Sarah H. Shahmoradian

OrcID: orcid.org/0000-0001-9752-7287
Google Scholar: https://scholar.google.com/citations?user=lU1FofAAAAAJ
D.O.B.: 08.08.1984
Office: OFLC/110, Laboratory for Biomolecular Research, 5232 Villigen PSI
Email: sarah.shahmoradian@psi.ch **Mobile:** +41 77 481 67 10

■ Education

09/2006 – 02/2013 **Baylor College of Medicine, Houston, Texas, USA**
Ph.D., Molecular Physiology and Biophysics

- Date of Ph.D. Certificate: February 10, 2013
- Ph.D. Advisor: Wah Chiu
- Ph.D. Committee: Hui Zheng, Mary Dickinson, Robia Pautler, Michael Schmid, Samuel M.-S. Wu
- Thesis Title: "Structural Characterizations of Aggregating Proteins Relevant to Neurodegenerative Diseases."

09/2002 – 05/2006 **James Madison University, Harrisonburg, Virginia, USA**
B.Sc., Biology

- Neurobiology Research Focus (Neuroanatomy and Imaging)
- Undergraduate Research Advisor: Mark Gabriele

■ Employment History

03/2016 – Present **Principal Investigator**
Laboratory for Biomolecular Research (LBR), Department of Biology and Chemistry (BIO), Paul Scherrer Institut, Villigen, Switzerland

- **Superior/Advisor: Gebhard Schertler**
- Responsible for leading own research at intersection of cryo ptychographic X-ray computed tomography and cryo electron microscopy, primarily focused on brain mechanisms and disease
- Acquired funding for 1 PhD student and 1 Postdoctoral Fellow, and equipment funding (973 kCHF total)
- Remote supervision of an additional PhD student at different campus (University of Basel)

03/2013 – 02/2016 **Roche Post-Doctoral Fellow**
Center for Cellular Imaging and NanoAnalytics (C-CINA), Biozentrum, University of Basel at the Department for Biosystems Science and Engineering (D-BSSE) of ETH Zürich, Basel, Switzerland

- **Superior/Advisor: Henning Stahlberg**
- Responsible for planning and conducting research mainly focused on ultrastructural studies of Parkinson's diseased human brain tissue samples mainly through various electron microscopies (correlative serial block-face scanning electron microscopy SBF-SEM, transmission electron tomography)
- Coordinated cross-validation studies with other teams (STED, CARS/FTIR imaging of tissues, mass spec)
- Direct supervisor of PhD student

09/2007 – 02/2013 **Graduate Researcher**
National Center for Macromolecular Imaging (NCMI), Baylor College of Medicine, Houston, Texas, USA

- **Superior/Advisor: Wah Chiu**
- Responsible for planning and conducting research mainly focused on cryo-electron tomography of proteins relevant to neurodegeneration (Huntingtin, alpha-Synuclein) and developing working protocol for imaging of axons (transportation/communication "highways") of rat neurons

- Trained and supervised junior scientists: new PhD students (2), visiting summer student (1).

05/2005 – 08/2005 **S.M.A.R.T. Research Intern**
Summer Medical And Research Training Program, Baylor College of Medicine**,** Houston, Texas, USA

- **Superior/Advisor: Robia Pautler**
- Responsible for planning and conducting research mainly focused on measuring axonal transport in brain and cardiac changes (ventricular hypertrophy) using magnetic resonance imaging (MRI) of a mouse model of a lysosomal storage disease (Sandhoff's), with and without effects of drug treatment
- Research resulted in 2 poster presentations at an international medical conference (ISMRM)

09/2003 – 05/2006 **Undergraduate Research Assistant**
Department of Biology, Neuroanatomy Laboratory, James Madison University, Harrisonburg, Virginia, USA

- **Superior/Advisor: Mark Gabriele**
- Responsible for conducting research to understand auditory development in cat and mouse using immunohistochemistry, neuroanatomical tract tracing, image processing and data analysis
- Developed algorithm for quantifying and comparing changes in tissue growth patterning
- Trained and supervised junior scientists in lab techniques and mouse brain anatomy

05/2004 – 08/2004 **Summer Research Intern**
School of Medicine, Virginia Commonwealth University, Richmond, Virginia (USA)

- **Superior/Advisor: Kimberle Jacobs**
- Initiated a volunteer internship to gain practical neuroscience experience
- Self-taught IGOR Pro programming language to design macros for detecting and efficiently quantifying different types of epileptic brain activity. My macros continue to be used by the lab.

■ Supervision of Junior Researchers

- Currently responsible for training, designing experiments and supervising PhD student Tri Tran in my own lab, a new postdoctoral fellow in my lab (Iman Rostami) and continuing to supervise and guide PhD student Paula Perez-Navarro at the University of Basel
- Responsible for training, designing experiments and supervising PhD student Paula Perez-Navarro at the University of Basel, during my last year as a postdoctoral fellow there.
- Responsible for training and supervising junior PhD students Boxue Ma, Corey Hecksel, and Bachelor's level summer student Shurui Chen respectively on (1) protein aggregation assays and cryo-EM vitrification of protein-chaperonin complexes, (2) growing neurons on EM grids for cryo-EM analysis, and (3) Tomogram reconstruction, 3-D color segmentation and annotation using Amira software, during my PhD time at the Baylor College of Medicine.

■ Teaching Activities and Invited Lectures

03/2017 **Invited lecture** at University of Zurich by Lawrence Rajendran (Prof. Dr., Head of Cell- and System Biology, Institute for Regenerative Medicine – IREM, University of Zurich) for a Nano Symposium. "Ultrastructural and Biophysical Investigations of Lewy Pathology in Parkinson's Disease." May 3, 2017.

10/2016 **Invited lecture** at Univeristy of Zurich by Anton Gietl (Head of Clinical Trials, Institute for Regenerative Medicine – IREM, University of Zurich, Center for Prevention and Dementia Therapy). "Re-defining the Lewy Body in Human Brain Using Multi-Modal Microscopy." October 17, 2016.

03/2016 **Invited lecture** at ETH Zürich by Roger Schibli (Prof. Dr., Head of the Center for Radiopharmaceutical Sciences ETH-PSI-USZ) for Seminar Day of the Center for Radiopharmaceutical Sciences. "Re-defining the Lewy Body in Human Brain Using Multi-Modal Microscopy." May 13, 2016.

06/2016 **Invited Lecturer, Stereology and Morphometry in Neurosciences Course**
VU Medical Center (Netherlands)

- Lectured to PhD students, postdocs, and research technicians on topics related to advanced electron microscopy techniques (SBF-SEM, FIB-SEM, TEM, immunoTEM) and advanced 3D post-processing and analyses of resulting datasets. Integrated methods for qualitative and quantitative EM analyses and dimensional reconstruction and color segmentation of sub-cellular structures.

09/2015 **Instructor, Block Course *Structural Biology and Biophysics (VV15920)***
University of Basel, Biozentrum (Switzerland)

- Taught and supervised Bachelor's and Master's level university students on theory, examples and aspects of practical usage of serial block face – scanning electron microscopy (SBF-SEM) for biological samples.

■ Active Memberships in Scientific Societies

- Member: **(1)** Society for Neuroscience (SfN); **(2)** Swiss Society for Neuroscience (SSN) part of the Federation of European Neurosciences Societies (FENS); **(3)** Life Sciences Switzerland (LS2); **(4)** Basel Declaration Society; **(5)** Swiss Society for Optics and Microscopy (National Branch of European Microscopy Society); **(6)** Society for Experimental Biology (SEB); **(7)** Biophysical Society

■ Selected Prizes, Awards, Fellowships

- Roche Post-Doctoral Fellowship, via Roche Pharma Research and Early Development: Chemical Biology, Neurosciences Opthamology and Rare Diseases – Discovery Technologies, 03/2013 – 02/2016
- Keck Fellowship, Pre-Doctoral Training Grant in Nanobiology (NIGTP) of the National Institute of Biomedical Imaging and Bioengineering (NIBIB), National Institutes of Health (NIH), 02/2010 – 02/2012
- European Molecular Biology Laboratory (EMBL) Advanced Training Centre Corporate Partnership Programme Fellowship, 05/2011
- Margaret A. Gordon Memorial Scholarship, Excellence in Undergraduate Biological Research, 2006
- Altria Group, Inc. Scholarship (USD 5000 per year) "based in recognition of outstanding scholastic ability, leadership and character as deemed by a committee of independent educators." 09/2002 – 05/2006
- Dow Jones / Richmond Times Dispatch Entrepreneur Award and Scholarship, USD 500 per year, 09/2002 – 05/2005

■ List of Publications

- **Shahmoradian SH**, Tsai EHR, Diaz A, Guizar-Sicairos M, Raabe J, Spycher L, Britschgi M, Ruf A, Stahlberg H, Holler M. "Three-Dimensional Imaging of Biological Tissue by Cryo X-Ray Ptychography." *Sci Rep*. 2017 Jul 24;7(1):6291. doi: 10.1038/s41598-017-05587-4.
- **Shahmoradian SH**, Genoud C, Graff-Meyer A, Hench J, Moors T, Schweighauser G, Wang J, Goldie KN, Suetterlin R, Castano-Diez D, Perez-Navarro P, Huisman E, Ipsen S, Ingrassia A, de Gier Y, Rozemuller AJM, De Paepe A, Erny J, Staempfli A, Hoernschemeyer J, Grosserueschkamp F, Niedieker D, El-Mashtoly SF, Quadri M, van Ijcken WFJ, Bonifati V, Gerwert K, Bohrmann B, Frank S, Britschgi M, Stahlberg H, van de Berg WDJ, Lauer ME. "Lewy pathology in Parkinson's disease consists of a crowded organellar membranous medley." Under review in *Nature Neuroscience*. Published on preprint server, *bioRxiv* 137976; doi: https://doi.org/10.1101/137976
- Pérez-Navarro P, Genoud C, Castaño Díez D, Graff-Meyer A, de Gier A, Lauer ME, Britschgi M, Frank S, Rozemuller AJM, van de Berg WDJ, Stahlberg H, **Shahmoradian SH**. "Corpora amylacea are dense membranous labyrinths containing intact mitochondria and vesicles." *In preparation*.

- Shen K, Calamini B, Fauerbach JA, Ma B, **Shahmoradian SH**, Serrano Lachapel IL, Chiu W, Lo DC, Frydman J. "Control of the structural landscape and neuronal proteotoxicity of mutant Huntingtin by domains flanking the polyQ tract." *eLife*. 2016 Oct 18;5. pii: e18065. doi: 10.7554/eLife.18065.
- Zhao X, Chen XQ, Han E, Hu Y, Paik P, Ding Z, Overman J, Lau AL, **Shahmoradian SH**, Chiu W, Thompson LM, Wu C, Mobley WC. " TRiC subunits enhance BDNF axonal transport and rescue striatal atrophy in Huntington's disease." *Proc Natl Acad Sci U S A*. 2016 Sep 20;113(38):E5655-64. doi: 10.1073/pnas.1603020113.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Shen K, Schmid MS, Frydman JA, Chiu W. "Preparation of Primary Neurons for Visualizing Neurites in a Frozen-hydrated State Using Cryo-Electron Tomography." *J Vis Exp*. 2014 Feb 12;(84):e50783. doi: 10.3791/50783.
- **Shahmoradian SH**, Galaz JG, Cong Y, Khant HA, Schmid MS, Spiess C, Frydman JA, Chiu W. "TRiC's tricks inhibit huntingtin aggregation." *eLife.* 2013 Jul 9;2:e00710. doi: 10.7554/eLife.00710.
- Fauerbach JA, Yushchenko DA, **Shahmoradian SH**, Chiu W, Jovin TM, Jares-Erijman EA. "Supramolecular Non-Amyloid Intermediates in the Early Stages of α-Synuclein Aggregation." *Biophys J.* 2012 Mar 7;102(5):1127-36. doi: 10.1016/j.bpj.2012.01.051.
- Gabriele ML, **Shahmoradian SH**, French CC, Henkel CK, McHaffie JG. "Early segregation of layered projections from the lateral superior olivary nucleus to the central nucleus of the inferior colliculus in the neonatal cat." *Brain Res*. 2007 Oct 10;1173:66-77. Epub 2007 Aug 8.

■ Presentations

- **Sarah H. Shahmoradian**, Christel Genoud, Alexandra Graff-Meyer, Kenneth N. Goldie, Tim Moors, Evelien Huisman, Daniel Castaño-Díez, Rosmarie Sütterlin, Angela Ingrassia, Annemieke J.M. Rozemuller, Anne De Paepe, Johannes Erny, Andreas Staempfli, Joerg Hoernschemeyer, Frederik Großerüschkamp, Daniel Niedieker, Samir F. El-Mashtoly, Marialuisa Quadri, Vincenzo Bonifati, Klaus Gerwert, Bernd Bohrmann, Markus Britschgi, Henning Stahlberg, Wilma D. J. van de Berg, Matthias E. Lauer. "*Identification and Characterization of Lewy Bodies in Human Brain as Lipid-Rich Hallmarks of Parkinson's Disease*." Biozentrum Annual Symposium. January 2017. Abstract and oral presentation.
- **Sarah H. Shahmoradian**, Christel Genoud, Alexandra Graff-Meyer, Kenneth N. Goldie, Tim Moors, Evelien Huisman, Daniel Castaño-Díez, Rosmarie Sütterlin, Angela Ingrassia, Annemieke J.M. Rozemuller, Anne De Paepe, Johannes Erny, Andreas Staempfli, Joerg Hoernschemeyer, Frederik Großerüschkamp, Daniel Niedieker, Samir F. El-Mashtoly, Marialuisa Quadri, Vincenzo Bonifati, Klaus Gerwert, Bernd Bohrmann, Markus Britschgi, Henning Stahlberg, Wilma D. J. van de Berg, Matthias E. Lauer. "*Identification and Characterization of Lewy Bodies in Human Brain as Lipid-Rich Hallmarks of Parkinson's Disease*." Roche Symposium of the Postdoc Fellowship Program. Session: Multi-disciplinary Brain Research and Neuroscience to Explore Neuropathological Diseases. October 12-13, 2015. Copenhagen, Denmark. Abstract, poster, and oral presentation.
- **Sarah H. Shahmoradian**, Christel Genoud, Alexandra Graff-Meyer, Kenneth N. Goldie, Evelien Huisman, Angela Ingrassia, Annemieke J.M. Rozemuller, Anne De Paepe, Johannes Erny, Andreas Staempfli, Joerg Hoernschemeyer, Daniel Niedieker, Samir F. El-Mashtoly, Klaus Gerwert, Bernd Bohrmann, Markus Britschgi, Henning Stahlberg, Wilma D. J. van de Berg, Matthias E. Lauer. "*The Nanostructure of Lewy Bodies: Novel Insights into the Pathological Assemblies and Hallmarks of Parkinson's Disease*." Neuroscience Research Forum (NRF), Roche Innovation Center Basel. April 10, 2015. Basel, Switzerland. Oral presentation.
- **Sarah H. Shahmoradian**, Christel Genoud, Alexandra Graff-Meyer, Kenneth N. Goldie, Evelien Huisman, Angela Ingrassia, Annemieke J.M. Rozemuller, Anne De Paepe, Johannes Erny, Andreas Staempfli, Joerg Hoernschemeyer, Daniel Niedieker, Samir F. El-Mashtoly, Klaus Gerwert, Bernd Bohrmann, Markus Britschgi, Henning Stahlberg, Wilma D. J. van de Berg, Matthias E. Lauer. "*Structural Characterization of Alpha-Synuclein Aggregates in Parkinson's Diseased Human Brain Using 2D/3D Electron Microscopy.*" Roche Symposium of the Postdoc Fellowship Program. October 19-21, 2014. Munich, Germany. Abstract and poster presentation.
- **Sarah H. Shahmoradian**, Christel Genoud, Matthias E. Lauer, Kenneth N. Goldie, Liz Peixoto, Angela M. Ingrassia, Wilma D. J. van de Berg, Bernd Bohrmann, Markus Britschgi, Henning Stahlberg. "*Development of a Technical and Analytical Workflow for Ultrastructural Identification of Pathological Forms of α-Synuclein in Brain*." Roche Symposium of the Postdoc Fellowship Program. October 14-15, 2013. Basel, Switzerland. Abstract and poster presentation.

- **Shahmoradian SH**, Hecksel C, Chen S, Galiano M, Rasband M, Mobley W, Chiu W. "*Structural Investigation of Neurites Using Cryo-Electron Tomography*." Center for NeuroEngineering Annual Symposium, Rice University, Houston, TX. September 14, 2012. Abstract and poster presentation.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Spiess C, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Control and Contain mechanism for Blocking Protein Aggregation in Huntington's Disease*." Society for Neuroscience Conference (SfN), Washington D.C. November 12-16, 2011. Abstract and poster presentation.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Spiess C, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Control and Contain mechanism for Blocking Protein Aggregation in Huntington's Disease*." Keck Annual Research Conference, Rice University. October 6, 2011. Abstract and poster presentation.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Control and Contain Mechanism for Blocking Protein Aggregation in Huntington's Disease*." Molecular Mechanisms of Neurodegeneration, Fifth Conference. University of Milan, Italy. May 13 – 15, 2011. Abstract and poster presentation.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Control and Contain Mechanism for Blocking Protein Aggregation in Huntington's Disease*." Sixth International Congress on Electron Tomography, EMBL Heidelberg, Germany. May 5 – 8, 2011. Abstract and oral presentation.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Spiess C, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Structural Basis of TRiC in Inhibiting Htt Fibril Growth as Revealed by Cryo-Electron Tomography*." Baylor College of Medicine Graduate Symposium. October 28, 2010. Abstract and poster presentation.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Spiess C, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Structural Basis of TRiC in Inhibiting Htt Fibril Growth as Revealed by Cryo-Electron Tomography*." Keck Annual Research Conference, Rice University. October 15—16, 2010. Abstract and poster.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Spiess C, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Structural Basis of TRiC in Inhibiting Htt Fibril Growth as Revealed by Cryo-Electron Tomography*." Biochemistry/Molecular Biology and Pharmacology Research Conference, Baylor College of Medicine. Galveston, TX. October 13—14, 2010. Abstract and poster.
- **Shahmoradian SH**, Galaz-Montoya JG, Cong Y, Spiess C, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Capping Protein Aggregation: Structural Insight on TRiC Chaperonin Interaction with Huntingtin Fibrils*." Platform Presentation Speaker and Poster Presentation. Hereditary Disease Foundation 2010 Meeting: Milton Wexler Celebration of Life. Cambridge, MA. August 4 – 7, 2010.
- **Shahmoradian SH**, Cong Y, Galaz-Montoya JG, Spiess C, Chen B, Khant H, Schmid M, Ludtke S, Frydman J, Chiu W. "*Structural basis of TRiC in inhibiting Htt fibril growth revealed by cryo-electron tomography*." National Institute of Biomedical Imaging and Bioengineering: 2010 Training Grantees Conference. Bethesda, MD. June 24 – 25, 2010. Abstract and poster presentation.
- **Shahmoradian SH**, Khant HA, Fu CJ, Chen BY, Tam S, Frydman J, Chiu W. "*Structural basis of TRiC in inhibiting Htt fibril growth*." NIH Nanomedicine Development Centers 4th Annual Awardee Meeting. April 5 – 8, 2010. Abstract and poster presentation.
- **Shahmoradian SH**, Khant HA, Fu CJ, Chen BY, Tam S, Cong Y, Frydman J, Chiu W. "*How does huntingtin protein form fibrils over time, and how can TRiC be used as therapeutic treatment?"* Protein Folding Machinery 4th Annual Meeting. September 29, 2009. Oral presentation.
- **Shahmoradian SH**, Khant HA, Fu CJ, Chen BY, Spiess C, Frydman J, Chiu W. "*Electron cryo-tomography of Htt fibril*." Protein Folding Center 3rd Annual Meeting at UCSF. April 4-5, 2008. Poster presentation.
- **Shahmoradian SH**, Hu L, Sun Y, Mann D, Pautler RG. 2006. "*MRI Assessment of a Novel Mouse Model of Hypertrophic Cardiomyopathy*." International Society for Magnetic Resonance in Medicine (ISMRM) 14th Scientific Meeting and Exhibition. Abstract and poster presentation.
- **Shahmoradian SH**, Sun Y, Pautler RG. 2006. "*In Vivo Blood-Brain Barrier Permeability Assessment with Mn-Enhanced MRI (MEMRI). International Society for Magnetic Resonance in Medicine (ISMRM) 14th Scientific Meeting and Exhibition*." Abstract and poster presentation.
- Gabriele ML, Fathke RL, **Shahmoradian SH**, French CC, Henkel CK, McHaffie JG. 2006. "*Segregation of multiple layered projections to the central nucleus of the inferior colliculus in the neonatal cat*." *Soc for Neurosci Mtg* 520.6. Abstract and poster presentation.

- Hu L, Sun Y, Sen D, **Shahmoradian SH**, Pautler RG. 2006. "*Early Murine Embryonic Cardiac Hypertrophy Associated with Increased Ganglioside Storage. International Society for Magnetic Resonance in Medicine 14th Scientific Meeting and Exhibition*." Abstract and poster presentation.
- **Shahmoradian SH**, James RL, Simpson NS, Gabriele ML. 2005. "*Banded ephrin-B3 expression patterns in the neonatal rat inferior colliculus*." *Soc for Neurosci Mtg* 942.2. Abstract and poster presentation.
- Gabriele ML, Robenolt J, Laz A, **Shahmoradian SH**, Jaynes CD. 2005. "*Involvement of ephrins and Eph receptors in establishing early pattern formation in the auditory midbrain.*" *Assoc Res Otolaryngol Mtg* 28(1):#690. Abstract and poster presentation.