J, Pasca AM. *Adrenomedullin promotes interneuron migration in a dual human model for hypoxic interneuronopathy of prematurity.* **BioRxiv** *equal contribution.
- 2023 Kim JI*, Miura Y*, Li MY, Revah O, Selvaraj S, **Birey F**, Meng X, Thete MV, Pavlov SD, Andersen J, Pasca AM, Porteus MH, Huguenard JR and Pasca SP. *Human assembloids reveal the consequences of CACNA1G gene variants in the thalamocortical pathway.* **BioRxiv** *equal contribution.

Peer-reviewed

- 2022 Revah O*, Gore F*, Kelley KW*, Andersen J, Sakai N, Chen X, Li MY, **Birey F**, Yang X, Saw NL, Baker SW, Amin ND, Kulkarni S, Mudipalli R, Cui B, Nishino S, Grant GA, Knowles JK, Shamloo M, Huguenard JR, Deisseroth K, Pasca SP. *Maturation and circuit integration of transplanted human cortical organoids.* **Nature** 610, 319–326
- 2022 **Birey F** and Pasca SP. *Imaging neuronal migration and network activity in human forebrain assembloids.* **STAR Protocols** 3,101478.
- 2022 **Birey F**, Li M, Gordon A, Thete M, Valencia A, Revah O, Pasca AM, Geschwind D, Pasca SP. *Dissecting the molecular basis of human interneuron migration in forebrain assembloids from Timothy syndrome.* **Cell Stem Cell** 2021 Dec 30:S1934-5909(21)00483-5. (Cover Article)
- Preview, "Quickly moving too slowly: Interneuron migration in Timothy Syndrome" **Cell Stem Cell** 3;29(2):181-183
- 2021 Agoglia RM, Sun D, **Birey F**, Yoon SJ, Miura Y, Sabatini K, Pasca SP, Fraser H. *Primate cell fusion disentangles gene regulatory divergence in neural development.* **Nature** 592, 421–427
- 2020 Miura Y, Li MY, **Birey F**, Ikeda K, Revah O, Thete M, Park JY, Puno A, Porteus M, Pasca SP. *Generation of human striatal organoids and cortico-striatal assembloids from pluripotent stem cells.* **Nature Biotechnology** 38, pages 1421–1430
- 2020 Liu J*, Kim YS*, Richardson CE*, Tom A*, Ramakrishnan C, **Birey F**, Katsumata T, Chen S, Wang C, Want X, Joubert LM, Jiang Y, Wang H, Fenno LE, Tok JBH, Pasca, SP, Shen K, Boa Z, Deisseroth K.

Genetically targeted chemical assembly of functional materials in living cells, tissues, and animals.
Science Mar; Vol. 367, Issue 6484. *equal contribution

- 2018 Sloan SA*, Andersen J*, Paşca AM*, **Birey F***, Paşca SP. *Generation and Assembly of Human Brain Region-Specific 3D Cultures.*
Nature Protocols Sep;13(9):2062-2085. *equal contribution (Cover Article)
- 2017 **Birey F**, Kokkosis AG, Aguirre A. *Oligodendroglia-lineage cells in brain plasticity, homeostasis and psychiatric disorders.*
Current Opinion in Neurobiology 23;47:93-103
- 2017 Sloan SA, Darmanis S*, Huber N*, Khan TA, **Birey F**, Caneda C, Reimer R, Quake SR, Barres BA*, Paşca SP*. *Human Astrocyte Maturation Captured in 3D Cortical Spheroids Derived from Pluripotent Stem Cells.*
Neuron 95(4):779-790 *equal contribution
- F1000 recommended
- Best papers of 2016-2017, Neuron
- 2017 **Birey F***, Andersen J*, Makinson CD*, Islam S, Wei W, Huber N, Fan HC, Metzler KRC, Panagiotakos G, Thom N, O'Rourke NA, Steinmetz LM, Bernstein JA, Hallmayer J, Huguenard JR, Paşca SP. *Assembly of functionally integrated human forebrain spheroids.*
Nature 545(7652):54-59. *equal contribution
- News & Views, "Human development: Advances in mini-brain technology" *Nature* 545, 39–40
- Editor's Choice, "Modeling human Brain Development" *Science Translational Medicine* 7;9(393)
- Technology Feature, "Organoids: a better *in vitro* model" *Nature Methods* 14, 559–562
- F1000 recommended
- 2017 Noteworthy Advances in Basic Research, NIH
- Selected as a "Method to Watch", *Nature Methods* 2021
- 2017 Cao Y, Hjort M, Chen H, **Birey F**, Leal-Ortiz SA, Han CM, Santiago JG, Paşca SP, Wu JC, Melosh NA. *Nondestructive nanostraw intracellular sampling for longitudinal cell monitoring.* **PNAS** 114(10):E1866-E1874
- Perspective, "Extracting the contents of living cells" *Science* 356(6336):379-80
- 2015 **Birey F**, Kloc M, Chavali M, Hussein I, Wilson M, Christoffel DJ, Chen T, Frohman MA, Robinson JK, Russo SJ, Maffei A, Aguirre A. *Genetic and Stress-Induced Loss of NG2 Glia Triggers Emergence of Depressive-like Behaviors through Reduced Secretion of FGF2.* **Neuron** 88(5):941-56
- Editor's Choice, "Signals from glia to neurons" *Science Signaling* Vol. 8, Issue 40
- 2015 **Birey F** and Aguirre A. *Age-Dependent Netrin-1 Signaling Regulates NG2+ Glial Cell Spatial Homeostasis in Normal Adult Gray Matter.* **Journal of Neuroscience** 35, 6946-6951

PATENTS

U.S. patent No. 10,676,715. J Andersen, **F Birey**, SP Pasca. "Assembly of Functionally Integrated Human Forebrain Spheroids and Methods of Use Thereof". Licensed by Stem Cell Technologies (Catalog #08620, #08630).

U.S. patent No. 17/641,710. SP Pasca, **F Birey**. "Generation of functional neuromodulatory assembloids from human pluripotent stem cells"

Application No. 63/422,567. SP Pasca, X Chen, **F Birey**. Splicing Modulators for the Treatment of Timothy Syndrome.

ORAL PRESENTATIONS

- 2023 In vitro modeling of human cortical circuit assembly. **Bioinfo Congress IV** (virtual)
- 2023 In vitro modeling of human cortical circuit assembly in health and disease. Stem Cell Seminar Series, **University of Michigan** (virtual)

- 2022 In vitro modeling of human cortical circuit assembly in health and disease. **KAUST**, Saudi Arabia (virtual)
- 2022 Uncovering molecular and cellular mechanism underlying human cortical assembly in development and disease using forebrain assembloids. **UTSA Neuroscience Symposium**, San Antonio, TX
- 2022 In vitro modeling of human cortical circuit assembly in health and disease. **BDCI Organoids Session**, Atlanta, GA
- 2022 In vitro modeling of human cortical circuit assembly. **Hacettepe Neuroscience Seminar Series**, Ankara, Turkey (virtual)
- 2020 In vitro modeling of human cortical circuit assembly. **EMBL Barcelona Postdoc Seminar Series**, EMBL Barcelona, Spain (virtual)
- 2020 Investigating human cortical development and disease using forebrain assembloids. **MSN Seminar Series**, Mount Sinai Department of Neuroscience, New York, NY (virtual)
- 2020 In vitro modeling of human cortical circuit assembly. **King's College London**, UK (virtual)
- 2020 Investigating human cortical development and disease using forebrain assembloids. **Alector**, South San Francisco, CA (virtual)
- 2018 Assembling functional human brain organoids. **Big Ideas on Human Brain Organogenesis Symposium**, Stanford University, Stanford, CA
- 2017 Building Human Brain Models in a Dish. **Cyprus International University**, Nicosia, Cyprus
- 2013 Mood Disorders are Glial Disorders. **TEDxSBU**, Stony Brook, NY
- 2013 Breaking the Wall of Depression through Glia. **Falling Walls Lab**, Berlin, Germany
- 2013 NG2+ glia and CNS homeostasis. **Department of Psychiatry, Stony Brook University School of Medicine**, Stony Brook, NY
- 2012 Ablation of NG2+ cells in the adult recapitulates early NG2 glial development. **Society for Neuroscience Nanosymposium (Cell Lineage and Differentiation)**, New Orleans, LA

SELECTED POSTER PRESENTATIONS (presenter)

- 2019 Birey F, Agoglia RM, Makinson CM, Revah O, Huguenard JR, Sergiu SP. Modeling cortical interneuron development and calcium channel dysfunction in human forebrain assembloids **Development & 3-D Modeling of the Human Brain**, Cold Spring Harbor, NY
- 2019 Birey F, Agoglia RM, Sergiu SP. Using forebrain assembloids to study the role of LTCCs in human cortical interneuron function and dysfunction. **Gordon Directed Cell Migration**, Galveston, TX
- 2018 Birey F, Agoglia RM, Makinson CM, Revah O, Huguenard JR, Sergiu SP. Using forebrain assembloids to study the role of LTCCs in human cortical interneuron function and dysfunction. **Annual Society for Neuroscience Meeting**, San Diego, CA
- 2017 Birey F, Andersen J, Makinson CM, Islam S, Wei W, Fan CH, Metzler KRC, O'Rourke NA, Steinmetz LM, Huguenard JR, Pasca SP. In vitro assembly of spheroids to model human forebrain development and disease. **Development & 3-D Modeling of the Human Brain**, Cold Spring Harbor, NY
- 2016 Birey F, Andersen J, Makinson CM, Islam S, Wei W, Fan CH, Metzler KRC, O'Rourke NA, Steinmetz LM, Huguenard JR, Pasca SP. Modeling human interneuron migration and integration with a novel 3D forebrain culture approach. **Annual Society for Neuroscience Meeting**, San Diego, CA
- 2014 Birey F and Aguirre A. The regenerative potential of NG2+ glia cells in the adult CNS are regulated by environmental cues. **Biennial Meeting of International Society for Developmental Neuroscience**, Montreal, Canada
- 2013 Birey F and Aguirre A. Unraveling the proliferative & lineage potential of NG2+ glia. **Biennial Meeting of International Society for Neurochemistry**, Cancún, Mexico
- 2011 Birey F and Aguirre A. NG2+ glia participates in adult CNS homeostasis. **Annual Society for Neuroscience Meeting**, Washington D.C.
- 2008 Birey F and Hileman L. Comparing the developmental genetic basis for bilateral flower symmetry. **Ecological Genomics Symposium**, Kansas City, MO

TEACHING & MENTORING

- 2023 **Thesis Committee Members:** Yonina Loskove (Genetics & Molecular Biology), Melisa Cadena (Biomedical Engineering)
- 2022 **Faculty Mentoring Workshop Series participant** (Atlanta Society of Mentors), Emory University
- 2020 **Co-organizer & lead instructor**, 1st Stanford Human Brain Organogenesis Workshop
- 2015 – 2019 **Mentoring (Postdoctoral):** Julia Marie Schaepe, Laura Persson, Avin Veerakumar, Juan Botero, Dan Fu, Nicolas Thom
- 2010 – 2014 **Mentoring (Graduate school):** Jagdeep Singh, Tony Chen, Raghil Siddiqui, Michael Wilson, Anthony Wilson, Israa Hussein
- 2008 – 2009 **Graduate teaching:** General Genetics (BIO 320), Techniques in Molecular & Cellular Biology (BIO 311)

SERVICE & OUTREACH

- 2023 **Grant review panel member:** Neural Cell Fate (NCF) 06/2023
- 2018 – **Invited journal reviewer;** *Neurotherapeutics, Trends in Cognitive Sciences, Nature Ecology and Evolution, eLife, Nature Communications, Scientific Reports, Biological Psychiatry*
- 2017 – **External reviewer;** *PTEN research foundation, Wellcome Trust DBT India Alliance, Fondazione Telethon*
- 2021 **Associate Editor**, “Improving In Vitro Modeling of Human Brain with Future Brain Organoids”, *Frontiers in Molecular Neuroscience*
- 2020 **Co-author**, “Studying Human Brain Development and Disease”, Leica Science Labs
- 2019 **Working group member;** NIH Brain initiative at The Brainstorm Project: A Collaborative Approach to Developing the Neuroethics of Bioengineered Brain Modeling Research
- 2014 **Byline**, *Scientific American*, “Rats Experience Feelings of Regret”
- 2014 **Byline**, *Scientific American*, Salon, “Memories Can Be Edited”
- 2013 – 2015 **Member;** Scientific Advisory Committee at Humanology Project, Stony Brook University
- 2007 – 2008 **Member;** Biology Majors Advisory Committee, University of Kansas