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NEUROSCIENCE
NEWSLETTER

Georg-August-Universität Göttingen · International Max Planck Research School

The Neuroscience Program...

in Sorrow and Joy

Welcome to the 6th Neuro-Newsletter published by the Göttingen International Master/PhD/MD-PhD Program and International Max Planck Research School (IMPRS) Neurosciences.

While 2017 was the year to look ahead, to write reports and proposals, and to prepare for the next period of a successful study program, 2018 simply threw us back and reminded us how close joy and sorrow can be to each other. While we still had the chance to raise our glasses together in a toast to the successful prolongation of the IMPRS Neurosciences, it was not even one year later that we had to say goodbye to our dear friend and colleague Prof. Dr. Michael Hörner. Michael had been the coordinator of the IMPRS Neurosciences since 2005 and program speaker of the GGNB PhD Program Molecular Physiology of the Brain since 2009. Additionally, he established the electrophysiology training lab at the ENI and was an active organizer of international courses, summer schools, and symposia in the field of neurosciences. We cherish the memories of his kind and generous personality.

One of Michael's last activities in the program was the visit of the opening ceremony of NEURIZONS 2018 and

CONTENT

NEURIZONS Symposium 2018 at the Max Planck Institute for Biophysical Chemistry

Neuroscience in Göttingen...

the awarding of the Otto Creutzfeldt Ph.D. Prize 2018. The biennial NEURIZONS symposium organized by the PhD students of the Neuroscience Program again attracted national and international scientists and alumni to visit Göttingen. Likewise, the ELECTRAIN course in electrophysiology - organized and conducted by Michael and other enthusiastic "Electrainers" in the ENI teaching labs - was successful again, and it makes us happy that the course instructors decided to continue Michael's legacy and offer the course also this year.

The renewal of the IMPRS is of utmost importance for the Neuroscience Program and its continuation. The IMPRS Neuroscience as well as our twin program of the IMPRS Molecular Biology have continuously been successful in attracting high numbers of applicants with an excellent academic quality from all around the world. Still: competition never rests and we will use our chances to further improve the program and select the best candidates to be embedded in an excellent research environment and become a part of our Göttingen Neuroscience family.

The Neuroscience coordination team has been completed again after Dr. Jonas Barth joined us as new scientific coordinator in March this year. Being an alumnus of our program himself and coming from the position of scientific coordinator of the Georg-August University School of Science (GAUSS) which he helped to develop to its current state since late 2015, Jonas brings the best qualifications for the job and is eager to further improve the program.

Work and fun should never be mutually exclusive, so we held our annual PhD retreat and enjoyed some wonderful and hot summer days in the air-conditioned seminar room of the Wälderhaus in Hamburg and enjoyed the city and harbor as balance for an intense scientific program (see article in this newsletter edition). We have started combining the retreats with career sessions at which alumni of various professional backgrounds (academia and private sector) give short presentations about their individual career paths and their current positions. The talks are followed by round-table discussions in a speed-dating format. These events proved to be very successful to bring our PhD students in touch with former members of our program who have already made good progress in their profession.

This summer we will head north again and visit Schloss Etelsen and the city of Bremen.

Sandra Drube
Administrative Coordinator

Jonas Barth
Scientific Coordinator

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Towards novel drugs to treat anxiety

by Olga Babaev

Most of us are familiar with anxiety that may strike before detrimental events. This feeling is normal as long as it is proportional to the event; anxiety experienced by a student the night before an important exam should be milder than this of a soldier before he enters into enemy's territory. Activation of anxiety circuitry is crucial to our survival because it increases alertness during dangerous situations or makes us avoid them altogether. But while the behavior of the soldier who deserts the battlefield out of fear of death is normal, the student who avoids taking exams because of fear of failure may suffer from pathological anxiety.

Luckily for the anxious student, there are available treatments. Benzodiazepines, the most widely used drugs for anxiety-related disorders, enhance inhibitory transmission in the brain network that produces avoidance behavior. In the heart of this network lies a group of interconnected nuclei known as the basal and centromedial amygdala. Amygdala constantly evaluates the environment via processing of sensory information. Inputs that are related to potentially dangerous situations, for example, a smell of a burning pan, will trigger the activation of the amygdala. Like a smoke detector, amygdala (particularly its centromedial part) then will alert the rest of the brain to activate defense mechanisms including freezing, escape or avoidance from entering the danger zone. Benzodiazepines silence the amygdala, which disproportional triggering by very mild or even non-existent danger-related inputs underlies anxiety disorders. The major downside of benzodiazepines is that they impede the neural activity not only of amygdala but of the whole brain – while the student will make it to the exam, he may find it difficult to concentrate on the questions.

Despite the side effects of benzodiazepines, there are currently no better treatments available, mainly due to the poor understanding of the molecular mechanisms underlying anxiety. The goal of my Ph.D. work with Dilja Krueger Burg and Nils Brose was to identify proteins that regulate anxiety-related neural activity, hoping to find pharmacological targets that will offer an alternative to benzodiazepines.

To be efficient, anxiety drugs should predominantly target proteins that acutely regulate both the neural transmission within the amygdala and the anxiety-related behavior. I focused on two synaptic proteins: Neuroligin 2 (Nlgn2) and IgSF9b. Unlike Nlgn2 that had an established role in anxiety in mice and humans, nothing was known about the function of IgSF9b. Nevertheless, we became interested in IgSF9b after an almost accidental discovery that deletion of IgSF9b has a dramatic effect on anxiety.

Using an open field test that measures the time mice spend in anxiogenic center of the field, we showed that Nlgn2 KO mice are anxious because they avoid the center to a far greater extent than their WT littermates. However, this anxiety of Nlgn2 KO mice can be "fixed", or rescued, once we additionally delete IgSF9b. These double KO mice demonstrated a completely normal level of anxiety, suggesting that blocking IgSF9b is a potential approach to treat anxiety.

Next, we asked whether IgSF9b regulates neural transmission in the amygdala. Both counting the number of activated neurons (using the expression of activation marker cFOS) in the amygdala and measuring amygdala activity *in vivo* in mice that explore anxiogenic environment demonstrates that deletion of IgSF9b suppresses the highly activated centromedial amygdala of Nlgn2 KO mice. This downregulation of neural activity happens due to enhanced inhibitory transmission and increased number of inhibitory synapses in IgSF9b KO mice. Most importantly, blocking IgSF9b expression in the centromedial amygdala of adult Nlgn2 KO mice enhances their inhibitory synapses and relieves their anxiety almost as efficiently as congenital KO of IgSF9b. Together, these findings demonstrate that deletion of IgSF9b, that has an acute anxiolytic effect in anxious mice because it puts breaks on the main output region of the amygdala, may be a potential therapeutic approach to anxiety.

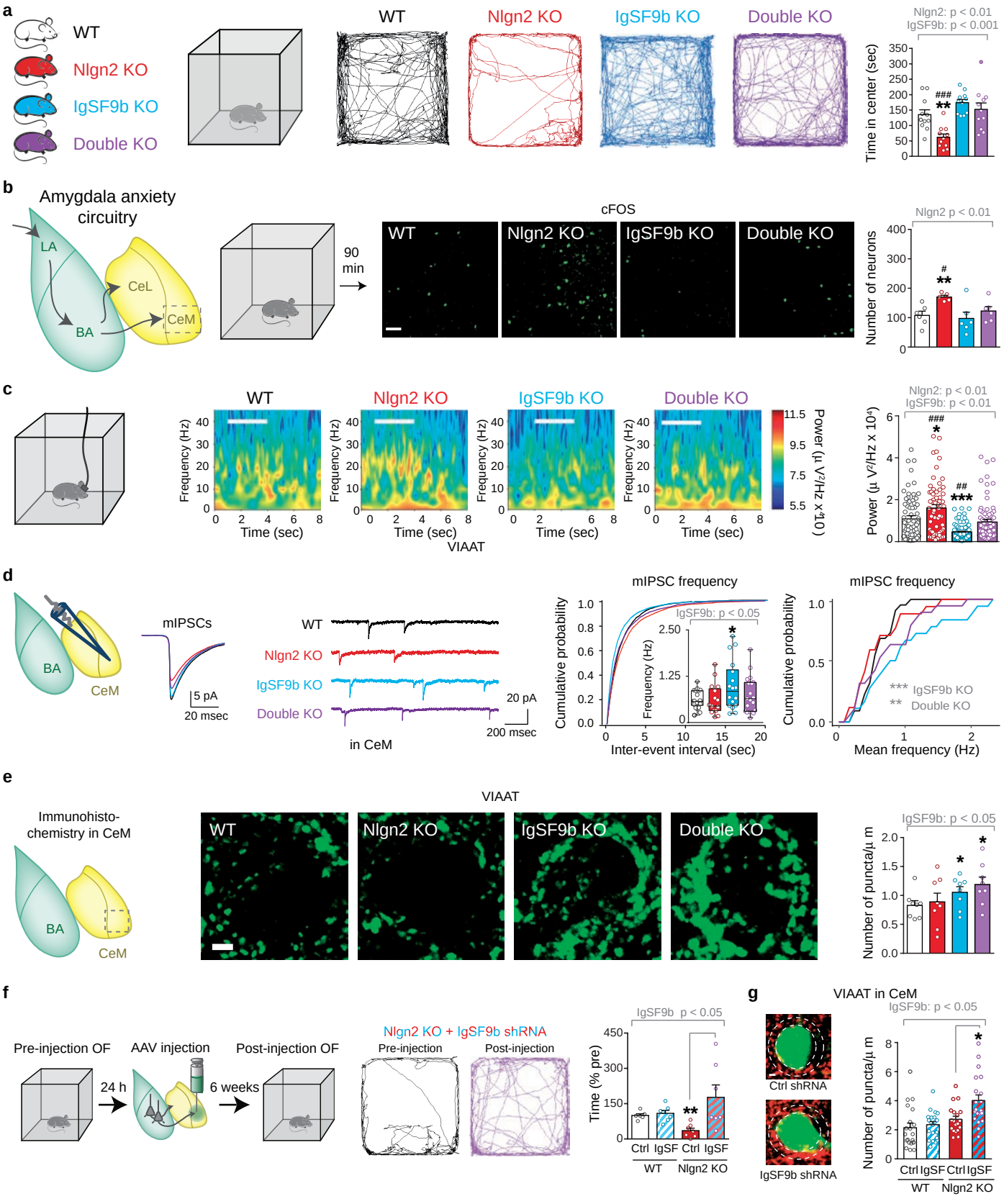
a
WT
Nlgn2 KO
IgSF9b KO
Double KO
Nlgn2: p < 0.01
IgSF9b: p < 0.001
Time in center (sec)
b
Amygdala anxiety circuitry
LA
BA
CeL
CeM
90 min
cFOS
Nlgn2 p < 0.01
Number of neurons
c
Frequency (Hz)
Time (sec)
VIAAT
Power (μ V²/Hz x 10⁴)
d
mIPSCs
5 pA
20 msec
in CeM
20 pA
200 msec
mIPSC frequency
Cumulative probability
Inter-event interval (sec)
Frequency (Hz)
Mean frequency (Hz)
IgSF9b KO
Double KO
e
Immunohisto-chemistry in CeM
Number of puncta/μ m
f
Pre-injection OF
AAV injection
Post-injection OF
24 h
6 weeks
Nlgn2 KO + IgSF9b shRNA
Pre-injection
Post-injection
Time (% pre)
Ctrl
IgSF
WT
Nlgn2 KO
g
VIAAT in CeM
Ctrl shRNA
IgSF9b shRNA

Fig. 1: a, Representative tracks made in the open field and the time spent in the center of the open field of WT, Nlgn2 KO, IgSF9b KO and double KO mice. **b,** cFOS expression in centromedial amygdala (CeM) in mice that were exposed to anxiogenic open field. **c,** local field potentials in CeM of mice during exploration of the open field. The spectrograms show the CeM activity when the mice enter anxiogenic compartment (white line). **d,** patch clamp recording of inhibitory currents in CeM. **e,** quantification of inhibitory marker VGAT puncta in CeM. **f,** injection of AAV-shRNA-IgSF9b into CeM, representative tracks and time spent in the center of the open field of WT+control virus, WT+shRNA, Nlgn2 KO+control virus and Nlgn2 KO+shRNA. **g,** quantification of VGAT puncta in mice after injection of AAV-shRNA-IgSF9b into CeM.

Olga BABAEV completed her doctoral thesis in Nils Brose's department of Molecular Neurobiology at the Max Planck Institute of Experimental Medicine in Göttingen. She was awarded the Minerva Fellowship in 2013. After graduation in 2018, she joined the CNS research department in Böhringer Ingelheim as a post-doctoral researcher.

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References

1. IgSF9b regulates anxiety behaviors through effects on centromedial amygdala inhibitory synapses. Olga Babaev, Hugo Cruces-Solis, Carolina Piletti Chatain, Matthieu Hammer, Sally Wenger, Heba Ali, Nikolaos Karalis, Livia de Hoz, Oliver M. Schlüter, Yuchio Yanagawa, Hannelore Ehrenreich, Holger Taschenberger, Nils Brose & Dilja Krueger-Burg. Nature Communications, 9:540, 2019
2. Inhibition in the amygdala anxiety circuitry. Olga Babaev, Carolina Piletti Chatain & Dilja Krueger-Burg. Experimental & Molecular Medicine, 50:18, 2018
3. Neuroligin 2 deletion alters inhibitory synapse function and anxiety-associated neuronal activation in the amygdala. Olga Babaev, Paolo Botta, Elisabeth Meyer, Christian Müller, Hannelore Ehrenreich, Nils Brose, Andreas Lüthi, Dilja Krueger-Burg. Neuropharmacology, 100, 2016

Brain Illuminatio:

Towards optical probing of brain circuits *in vivo* via holography *by I-Wen Chen*

What is the neuronal wiring diagram underlying activity patterns of synchronous or sequential firing? Can we replay or alter such activity pattern to figure out its causal link to sensation, movement, or cognition? The ability to control the neuronal excitability with millisecond temporal precision and cellular resolution in vivo, however challenging, is necessary for tackling these fundamental problems.

Optogenetics brings about opportunities for brain circuit interrogation via optical control of spike generation by illuminating neurons expressing light-sensitive ion channels, the opsins (1, 2). Two-photon (2P) excitation, providing excellent optical sectioning in the scattering brain tissue (3), is the prerequisite for precise optogenetic activation *in vivo*. With the joint progress of new-generation opsins and amplified laser sources, optical methods are indispensable for millisecond control of optogenetic activation in the living brain (4). So far, two main optical approaches, scanning or parallel, have been demonstrated for 2P optogenetic activation (5). The scanning approach swiftly deflects a diffraction-limited light-spot in a trajectory covering the target soma for actuating opsins sequentially (6, 7). The parallel approach employs a light-pattern, generated via expanded Gaussian beam (8–10) or wavefront-shaping methods of computer-generated holography (CGH; Fig. 1A) (11) or generalized phase contrast (12), covering the target area of one or multiple somata at once. The axial confinement of light-pattern can

be preserved into the brain by integrating temporal focusing (TF) (8–13). The advantage of parallel approach is simultaneous actuation of all opsins under illumination of the desired light-pattern (14), thus permitting fast and precise neuronal activation for opsins of a wider range of channel kinetics (15–17).

My post-doc project, being carried out in an interdisciplinary team led by Prof. Valentina Emiliani (Vision Institute, Paris, France), aims at applying the innovative wavefront-shaping methods for investigating the functional wiring in the mouse visual cortex *in vivo*. Till today, only few studies reported *in vivo* 2P optogenetic activation (7, 9, 10, 18, 19), without sufficient details of its temporal properties. We sought to apply the parallel method of TF-CGH for *in vivo* spike generation for 3 opsins of different channel closing time constants: ReaChR of ~100 ms (20), CoChR of ~30 ms, and ChrimsonR of ~15 ms (21). Using 2P-guided patch recordings in the layer 2/3 neurons of anesthetized mice, we found the illumination conditions enabling action potential induction of <10 ms peak latency and <1 ms jitter for the 3 opsins (Fig. 1B). Spike trains can be precisely induced by repetitive illuminations at the target neuron (Fig. 1C). We demonstrated multi-cell activation in an all-optical manner by simultaneous holographic illumination onto multiple target cells while monitoring cal-

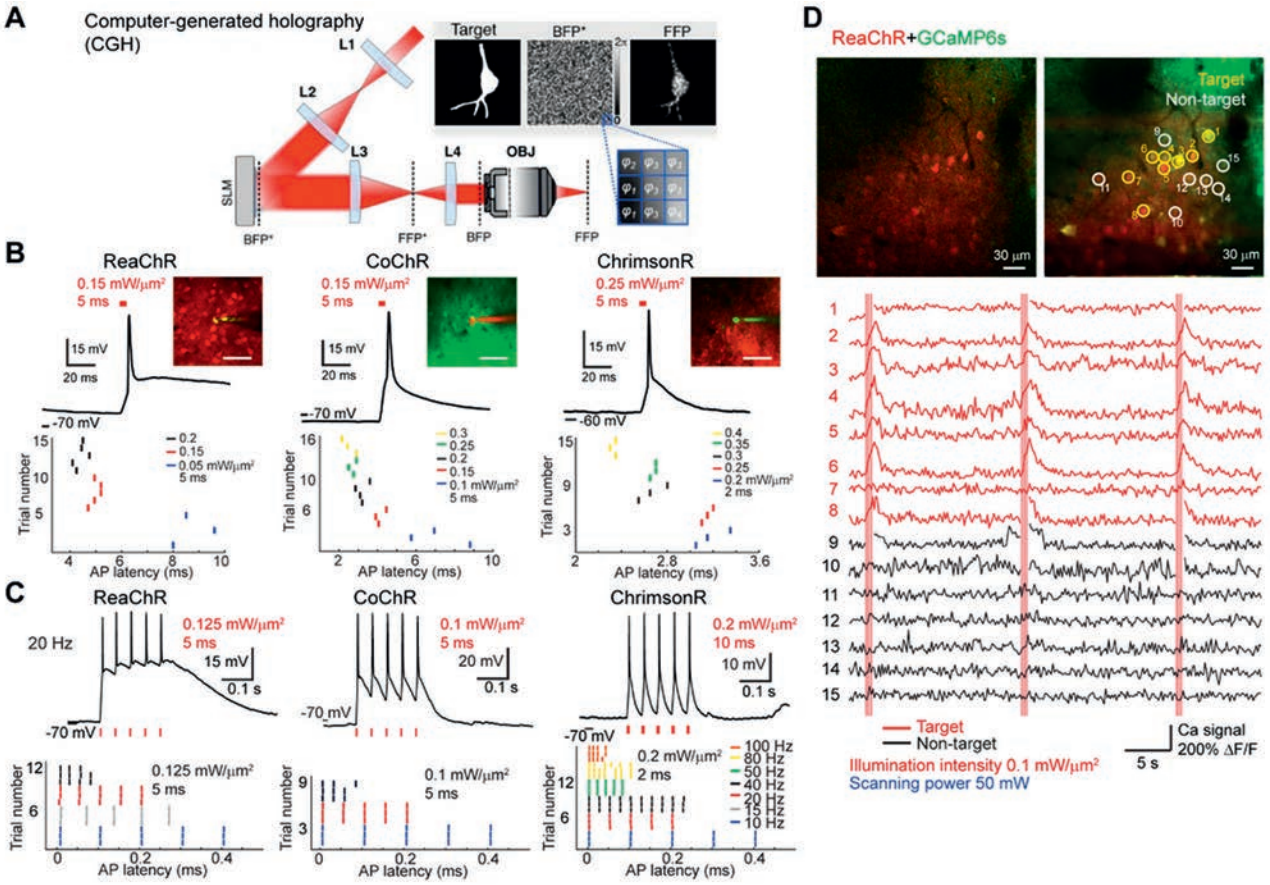
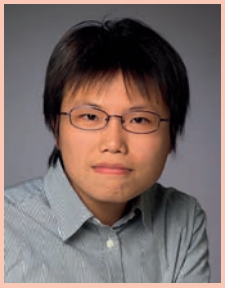


Figure 1: Holographic activation of one or multiple neurons *in vivo*. A) The wavefront-shaping method of CGH achieves intensity modulation at the front focal plane (FFP) via phase modulation at the back focal plane (BFP) using spatial light modulator (SLM). B) Example traces of holography-induced spike for ReaChR, CoChR, ChrimsonR and raster plot upon increasing illumination intensity. C) Holography-induced spike train at 20 Hz for the 3 opsins and raster plots upon different illumination frequencies. D) In the example field-of-field, 8 target cells are stimulated. Their calcium signal and those from nearby non-target cells are presented at the right.

cium signal in a neuronal population expressing both opsins and GCaMP6 (22) in anesthetized and awake mice (Fig. 1D). These results are summarized in a research article in Journal of Neuroscience (23). We are now working towards probing the relationship between neuronal wiring and functional properties, e.g. visual selectivity. In sum, the light-shaping technology of holography provides unprecedent spatiotemporal resolution and precision for brain circuit manipulation (24).

I-Wen CHEN After finishing the Neuroscience Msc program in Goettingen in 2010, I-Wen CHEN did her doctoral thesis in Fritjof Helmchen's laboratory at the Brain Research Institute, University of Zurich. After completing her dissertation, she then joined as a post-doc in Valentina Emiliani's laboratory at Paris Descartes University/Vision Institute. She was awarded a Marie Sklodowska Curie Individual Fellowship in 2017.



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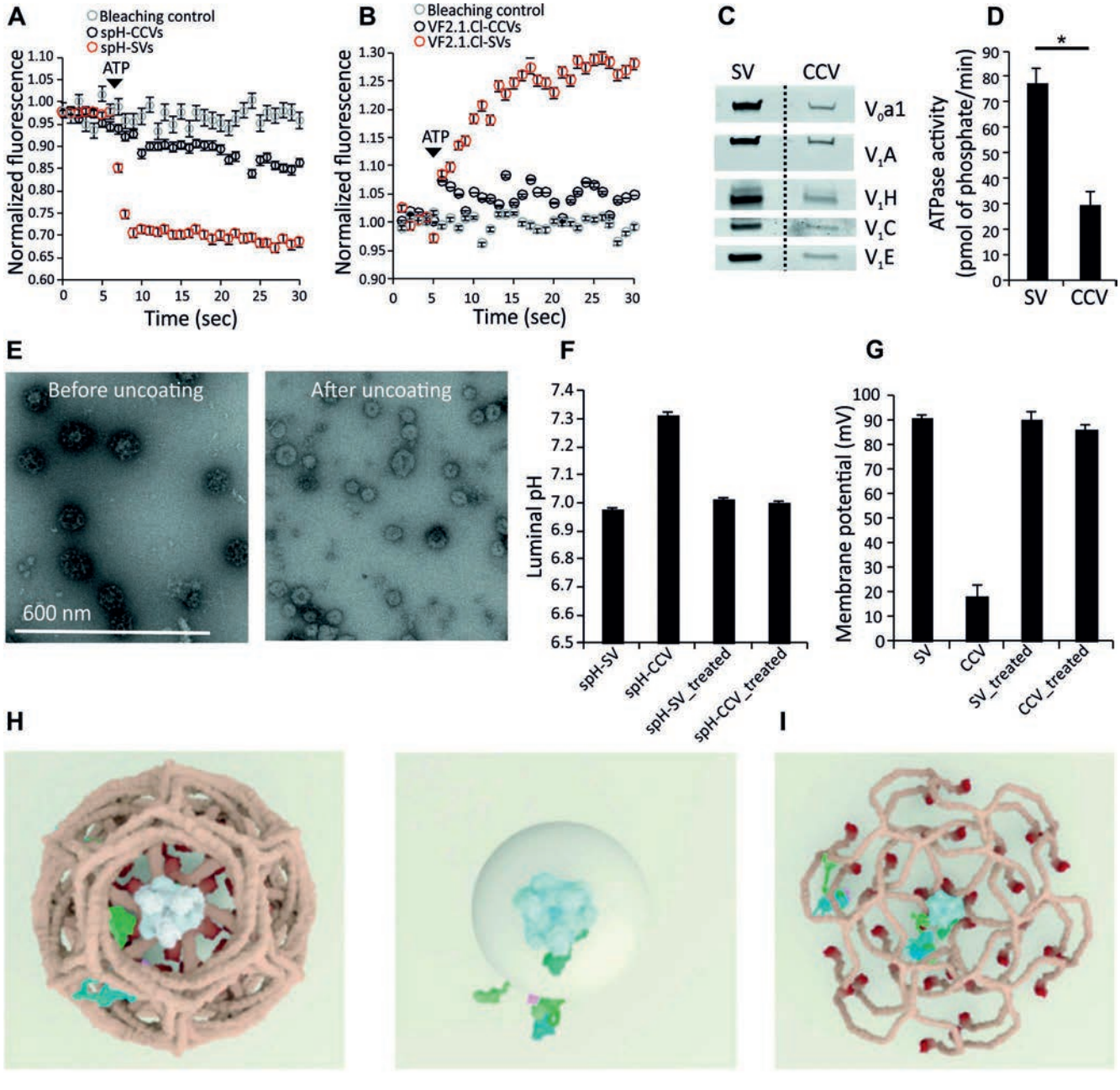
References

1. Boyden ES, Zhang F, Bamberg E, Nagel G, Deisseroth K (2005) Millisecond-timescale, genetically targeted optical control of neural activity. Nat Neurosci 8(9):1263–1268.
2. Emiliani V, Cohen AE, Deisseroth K, Häusser M (2015) All-optical interrogation of neural circuits. J Neurosci 35(41):13917–13926.
3. Helmchen F, Denk W (2005) Deep tissue two-photon microscopy. Nat Methods 2(12):932–940.
4. Papagiakoumou E (2013) Optical developments for optogenetics. Biol Cell 105(10):443–464.
5. Oron D, Papagiakoumou E, Anselmi F, Emiliani V (2012) Two-photon optogenetics (Elsevier B.V.). 1st Ed. doi:10.1016/B978-0-444-59426-6.00007-0.
6. Rickgauer JP, Tank DW (2009) Two-photon excitation of channelrhodopsin-2 at saturation. Proc Natl Acad Sci U S A 106(35):15025–15030.
7. Packer AM, Russell LE, Dalgleish HWP, Häusser M (2015) Simultaneous all-optical manipulation and recording of neural circuit activity with cellular resolution in vivo. Nat Methods 12(2):140–146.
8. Andrasfalvy BK, Zemelman B V, Tang J, Vaziri A (2010) Two-photon single-cell optogenetic control of neuronal activity by sculpted light. Proc Natl Acad Sci U S A 107(26):11981–11986.
9. Rickgauer JP, Deisseroth K, Tank DW (2014) Simultaneous cellular-resolution optical perturbation and imaging of place cell firing fields. Nat Neurosci 17(12):1816–1824.
10. Pegard NC, et al. (2017) Three-dimensional scanless holographic optogenetics with temporal focusing (3D-SHOT). Nat Commun 8(1):1228.
11. Bègue A, et al. (2013) Two-photon excitation in scattering media by spatiotemporally shaped beams and their application in optogenetic stimulation. Biomed Opt Express 4(12):5391–5401.
12. Papagiakoumou E, et al. (2010) Scanless two-photon excitation of channelrhodopsin-2. Nat Methods 7(10):848–854.
13. Papagiakoumou E, et al. (2013) Functional patterned multiphoton excitation deep inside scattering tissue. Nat Photonics 7(4):274–278.
14. Ronzitti E, et al. (2017) Recent advances in patterned photostimulation for optogenetics. J Opt 19(11):113001.
15. Chaigneau E, et al. (2016) Two-photon holographic stimulation of ReaChR. Front Cell Neurosci 10:234.
16. Shemesh OA, et al. (2017) Temporally precise single-cell-resolution optogenetics. Nat Neurosci 20(12):1796–1806.
17. Ronzitti E, et al. (2017) Sub-millisecond optogenetic control of neuronal firing by two-photon holographic photoactivation of Chronos. J Neurosci 37(44):10679–10689.
18. Yang W, Carrillo-reid L, Bando Y, Peterka DS, Yuste R (2018) Simultaneous two-photon imaging and two-photon optogenetics of cortical circuits in three dimensions. Elife 7(e32671):1–21.
19. Mardinly AR, et al. (2018) Precise multimodal optical control of neural ensemble activity. Nat Neurosci 21(6):881–893.
20. Lin JY, Knutsen PM, Muller A, Kleinfeld D, Tsien RY (2013) ReaChR: a red-shifted variant of channelrhodopsin enables deep transcranial optogenetic excitation. Nat Neurosci 16(10):1499–1508.
21. Klapoetke NC, et al. (2014) Independent optical excitation of distinct neural populations. Nat Methods 11(3):338–346.
22. Chen TW, et al. (2013) Ultrasensitive fluorescent proteins for imaging neuronal activity. Nature 499(7458):295–300.
23. Chen I-W, et al. (2018) Parallel holographic illumination enables sub-millisecond two-photon optogenetic activation in mouse visual cortex in vivo. J Neurosci. 39 (18) 3484-3497.
24. Chen I-W, Papagiakoumou E, Emiliani V (2018) Towards circuit optogenetics. Curr Opin Neurobiol 50:179–189.

Crack the Sell

Clathrin Chokes V-ATPase on Synaptic Vesicles *by Zohreh Farsi*

In order to maintain high-fidelity synaptic transmission, newly endocytosed synaptic vesicles (SVs) must accumulate large amounts of neurotransmitters quickly before subsequent exocytosis. It is known that the major endocytic pathways at the presynaptic terminals involves formation of a clathrin coat around the nascent vesicles. Whether newly formed clathrin-coated vesicles (CCVs) can be filled with neurotransmitters has remained unknown. The first and indispensable step in vesicle filling is the formation of a proton electrochemical gradient ($\Delta\mu_{H+}$) across the vesicular membrane by the Vacuolar ATPases (V-ATPase). Thus, to answer the question whether CCVs can be filled with neurotransmitters, we isolated CCVs from mouse brain and



measured the $\Delta\mu_{H+}$ across their membrane using a recently developed single-vesicle imaging approach (Farsi, et al. 2016).

Briefly, we measured ΔpH in CCVs isolated from brains of mice expressing super-ecliptic pHluorin in the vesicular lumen (spH-CCVs), and performed Δψ measurements in CCVs, isolated from the wild-type mouse brains, after labeling with the potentiometric probe VF2.1.Cl. Upon ATP addition, we observed significant impairment of $\Delta\mu_{H+}$ formation in CCVs as compared to SVs. We detected key V-ATPase subunits in both CCVs and SVs by immunoblotting, indicating that lack of acidification is not due to the absence of V-ATPase on the CCVs. Next, we measured the enzymatic ATPase activity in both CCVs and SVs, and observed that CCVs show significantly less ATPase activity compared to the same amount of SVs. One explanation for these results is that intact and functional V-ATPases are present on CCVs but are not able to pump protons most probably due to the clathrin coat. To test this hypothesis, we performed an *in vitro* uncoating assay by treating the CCVs with an alkaline Tris buffer (pH 9.0). Intriguingly, we observed that uncoated vesicles reached the same luminal pH and membrane potential as SVs upon application of ATP. This demonstrates unequivocally that the V-ATPase activity is indeed inhibited in the presence of a fully assembled clathrin coat, and the V-ATPase regains its function once the coat is removed. Based on available structural information, we believe that the steric hindrance provided by the formation of the clathrin coat around the vesicles results in dislocation of one of the key subunits of V-ATPase which in turn would block the activity of the proton pump. In this model, the clathrin coat may conserve ATP at the synapse and allows for V-ATPase function only when the vesicle is properly formed.

Figure 1: Averaged fluorescence traces of single spH-vesicles **(A)** and VF2.1.Cl-labeled vesicles **(B)** over time in response to ATP. **C)** Immunoblots of isolated SVs and CCVs for different subunits of Vo and V1 of the vATPase. **D)** ATPase activity measured in 1.3 µg of isolated SVs and CCVs. **E)** Electron micrographs of negatively stained CCVs before and after uncoating with Tris-buffer (pH 9.0). Luminal pH **(F)** and membrane potential **(G)** of acidified SVs and CCVs before and after treatment with Tris-buffer. **H-I)** Model of V-ATPase block by clathrin ring: solved structures of V-ATPase, clathrin coat and AP2 were used to show how V-ATPase fits within the clathrin lattice. The plasma membrane is depicted in light beige, clathrin triskelia in brown, V-ATPase complex in gray (when inactive) and light blue (when active). As clathrin triskelia are recruited (possibly through AP2), clathrin ring starts building around the V-ATPase complex. Insertion of the last clathrin triskelion would collide with the regulatory H-subunit of V-ATPase **(I)**, thus we hypothesize that the displacement the regulatory H-subunit blocks the V-ATPase activity.

Zohreh FARSI Zohreh FARSI did her doctoral thesis in Reinhard Jahn`s department at the Max-Planck Institute for Biophysical Chemistry, Goettingen. After graduation in 2015, she then joined MDC-BIMSB as a postdoc in the group of Andrew Woehler in Berlin. She was awarded the Otto-Hahn Award from MPI and a postdoctoral fellowship from Peter und Traudl Engelhorn Foundation in 2017. She will join Morgan Sheng's group in the Broad Institute, Cambridge, MA in September 2019.

Touching upon Piezo2 function

Understanding the role of modulatory proteins and membrane lipids in the functioning of Piezo2

by Pratibha Narayanan

The sense of touch is often taken for granted, despite the fact that our our everyday life greatly depends on this sense. The ability to perceive our environment to alert us of danger or to further social interactions, such as mother-child bonding are all essential to our survival. Our sense of touch relies on the conversion of mechanical stimuli to electrical signals (this is known as mechanotransduction), which then travel to the brain to be processed. This task is fulfilled by specific ion channels called Piezo2, which are activated when cells are exposed to pressure and other mechanical forces. These channels can be found in sensory nerves and specialized structures in the skin. These channels help detect physical contact, roughness of surfaces and the position of our body parts.

From this screen we identified another protein namely, myotubularin related protein-2, or Mtmr2 for short. In our work published in 2018 (Narayanan et al., 2018), we have explored the function of mtmr2 in modulating piezo2.

To test if Mtmr2 played a role in mechanotransduction, we studied if changing the levels of mtmr2 in sensory neurons of mice grown in the laboratory, would affect Piezo2 mediated mechanotransduction. We found that when Mtmr2 levels were low, the activity of Piezo2 channels increased. However, when the protein levels were high, Piezo2 channels were inhibited. These results suggest that Mtmr2 can control the activity of Piezo2. In order to further study the molecular basis of mtmr2 function, we explored the known roles of mtmr2. Mtmr2 is known to catalyse conversion of phosphatidyl inositols. It's preferred substrate is phosphatidylinositol (3,5) diphosphate [PI(3,5)P2].

An inhibition of Mtmr2 would be expected to increase PI(3,5)P2. To test if this increase of PI(3,5)P2 lead to the potentiation of Piezo 2, as mentioned earlier, we used Apilimod to counteract increase of PI(3,5)P2 upon Mtmr2 knockdown. Apilimod is a specific blocker of the PI(3,5)P2 synthesizing enzyme PIKfyve (Vaccari et al., 2011). We found that it's application indeed reverses the Piezo2 potentiation seen upon Mtmr2 knockdown. We also found additional evidence that PIP2 directly binds to piezo2 through biochemical bidding assays. Based on our study we proposed a potential mechanism of piezo2 modulation by mtmr2 and pip2, as shown in figure 1.

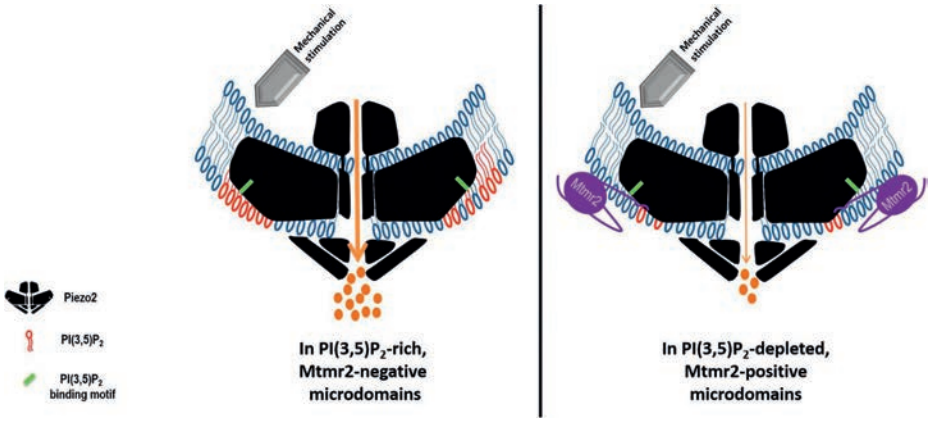


Figure 1: Working model: Local control of Piezo2 function by interdependent actions of Mtmr2 and PI(3,5)P2. Mtmr2 controls the abundance of PI(3,5)P2 by dephosphorylation. Mtmr2 and Piezo2 expression as well as PI(3,5)P2 might be compartmentalized in membrane microdomains. Piezo2 localization in Mtmr2-negative microdomains would facilitate its access to local PI(3,5)P2 and consequently potentiate Piezo2 RA-MA currents (left side). On the other hand, high Mtmr2 levels and its localization in the proximity of Piezo2 would augment PI(3,5)P2 turnover, thereby decreasing local PI(3,5)P2 availability and suppressing Piezo2 RA-MA currents (right side). One could further speculate that Mtmr2, via binding Piezo2, might recruit Piezo2 to membrane microdomains depleted of PI(3,5)P2. This would provide an active mechanism to inhibit Piezo2 RA-MA currents in membrane compartments – may they be at the plasma membrane or intracellular membranes.

This study is the first step towards identifying how the complex sense of touch is mediated by an orchestra of proteins and lipids. This information would be essential not only to understand the sense of touch but also the mechanism of Piezo2 when the skin has become injured or upon inflammation. Understanding the components of the machinery will then be imperative to finding potential targets and therapies for inflammation.

Pratibha NARAYANAN completed her PhD at the Max Plank Institute of Experimental Medicine, in the lab of Dr. Manuela Schmidt. During her PhD, she worked on the characterization of Piezo2, a protein crucial to the sense of touch in mammals.
Currently she is in India, with a non-profit organization, Teach for India, which focuses on education for underprivileged children.

Fellow 2018-2020
Teach For India,
Mumbai

References

1. Coste, B., Mathur, J., Schmidt, M., Earley, T.J., Ranade, S., Petrus, M.J., Dubin, A.E., and Patapoutian, A. (2010). Piezo1 and Piezo2 are essential components of distinct mechanically-activated cation channels. Science 330, 55-60.
2. Coste, B., Xiao, B., Santos, J.S., Syeda, R., Grandl, J., Spencer, K.S., Kim, S.E., Schmidt, M., Mathur, J., Dubin, A.E., et al. (2012). Piezo proteins are pore-forming subunits of mechanically activated channels. Nature 483, 176-181.
3. Hu, J., Chiang, L.-Y., Koch, M., and Lewin, G.R. (2010). Evidence for a protein tether involved in somatic touch. The EMBO journal 29, 855-867.
4. Narayanan, P., Sondermann, J., Rouwette, T., Karaca, S., Urlaub, H., Mitkovski, M., GomezVarela, D., and Schmidt, M. (2016). Native Piezo2 interactomics identifies pericentrin as a novel regulator of Piezo2 in somatosensory neurons. Journal of Proteome Research 15, 2676-2687.
5. Narayanan P., Hütte M., Kudryasheva G., Taberner FJ., Lechner SG., Rehfeldt F., Gomez-Varela D., Schmidt M. (2018). Myotubularin related protein-2 and its phospholipid substrate PIP2 control Piezo2-mediated mechanotransduction in peripheral sensory neurons. Elife. 2018 Mar 9;7.
6. Poole, K., Herget, R., Lapatsina, L., Ngo, H.-D., and Lewin, G.R. (2014). Tuning Piezo ion channels to detect molecular-scale movements relevant for fine touch. Nature communications 5, 3520.
7. Qi, Y., Andolfi, L., Frattini, F., Mayer, F., Lazzarino, M., and Hu, J. (2015). Membrane stiffening by STOML3 facilitates mechanosensation in sensory neurons. Nature Communications 6, 8512.
8. Vaccari, I., Dina, G., Tronchere, H.l.n., Kaufman, E., Chicanne, G.t., Cerri, F., Wrabetz, L., Payrastre, B., Quattrini, A., Weisman, L.S., et al. (2011). Genetic interaction between MTMR2 and FIG4 phospholipid phosphatases involved in Charcot-Marie-Tooth neuropathies. PLoS Genetics 7.
9. Wetzel, C., Hu, J., Riethmacher, D., Benckendorff, A., Harder, L., Eilers, A., Moshourab, R., Kozlenkov, A., Labuz, D., Caspani, O., et al. (2007). A stomatin-domain protein essential for touch sensation in the mouse. Nature 445, 206-209.

Students

Current

Master's class 2017/18

Irene Melati Aji Indonesia, BSc from Philipps University Marburg, Germany

Aishwarya Bhonsle India, MSc from University of Bristol, UK

Tony Carricarte Cuba, BSc from University of Havana, Cuba

Daniela Doda Albania, BSc from University of Genoa, Italy

Delane Espinueva Canada, BSc from University of British Columbia, Canada

Conor Heins USA, BSc from Swarthmore College, USA

Hendrik Heiser Germany, BSc from Georg August University Göttingen, Germany

Inés Hojas García-Plaza Spain, BSc from Universidad Autónoma de Madrid, Spain

Anna Marie Müllen Germany, BSc from Georg August University Göttingen, Germany

Dmytro Nesterenko Ukraine, MSc from Taras Shevchenko University of Kyiv, Ukraine

Tarana Nigam India, BTech from VIT University Vellore, India

Melanie Nuesch Germano Uruguay, BSc from Universidad de la República, Uruguay

Adrián Palacios Muñoz Mexico, BSc from Universidad Autónoma de Nuevo León, Mexico

Sabine Rannio Germany, BSc from University of Bristol, UK

Marina Slashcheva Russian Federation, BSc from St. Petersburg State University, Russian Federation

Jesse St. Amand USA, BSc from Arizona State University, USA

Yannan Su P.R. China, BSc from Nanjing University, P.R. China

Mariia Zeziulia Ukraine, BSc from Taras Shevchenko University of Kyiv, Ukraine

Applications 2017

In the year 2017, the Neuroscience program received 420 applications from 72 countries.

Germany 23
other Western Europe 32
Eastern Europe 10
North America 21
Central/South America 25
North Africa 29
Central/South Africa 42
Asia / Near East 77
Central Asia / Far East 156
Australia 1

Master's class 2018/19

Hebatallah Abdelrasol Egypt, BSc from Helwan University, Egpyt

Mohammed Abdelwahab Osman Mohammed Sudan, MBBS from University of Khartoum, Sudan

Lukas Amann Germany, BSc from Georg August University Göttingen, Germany

Mathis Baßler Germany, BSc from University of Heidelberg, Germany

Jasmina Bier Germany, BSc from Jacobs University Bremen, Germany

Max Crayen Germany, BSc from Johannes Gutenberg University Mainz, Germany

Julia Dziubek Poland, BSc from University of Wroclaw, Poland

Jonas Hemesath Germany, BSc from Georg August University Göttingen, Germany

Nare Karagulyan Armenia, BSc from Yerevan State University, Armenia

Priyanka Kislai India, MSc from St. Xavier's College, Mumbai, India

Anna Liashenko Ukraine, BSc from Taras Shevchenko National University of Kyiv, Ukraine

Selene Lickfett Germany, BSc from Ulm University, Germany

Yifan Mayr P.R. China, BSc (double degree) from Johannes Kepler University Linz, Austria / University of South Bohemia, Czech Republic

Tor Memhave Denmark, BSc from University of Copenhagen, Denmark

Aditi Methi India, BS-MS (dual degree) from Indian Institute of Technology Madras, Chennai, India

Andrew Sasmita Indonesia, BSc from International Medical University, Malaysia

Patricia Schikorra Germany, BSc from University Duisburg-Essen, Germany

Ivan Skorodumov Russian Federation, Pharmacy Specialist from Lomonosov Moscow State University, Russian Federation

Applications 2018

In the year 2018, the Neuroscience program received 481 applications from 70 countries.

Germany 37
other Western Europe 30
Eastern Europe 9
North America 21
Central/South America 30
North Africa 24
Central/South Africa 64
Asia / Near East 82
Central Asia / Far East 183
Australia 1

New Students

PhD projects started in 2017 and 2018

Heba Ali
Role of novel Neuroligin2-interacting proteins in amygdala fear and anxiety circuits
Nils Brose,
Camin Dean,
Hannelore Ehrenreich

Yunus Can Erol
Encoding of Global Motion Signals in the Mammalian Retina
Tim Gollisch,
Stefan Treue,
Jan Clemens

Madhura Ketkar
Network dynamics of the *Drosophila* brain
Marion Silies,
Tim Gollisch,
Viola Priesemann

Theocharis Alvanos
Quantitative Molecular Physiology of Active Zones at Calyceal Synapses of the Auditory Pathway
Tobias Moser,
Silvio Rizzoli,
Erwin Neher

Burak Gür
Synapse specific analysis of circuit functioning
Marion Silies,
Silvio Rizzoli,
Jan Clemens

Henry Klemp
Establishing parameters for the characterization of neurometabolic and neurodegenerative dieseases using mass-spectroscopy based Metabolomics
André Fischer,
Klaus-Armin Nave,
Jutta Gärtner

Tal Dankovich
Imaging the brain in time: molecular mechanisms of long-lasting synaptic plasticity
Silvio Rizzoli,
Oliver Schlüter,
André Fischer

Dimokratis Karamanlis
How nonlinear processing shapes natural stimulus encoding in the retina
Tim Gollisch,
Alexander Gail,
Marion Silies

Ronja Markworth
Role of protein-protein interactions and posttranslational modifications of presynaptic proteins in the regulation of calcium-triggered exocytosis
Mathias Bähr,
Silvio Rizzoli,
Reinhard Jahn

Students New

Sebastian Molina Obando
ON and OFF pathway interactions in the *Drosophila* visual system
Marion Silies,
André Fiala,
Tim Gollisch

Jenifer Rachel
Inhibitory feedback connectivity of supragranular VIP cells to layer IV target neurons: postsynaptic cell-type specificity and impact of presynaptic firing patterns
Jochen Staiger,
Camin Dean,
Oliver Schlüter

Elsa Steinfath
Neural basis of acoustic communication in *Drosophila*
Jan Clemens,
Marion Silies,
Viola Priesemann

Helena Maria (Linda) Olsthoorn
Ionic mechanisms of vesicular neurotransmitter transporters
Reinhard Jahn,
Tobias Moser,
Ira Milosevic

Alejandro Restrepo Arango
Oligodendroglial communication of axonal activity to the vasculature
Klaus-Armin Nave,
Susann Boretius,
Nuno Raimundo

Agnes Steixner
Phenotype-based genetic association studies - from myelin to cognition
Hannelore Ehrenreich,
Susann Boretius,
Walter Paulus

Sonja Pribicevic
Molecular mechanism of the kinetics of SNAREs
Reinhard Jahn,
Tobias Moser,
Marina Rodnina

Nikoloz Sirmpilatze
Influence of anesthesia on brain function, metabolism and blood perfusion – implications for preclinical neuroimaging
Susann Boretius,
Jochen Staiger,
Hansjörg Scherberger

Chrystalleni Vassiliou
The role of the TRPV1 channel and OLM interneurons in Sharp-wave ripples, place maps and spatial memory
Camin Dean,
Hansjörg Scherberger,
Tobias Moser

Graduated Students

The Masters of 2017 and 2018

Heba Ali
(*A. Fischer*) Effect of Glia-mediated Immune Responses on the Neuronal Transcriptome

Theocharis Alvanos
(*T. Moser*) The role of RIM-binding proteins at the Endbulb of Held synapse of the auditory pathway

Çağatay Aydın
(*M. Silies*) Characterization of visual wide-field neurons in Drosophila

Allison Barry
(*M. Schmidt*) Modulation of TRPV1 by Interaction Partners

Tizibt Bogale
(*K.-A. Nave*) Oligodendrocytes as modifiers of disease progression in a mouse model of inherited Amyotrophic Lateral Sclerosis (ALS)

Tal Dankovich
(*S. Rizzoli*) Super Resolution Imaging of Synaptic Plasticity in Cultured Hippocampal Neurons

Yunus Can Erol
(*T. Gollisch*) Effect of receptive field surround on luminance dependent ON-OFF response changes in mouse retinal ganglion cells

Elisabeth Fritsch
(*S. Rizzoli*) Developing a Correlative Light and Electron Microscopy approach for studying the role of neuronal membrane glycolipid protein nmgp-1 in synaptic pruning in *C. elegans*.

Burak Gür
(*M. Silies*) Molecular mechanisms shaping functional properties of early visual processing

Alina Heukamp
(*T. Gollisch*) Establishing a two-photon microscope setup to study the effects of acetylcholine on response properties of distinct types of retinal ganglion cells

Nehal Johri
(*H. Scherberger*) Effective connectivity of the macaque grasping network: Granger causality analysis of resting-state fMRI

Dimokratis Karamanlis
(*T. Gollisch*) Spatial integration in mouse retinal ganglion cells

Danai Katsere
(*M. Bähr*) Chapter 1: TrkB-dependent re-routing of the CaSR into late endosomes - Chapter 2: Rab7 mutations potentially affect vesicle trafficking speeds and recruitment of EndophilinA2, a proposed component of the retromer complex

Henry Klemp
(*T. Friede*) Metabolomics in rare neurological diseases

Ima Mansori
(*T. Bayer*) Assessing the Preventive Potential of Cannabidiol on Alzheimer's Disease Pathology

Ronja Markworth
(*C. Dean*) The Effect of Co-activation on Endosomal Sorting of TrkB and CaSR

Sebastian Molina Obando
(*M. Silies*) Molecular mechanisms that shape ON responses in the *Drosophila* visual system

Vasyl Mykytiuk
(*N. Brose*) Regulation of mice reward-seeking behavior and locomotion by optogenetic stimulation of dopaminergic inputs from the ventral tegmental area to the lateral septum and the lateral hypothalamus

Helena Maria (Linda) Olsthoorn
(*R. Jahn*) Reconstitution and Functional Characterization of the Vesicular GABA Transporter

Carolina Piletti Chatain
(*N. Brose*) Region-specific Roles of Nlgn2 and lgSF9b in the Anxiety Circuitry

Students Graduated

Sonja Pribicevic
(*H. Kawabe*) The role of HECT-type E3 ligases in developing neurons

Juan Diego Prieto
(*T. Moser*) Evaluation of the role of the CaV1.3 Ca^{2+}-channel in the calcium current of rod bipolar cells of the mouse retina

Jenifer Rachel
(*J. Staiger*) Optogenetic Characterization of Calretinin or CCK expressing VIP interneuron projections in primary somatosensory cortex of mouse

Alejandro Restrepo Arango
(*A. Flügel*) Role of pericytes in regulating the blood-brain barrier in homeostasis in adult brain

Yasmine Shorafa
(*A. Antal*) The Effects of Concurrent Finger Movements on Transcranial Alternating Current Stimulation (tACS)-Induced Aftereffects

Nikoloz Sirmpilatze
(*S. Boretius*) The temporal stability of BOLD fMRI measurements in medetomidineanesthetized rats

Elsa Steinfath
(*M. Silies*) Glial Ca^{2+} activity in the visual system of *Drosophila melanogaster*

Agnes Steixner
(*H. Ehrenreich*) Phenotype-based genetic association studies on myelin-genes in neuropsychiatric diseases

Clara Tepohl
(*T. Gollisch*) Chronic functional imaging of dendritic spines in the ferret primary visual cortex

Diana Toscano Tejeida
(*M. Wilke*) Neural Variability Quenching and its Relation to Cognitive Performance in Young and Old Adults

Özge Uslu
(*A. Pooresmaeili*) The Effect of Subliminal Reward Signals on Sensory-Motor Processing

Juan Felipe Vargas Fique
(*M. Silies*) The role of GABAergic and glutamatergic fast inhibitory transmission in the *Drosophila* ON visual pathway

Chrystalleni Vassiliou
(*C. Dean*) Investigating the Role of the TRPV1 channel and OLM interneurons in Sharp-Wave Ripples

Kwok Yui Reymond (Tony) Yip
(*N. Brose*) Probing the Neural Circuits of Anxiety in Nlgn2 Knockout Mice using Whole-Brain Activity Mapping

Deniz Yüzak
(*M. Silies*) Spatio-temporal receptive field properties of direction selective cells in *Drosophila*

Yu Zhao
(*A. Fischer*) DNA hydroxymethylation changes accompany the formation and maintenance of memory

Lin Zhou
(*A. Gail*) Training Recurrent Neural Networks for Reaching Tasks

Students
Graduated

The Doctors of 2017 and 2018

Tamer Abdelaal
Schwann cell differentiation in Charcot-Marie-Tooth disease 1 A (CMT1A)
Michael Sereda,
Wolfgang Brück,
Alexander Flügel

Erika Avendaño Guzmán
Evaluating the function of the Aryl Hydrocarbon Receptor in CNS autoimmunity
Wolfgang Brück,
Klaus-Armin Nave,
Alexander Flügel

Olga Babaev
Role of Adhesion Proteins Neuroligin 2 and IgSF9b in the Amygdala Anxiety Circuitry
Nils Brose,
Camin Dean,
Hannelore Ehrenreich

Tanvi Butola
Molecular physiology of signal transmission along the auditory pathway
Tobias Moser,
Erwin Neher,
Thomas Dresbach

Guergana Dontcheva
Functional analysis of the parkinsonism-associated protein FBX07 (PARK15) in neuronsn
Judith Stegmüller,
Nils Brose,
Anastassia Stoykova

Diego Giraldo Sánchez
Linking senses: the genetics of *Drosophila* larval chordotonal organs
Martin Göpfert,
André Fiala,
Manuela Schmidt

Sindhuja Gowrisankaran
Molecular mechanisms of synaptic vesicle recycling with a focus on Endophilin A and Rabconnectin-3a
Ira Milosevic,
Reinhard Jahn,
Nils Brose

Mohammad Hossein Khani
Mechanisms of color processing in the retina
Tim Gollisch,
Tobias Moser,
Siegrid Löwel

Sabitha Joseph
A novel role for the E3 ubiquitin ligase FBXO7 in axon-myelin interaction
Judith Stegmüller,
Wolfgang Brück,
Klaus-Armin Nave

Amr Maamoun
Receptive Field Characterization in MSTd Neurons
Stefan Treue,
Melanie Wilke,
Tim Gollisch

Florentin Masurat
Control of sleep through sleep-active neurons
Henrik Bringmann,
Ralf Heinrich,
Nils Brose

Students Graduated

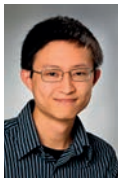
Sharlen Moore Corona
The role of oligodendrocytes in higher-order circuit functions
Klaus-Armin Nave,
Mikael Simons,
Swen Hülsmann

Ahmad Nazzal
Visual and Auditory Perceptual Decision-Making in The Human Brain as Investigated by fMRI and Lesion
Melanie Wilke,
Mathias Bähr,
Tobias Moser

Julia Sondermann
Identification and characterization of protein complexes involved in different pain states in vertebrates
Manuela Schmidt,
Martin Göpfert,
Henning Urlaub

Ramanathan Narayanan
BAF155 regulates the genesis of basal progenitors through both Pax6-dependent and independent
Jochen Staiger,
André Fischer,
Klaus-Armin Nave

Dennis Nestvogel
Electrophysiological Analysis of the Synaptic Vesicle Priming Processt
Nils Brose,
Erwin Neher,
Thomas Dresbach



Man Ho Wong
Synapse refinement in mouse visual cortex during development
Oliver Schlüter,
Siegrid Löwel,
Tobias Moser

Pratibha Narayanan
Touching upon regulators of Piezo2 in mouse somatosensation
Manuela Schmidt,
Martin Göpfert,
Luis Pardo

Julio Santos Viotti
The presynaptic protein Mover buffers synaptic plasticity at the hippocampal mossy fiber synapse
Thomas Dresbach,
Tobias Moser,
Michael Müller

King Faisal Yambire
Lysosomal and mitochondrial crosstalk: the role of lysosomal signaling on mitochondrial biogenesis and function
Ira Milosevic,
André Fischer,
Klaus-Armin Nave

The circle of academic life

by Tanvi Butola

Göttingen was my home for seven years, 2011-2018. I joined the IMPRS-Neuroscience program as a Master's student and stayed on to pursue doctoral research in Prof. Tobias Moser's lab. Six months ago, I started a new phase in my academic career as a postdoctoral research fellow in Dr. Jayeeta Basu's lab at the New York University Medical Center (NYUMC) in New York City.

Dr. Basu's lab focuses on synapses, circuits, and learning within the hippocampus-entorhinal cortex network. Much of the lab focuses on how the sensory input from entorhinal cortex influences memory and spatial navigation (place cell) function in the hippocampus.

I have a slightly different approach. I look at how the hippocampus reciprocally feeds back into the entorhinal cortex to shape cortical sensory processing. My work asks how 'real-time' sensory information is processed in the context of long-term memories of past experiences. The aim is to decipher the circuit principles that allow for quick adaptation of behaviour in response to changing environmental demands.

Another project that I have taken up here is in collaboration with the Comprehensive Epilepsy Center at the NYUMC. I have access to resected human hippocampal tissue from patients with refractory medial temporal lobe epilepsy. I record from acute human hippocampal slices as a means to validate the applicability of the circuit dynamics derived from rodent experiments in humans. Here, my aim is to establish the connectivity, synaptic strength, dendritic integration, and plasticity rules governing the human hippocampus-entorhinal cortex connection.

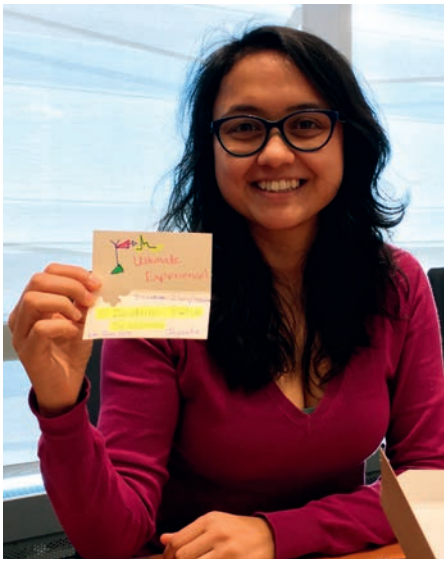
My PhD in Göttingen was a perfect starting point to delve into the field of circuit function. During my PhD I worked on synaptic transmission. I used giant synapses of the auditory system, like the calyx and endbulb of Held, as model systems to study the molecular players involved in signal transfer between neurons. I investigated how a single synapse functions and how the pre-synapse is coupled to the post-synapse to bring about time-locked reliable signal transmission. My focus was a single synapse.

In my first year of PhD, I attended the Gordon Research Conference for Synaptic Transmission in the US. It is a close-knit conference attended by, at most 200 people dedicated to the research topic. You spend a week in a far-off retreat spot, away from civilization for an absolute immersion in science. In the span of a week you meet all the giants in the field in a casual setting, free to approach anyone with your questions. You can talk about the latest developments in vesicle retrieval or neurotransmitter release while choosing the ingredients for your omelette.

This is where I met Dr. Jayeeta Basu in 2014. She was then a post-doc in Dr. Steven Siegelbaum's lab at Columbia University. She presented her research on the newly discovered long-range inhibitory input from the entorhinal cortex into the hippocampus, and how it modulates coding and learning behaviour. Her talk and her research fascinated me. I spoke to her after her talk and at my poster. Her meticulous dissection of the balance of individual synaptic excitation and inhibition dictating the output of a circuit gave me a sense of future

Lab brunch and Christmas gift exchange 2018

direction to build upon my current initiation into the field of synaptic transmission.



My Christmas gift from Jayeeta. (A, in hand) The Ultimate Experiment- a coupon for three 2-hour dendritic patch sessions. (B, on the face) Happy me.

Two years later in 2016, I was wrapping up my doctoral thesis. The same year Dr. Basu published her work, some of which she had already present at the 2014 conference. Her study again ignited in me several questions and ideas. What does the micro-circuit look like that is manipulated by long-range inhibition? How does the timing of signal transmission between synapses influence the dynamics of circuit function? How would a synaptic discrepancy (impairment of neurotransmitter release or Ca^{2+} channel or vesicle recycling) affect the local and hetero-synaptic plasticity, circuit output, and animal's learning behaviour? I was thinking of ways to extend my knowledge of a single synapse function to a collection of synapses: a neuronal circuit.

With this in mind, I reached out to Dr. Basu with my questions and ideas. She had just started her group at the Neuroscience Institute in the NYUMC. Several email exchanges later we arranged to meet at SFN in November 2016. We had a very stimulating discussion about the open questions in her lab and about my ideas. This was followed up several Skype meetings, more emails, interviews with other labs, intense discussions with my doctoral mentors, all culminating in a big dilemma about which direction to choose.

The questions researched by the Basu lab were close to my research interests. In the end, I decided to join Dr. Basu's lab to be a part of a dynamic new lab. I wanted to be a part of the initial phase of the development of the lab: establishing a lab, procuring equipment and start-up grants, attracting and getting good scientists to join a new lab, forging collaborations, balancing bench work, and administrative responsibilities. One day, I hope to have my own lab and apply the hands-on training I receive with Dr. Basu as my mentor.

Contrary to what it seems, my journey from the quaint and peaceful city of science, Göttingen, to the bustling metropolis of the new world, New York, is the epitome of 'life coming a full circle'. Dr. Basu is an alumnus of the program and she worked in the same department and even the same building (3rd floor, Tower 6 MPI-BPC, Faßberg) where I spent hours at my setup. From within this circle of academic life, I wish to go ahead and have my own research identity.

Tanvi BUTOLA did her doctoral work in Tobias Moser's laboratory 'Synaptic Nanophysiology' at the Max Planck Institute for Biophysical Chemistry Göttingen. After graduating in 2017, she joined New York University School of Medicine as a postdoctoral researcher with Jayeeta Basu. She currently works with learning and memory in the context of sensory processing.

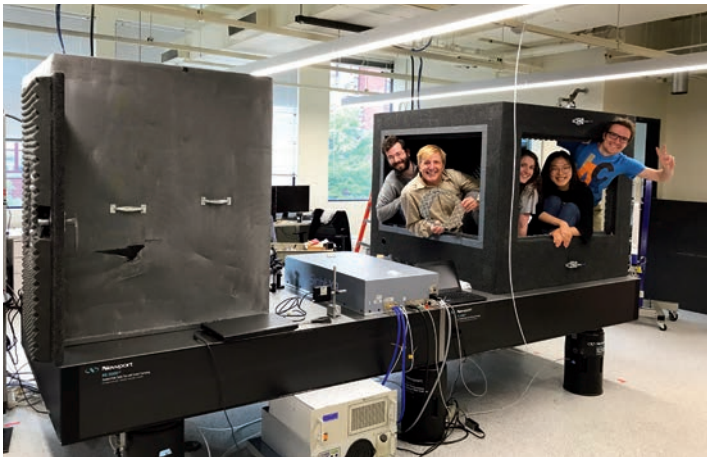
Studying Brain States in the States:

My Life as Postdoc in Oregon *by Dennis Nestvogel*

A fresh and delicious smell of fir trees, green grass and mossy shrubbery; people are incredibly friendly, patient, tolerant and have an amazing sense of humor; in the east, there are mountains covered in snow and in the west there is the beautiful Pacific Ocean – all of this is Oregon. Much of it is reminiscent of J.R.R. Tolkien's description of the shire in the book The Lord of the Rings. My family and I have moved here for my Postdoc more than a year ago, exactly on my 30th birthday – and we are loving it!

My host lab moved to Oregon at the exact time as we did, and my colleagues and I have mainly focused on building a new lab during the first year of my Postdoc. Building a new lab can be challenging; particularly when setting up new and complex equipment. However, it also forges strong bonds between the members of a lab and it offers a unique opportunity to know all of the equipment by heart.

While living in Goettingen as a PhD student, I carried out research in the field of Molecular Neurobiology. Back then, I was specifically interested in understanding how presynaptic proteins work together in establishing the high speed and fidelity of neurotransmission in the central nervous system. The knowledge and technical expertise I gained during my PhD have laid a solid foundation, on which I am now building as a postdoctoral research scholar. For my postdoc in Oregon, I am now studying the brain on a systems level, rather than on a molecular level. Changing fields never is easy and it requires much learning. However, I feel that it has already paid off in my case. Apart from the deep love and appreciation that I have developed for studying questions directly related to the "neural" code and to neural circuits driving behavior, I have been able to greatly broaden my technical expertise. I really enjoy the spirit and the atmosphere in the fields of systems neuroscience. Similar to scientists in the fields of astro- and particle physics, most labs in systems neuroscience tend to be extremely collaborative and do not shy away from sharing their data and their reagents with others before publication. This kind of behavior is particularly evident in the habit of most scientists in the field to publish their work on preprint servers and by sharing their mouse lines and tools freely with others without much hesitation. The positive spirit is also particularly evident by the work of the *Allen Institute for Brain Research* in Seattle, with which my host lab frequently exchanges various kinds of information and which is located within driving-distance.



In my current postdoc project, I study the impact of the behavioral state of animals on neural information processing in the brain. Processing of sensory information within neural networks has been shown to be highly dependent on behavioral state. This is particularly relevant for students in an early morning lecture who are striving to listen but find themselves drifting through periods of low- and high-arousal, taking in only a fraction of the words spoken by the lecturer. To study the influence of arousal and behavioral state on sensory processing, I employ *in-vivo* electrophysiology (intra- and extracellular recordings) in combination with behavioral analysis in awake mice. In correspondence with what has been described in humans, the relationship between the level of arousal and task performance follows

an inverted u-shape in mice, with the best performance in sensory tasks occurring during intermediate states of arousal. In my host lab, we are specifically interested in the neural mechanisms that enable "optimal" task performance and how these may be disturbed in patients suffering of psychiatric disorders.

This is a very exciting time to be conducting research in the neurosciences. The development of many new tools, such as optogenetics, improved calcium sensors, CRISPR and high-density electrophysiology recordings are enabling us now to conduct experiments, which other scientists only dreamed of several years ago. There are several long-standing questions, which can now be addressed with these new tools and I am very happy to be a scientist at this exciting time. I am looking forward to spending more time in Oregon together with my family, before we eventually move back to live closer to our parents and siblings.

Dennis NESTVOGEL carried out his PhD work under the supervision of JeongSeop Rhee and Nils Brose at the Max-Planck Institute of Experimental Medicine. After his graduation in 2017, he joined the research group of David McCormick at the University of Oregon. His postdoctoral project deals with state-dependent sensory processing in the visual system of mice.

Beginning a new line of research ...

at one of World`s top University *by Ramanathan Narayanan*

Almost a decade ago, during my Bachelor studies when I was awarded the Indian Academy of Sciences Summer Fellowship, little did I know that these two months of my life are going to shape the many years to follow. My first exposure to a research environment not only enhanced my passion for Science but also attracted me to the exciting field of Neuroscience. After my Bachelor`s degree, I worked at the National Brain Research Centre, India as a project fellow during which I received the great opportunity to join the IMPRS Neuroscience program. Coming from Chennai, one of the most populous and bustling cities of India, taking a stroll through the quiet and charming streets of Goettingen seemed like a different world in all sense. With numerous academic and research institutions dotting its map and nurturing excellent scientists for centuries, the city rightfully earned its name `Stadt die Wissenschaft`.

After rigorous coursework, I started my doctoral studies at the UMG Centre for Anatomy in the department of Prof. Jochen Staiger to work on transcriptional and chromatin remodelling mechanisms underlying cortical development. As time progressed, on the one hand learning new techniques and getting positive results excited me, while on the other a glimpse of the pitfalls that surround ` Science & Research ` prompted me to re-analyse my passion for academic research. Besides many factors, I believe that it is this threshold point that tests a PhD student either to continue in academic research or to choose alternative career paths. But I didn't give up...the freedom and joy exploratory research offers made me choose an academic career once

again…but the next obvious question, where? Choosing a postdoc project is not that easier than I thought. Finding the necessary funds and a project that interests you the most is an obvious thing to go for but should not be the sole reason to choose a particular position. It requires a careful balance of three aspects: a project that needs some (if not all) of your prior expertise, an environment that enables you to learn new concepts/techniques and a mentor who is willing and committed to promoting you professionally. Through my experience and that of my close contacts, it is unfortunate that these aspects are often poorly addressed.

Having worked in neurodevelopment, I wanted to expand my horizon into neurodevelopmental disorders during my postdoctoral phase. Fortunately, I received an attractive offer from the Swiss Federal Institute of Technology, ETH Zurich matching my expectations and promising in terms of future opportunities. Before relocating to Zurich, I was at least certain that I will get more sunshine (enough of the dull weather!) and will be at ease getting used to the city since it's in the German-speaking part of Switzerland (though I am still not perfect in German!). However, after a few weeks, it turned out that not only I love the city but my new workplace too. ETH Zurich is constantly ranked one of the best Universities worldwide and together with the University of Zurich, has a strong Neuroscience community. I joined as a postdoc in the group of Prof. Gerhard Schratt, one of the pioneers in the field of micro-RNA and synapse research. With very helpful team members and excellent infrastructure, I had a head start into my project that investigates the role of a mammalian micro-RNA cluster in social behaviour and autism spectrum disorder. As a significant recognition, I was awarded the ETH Zurich Postdoctoral Fellowship co-funded by Marie Sklodowska Curie Actions COFUND Program, including an additional budget for research and travel costs. Both ETH Zurich and the Swiss National Science Foundation offers several opportunities to obtain funding and to attain independence, thereby providing an ambient environment for early-career researchers to develop professionally. I hope the warm welcome "Grüezi" in Zurich will continue, giving the right balance and the impetus to continue in academic research.

Ramanathan NARAYANAN did his doctoral thesis in Jochen Staiger`s department at the Institute of Neuroanatomy, University Medical Centre Goettingen. After graduation in 2017, he then joined ETH Zurich as a postdoc in the group of Gerhard Schratt. He was awarded a fellowship under ETH Zurich – Marie Sklodowska Curie Actions COFUND Program in 2018.

Institute for Neuroscience
(Prof. Gerhard Schratt)
Department of Health Science & Technology (D-HEST)
Swiss Federal Institute of Technology, ETH Zurich
Winterthurerstrasse 190
8050 Zurich

Creutzfeldt Award

Creutzfeldt PhD Prize
The Creutzfeldt PhD Prize is awarded for the best PhD thesis in memoriam of Prof. Dr. Otto Detlev Creutzfeldt, founding director of the department of Neurobiology at the Max Planck Institute for Biophysical Chemistry in Göttingen. The prize is awarded since 2007 to PhD graduates of the Neuroscience program based on excellent achievements during the PhD and the grading of the written dissertation and the oral defense. In 2011 for the first time 2 winners have been selected for the Creutzfeldt Prize.

Traditionally, the award ceremony is part of the official opening of the NEURIZONS Symposium and takes place in the presence of the spokespersons of the MSc/PhD/MD-PhD Program & International Max Planck Research School for Neurosciences, a representative of Sartorius stedim AG and Mary Creutzfeldt.

The award includes the book present 'Cortex Cerebri' written by Otto Creutzfeldt and a gift of 500,-€ sponsored by the Göttingen company Sartorius stedim biotech AG, which has generously supported the Neuroscience program since its foundation

2007 Prize winner:
Dr. Irina Dudanova
Max Planck Institute of Neurobiology Martinsried

2009 Prize winner:
Dr. Henry Lütcke
Brain Research Institute Zurich, Switzerland

2011 Prize winners:
Dr. Ioanna Bethani
Goethe-Universität Frankfurt

Dr. Stephan Junek
Max Planck Institute for Brain Research Frankfurt

2013 Prize winners:
Sadim Jawhar, Ph.D.
Biomedical Research Institute, Doha, Qatar

Dr. David Owald
Oxford University, United Kingdom

2015 Prize winners:
Dr. Natalia Revelo Nuncira
Radboud umc, Institute for Molecular Life Sciences Nijmegen, Netherlands

Nicolas Snaidero, Ph.D.
Technical University / Ludwig-Maximilians University München

2018 Prize winners:
Dr. Pratibha Narayanan
Teach for India, New Delhi, India

Dr. Dennis Nestvogel
University of Oregon, Eugene, USA

Joining the program since 2017

Jan Clemens
How acoustic communication signals are processed to inform behavior is the major interest of Dr. Clemens' group 'Neural Computation and Behavior' at the European Neuroscience Institute. He teaches the development of the insect nervous system and neural modelling to our students and currently supervises his first Neuroscience Master's and PhD students.
Further information: http://www.uni-goettingen.de/en/601849.html

Igor Kagan
Well acquainted with the Göttingen research environment, Dr. Kagan now also joined our Neuroscience program. He has been a group leader at the German Primate Center since 2011 and has been active as a lab rotation supervisor and tutor for quite a while. His major research interests encompass neurophysiology, functional imaging of decision-making, and cognitive and visuomotor functions in primates.
Further information: http://www.uni-goettingen.de/en/365803.html

Caspar Schwiedrzik
graduated in 2011 and worked as a postdoc at the Rockefeller University in New York. Since 2017, he has headed the Neural Circuits and Cognition Lab at the European Neuroscience Institute. His work involves invasive and noninvasive approaches to study different forms of learning in the visual system.
Further information: http://www.uni-goettingen.de/en/589682.html

Left the program since 2017

Theo Geisel
was director and scientific member of the Max Planck Institute for Dynamics and Self-Organization and Professor at the University of Göttingen from 1996 until 2016. A world leader in theoretical neuroscience and one of the "pioneers" of the chaos theory, he joined the Neuroscience Program in 2004 and remained a member until his retirement. Theo Geisel was awarded numerous prizes, including the Gottfried-Wilhelm-Leibniz-Prize and the Gentner-Kastler-Prize of the Deutsche Physikalische Gesellschaft and the Société Francaise de Physique, and was our program's key link to the physics faculty

Hiroshi Kawabe
taught our students in biochemical techniques and supervised them during lab rotation projects from 2014 until 2017. Shortly after becoming a member of our program, Dr. Kawabe took the opportunity to further pursue his research at the University of Kobe in Japan, where he continues his research program on the role of protein ubiquitination in nerve cell development.

Till Marquardt
was a group leader at the European Neuroscience Institute (ENI-G) from 2007 until 2016 where he studied key aspects of nervous system development and function. Dr. Marquardt was an Emmy Noether Young Investigator (DFG) and a European Research Council (ERC) grant holder. In 2016, he was appointed as Professor for Neurobiological Research at the RWTH Aachen.

Faculty Leaving

Mikael Simons
came to Göttingen as a junior group leader at the Centre for Biochemistry and Molecular Cell Biology in 2004. In 2008, he became a group leader (Cellular Neuroscience Lab) at the Max Planck Institute of Experimental Medicine, with which he is still associated. In the same year, Prof. Simons became a faculty member of our program, where he supervised several MSc and PhD theses and took care of a number of lab rotation students. His current research at the Technical University Munich – where he joined the German Center for Neurodegenerative Diseases (DZNE) in 2017 – focuses on myelin biogenesis, regeneration in the CNS, and neurodegeneration.
Further information: http://www.neuroscience.med.tum.de/index.php?id=25

Judith Stegmüller
graduated from the University of Heidelberg and did a postdoc at Harvard Medical School, Boston, USA. Dr. Stegmüller became an independent group leader at the Max Planck Institute of Experimental Medicine in Göttingen in 2008 where she pursued a research program on the role of the ubiquitin proteasome system (UPS) in axon growth and regeneration. In 2016, she accepted a position at the Neurological Clinic, University Clinics Aachen, where she continues her work on the UPS and on genes involved in degenerative diseases.
Further information: http://www.neuroscience-aachen.de/arbeitsgruppe-stegmueller.html

Current Faculty Members

Andrea Antal
Matthias Bähr
Thomas Bayer
Susann Boretius
Henrik Bringmann
Nils Brose
Wolfgang Brück
Jan Clemens
Camin Dean
Peter Dechent
Thomas Dresbach
Hannelore Ehrenreich
Gregor Eichele
André Fiala
André Fischer
Alexander Flügel
Jens Frahm
Tim Friede
Alexander Gail
Tim Gollisch
Martin Göpfert
Robert Gütig
Ralf Heinrich
Stefan Hell
Swen Hülsmann
Reinhard Jahn
Igor Kagan
Siegrid Löwel
Ivan Manzini
Ira Milosevic
Tobias Moser
Klaus-Armin Nave
Tiago Outeiro
Luis Pardo
Walter Paulus
Arezoo Pooresmaeili
Jeong Seop Rhee
Michael Rickmann
Silvio Rizzoli
Annekathrin Schacht
Hansjörg Scherberger
Oliver Schlüter
Manuela Schmidt
Caspar Schwiedrzik
Michael Sereda
Marion Silies
Jochen Staiger
Anastassia Stoykova
Stefan Treue
Melanie Wilke
Sonja Wojcik
Fred Wolf
Fred Wouters

For details regarding the research of all faculty members, please see www.gpneuro.uni-goettingen.de/content/c_faculty.php

Faculty Leaving

Michael Hörner Obituary
Professor Dr. Michael Hörner, our program coordinator and member of our faculty, lost his fight against a malicious disease after long suffering in October 2018. This is painful for all of us, but of course in the first place for his family, especially his beloved son. Our thoughts are with them.

Since 2005, Michael had coordinated the IMPRS *Neurosciences* programme with great enthusiasm and success. In 2009, Michael also became the speaker of the PhD programme *Molecular Physiology of the Brain*. At the European Neuroscience Institute Göttingen, Michael ran a teaching lab where he trained students in electrophysiology, including the famous intracellular recordings from leech Retzius cells. Michael was highly engaged in teaching and lecturing neuroscience, covering a wide spectrum of neuroscientific topics, such as signalling in electric fish, acoustic communication, or immunohistochemistry.

Michael completed his dissertation in 1989 in the Department of Cellular Biology at Georg August University under the supervision of Prof. Friedrich-Wilhelm Schürmann. In those early days, Michael closely worked together with Klaus Schildberger (now professor at Leipzig University), and the two produced a remarkable paper documenting the effects of intracellular neuronal manipulations on cricket phonotactic behaviour. The respective setup had been developed in cooperation with their colleague Heribert Gras, with whom Michael had remained in close contact ever since. This was Michael as we all know him – highly cooperative, innovative, staying in contact, and having a true interest in the people around him and in what (and how) they are doing. These networking skills, together with his joy for teaching and research, also brought him a position as guest professor at the Hong Kong University of Science and Technology and manager of the DAAD German Centre in Hong Kong from 2002 to 2004. Before, between his dissertation (in 1989) and habilitation (in 1997), Michael had worked as an assistant professor at the Institute of Zoology at the Georg August University and, as a guest researcher, in Tucson, Woods Hole, and Boston, where he stayed from 1994 to 1995 as a Feodor-Lynen/Humboldt Fellow. Afterwards, he became an Associate Professor, again in Göttingen, before he moved to Hong Kong in 2002.
Through his diverse activities, Michael was well known in the neuroscience community, and we are very lucky to have had him here in Göttingen, running the IMPRs Neuroscience program and turning it into a great success. As we all know, Michael was remarkably talented in student mentoring, and together with his team, he organized memorable student retreats. He also had a particular love for long hikes and bird watching, walking with his binoculars, across Spiekeroog for instance, when time allowed during retreats.

Nearly everybody in the neuroscience community in Göttingen knows Michael Hörner, and he was one of the prime experts on MSc and PhD programs and research school organization. Many of our students profited tremendously from his compassionate individual guidance and his enthusiasm for teaching and research. This deep involvement of Michael would not have been possible without the strong support from his family, and we are very grateful for this. Honestly, it will be virtually impossible to fill the gap that Michael's death has torn into our community. Still, and not unexpectedly, he prepared things very well, so that the quality of our program can and will be maintained. But for our program, Michael was so influential that any future development will carry his stamp.

Andreas Stumpner, Martin Göpfert, Nils Brose

Neurizons 2018

Fire, wire, inspire – *by Linda Olsthoorn*

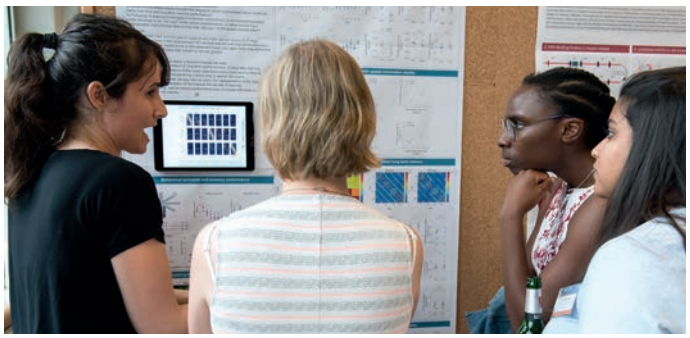
In May 2018 scientists from all over the world came together in the Max-Planck institute for Biophysical Chemistry full of anticipation. They were there for Neurizons, the biennial conference organized by the students of the MSc/PhD/MD-PhD Program and International Max Planck Research School (IMPRS) for Neurosciences. But actually, it all started many months before. While the then Master students were busy finishing their theses, the

first gathering had commenced to start the organization. Helpful advice and experiences from previous organizers was passed on and then the new organizers were ready for the immense task ahead of them: organizing a four-day neuroscience conference.

Fast forward twelve months and you would have found yourself in the middle of a buzzing conference where Nicholas Humphrey provided a more philosophical keynote talk with a whole new perspective. A range of talks were available from molecular neuroscience to higher brain functions. You could meet Amit Agarwal, an alumnus from our program in the middle of the process of starting his own group in Heidelberg, or have an inspiring conversation with Christopher Colwell about learning and memory. You might have been surprised by the fascinating behavior of Daniel Kronauer ants. Many inspiring talks formed the basis of a successful Neurizons.

A conference is so much more than just its talks. At Neurizons students participated in 'speeddating' sessions with CoachMe to learn more about their favorite speakers, further developed their soft skills by joining the soft skill workshop about career planning by Schiller & Mertens, challenged themselves by participating in the Young Investigator Contest and presented their own research in the posters sessions with some wine or beer in their hands. Neurizons provided ample opportunity to have fun and socialize with your peers and the speakers in the amazing neuroscience themed pub quiz on the first night, the conference party in EinsB, the wine-and-cheese/beer-and-pretzel poster sessions and the final BBQ.

From the outside it seemed as if everything was running smoothly



which is not surprising as behind the scenes more than 20 students dressed up in turquoise were addressing problems and emergencies as they came up. While one is calling with a speaker to frantically organize a new flight as the original flight was cancelled, another gets a call with the very legit question: 'Do we actually have wine openers for the wine-and-cheese session which is in an hour?'. Problems big and small were solved at rapid speed so that participants would not notice a thing. It was challenging to organize an event this size and work with so many different people at once, but in the end the memory that remains is one of a very successful conference full of great scientists and events. We hope we fired, wired and inspired your interest in neuroscience again. The preparation for the next conference will start again soon. **We hope to see you in 2020.**

Surprise in Thessaloniki

A neuro-inspired workshop at the 15th Annual Conference on Complex Systems *by Conor Heins*

In late September of 2018, my colleague Brennan Klein and I hosted a one-day satellite event called 'Complexity from Cells to Consciousness,' one of several events taking place at the annual Conference on Complex Systems (CCS 2018). Featuring keynote speakers such as Karl Friston from University College London and Jessica Flack from the Santa Fe Institute, the workshop revolved around the application of normative theories (most notably, the Free Energy Principle or FEP) to the study of complex systems. Described by a recent Wired magazine article as "the most all-encompassing idea since Darwin's theory of natural selection," the Free Energy Principle is a framework articulated by theoretical neurobiologist Karl Friston to describe the essential goal of nervous systems as predicting and modeling their sensory environments.

Brennan and I learned about FEP through an article written by philosopher Andy Clark that we discovered in 2013. Titled *Whatever Next? Predictive Brains, Situated Agents, and the Future of Cognitive Science*, Clark's review addresses an influential idea that's now known as the 'Predictive Processing Framework.' According to the most distilled form of Predictive Processing, the fundamental imperative of a nervous system is to minimize the *surprise* it encounters over time. At first glance, the notion of 'minimizing surprise' might sound vague or underspecified, but surprise has a formal definition in information theory and statistics: surprise scores the probability assigned to an event, given a model specifying how that event occurs. The mathematical consequences of surprise fuel the ability of theories like FEP to explain the structure and function of nervous systems. According to Clark and other proponents of this framework, by minimizing surprise the brain acts like an approximate 'prediction engine,' engaging in inference and model-building about the world it's embedded in.

The wide-reaching ideas introduced to us in Clark's review not only piqued our interest in predictive processing and FEP, but it also paved the way for extension of the principle to other fields of science. Brennan and I were immensely curious to learn whether and how FEP could be extended to describe complex phenomena encountered in other, non-neuroscientific domains. FEP provides a generic explanation for why any complex system, simply by existing, will appear to adapt to and anticipate its external world. We were therefore invigorated upon discovering that practitioners of various disciplines, from plant biologists to financial economists, were successfully applying FEP to investigate fundamental questions in their respective disciplines. Motivated by what we sensed was an emerging, interdisciplinary shift in the approach to understand complex systems, Brennan and I decided to organize the satellite workshop at CCS, inviting participants from across the world to discuss the ability of broad frameworks such as FEP to unify the study of complexity across disciplines.

CCS 2018 was hosted by Aristotle University, bringing the event to the city of Thessaloniki, Greece. The day was filled with discussions about the benefits and pitfalls of using theoretical guiding principles like FEP to explain phenomena across domains, conversations that were simultaneously validating and challenging. Invited talks addressed the application of free energy to a plethora of subjects, from quantum mechanical phenomena to the use of 'artificial curiosity' in reinforcement learning. We heard Jessica Flack stress the need to understand the application of these principles across spatial and temporal scales, especially the extent to which predictive processing occurs in biological collectives. Karl Friston examined the simple, dynamical conditions under which anticipation and surprise-minimization must naturally emerge. The workshop also featured a poster session, providing the opportunity for young researchers to exhibit their creative applications of FEP to problems in their own fields. It was humbling and encouraging to see researchers from seemingly-unrelated fields come together to contextualize their work in terms of a unifying principle: the drive to minimize surprise.

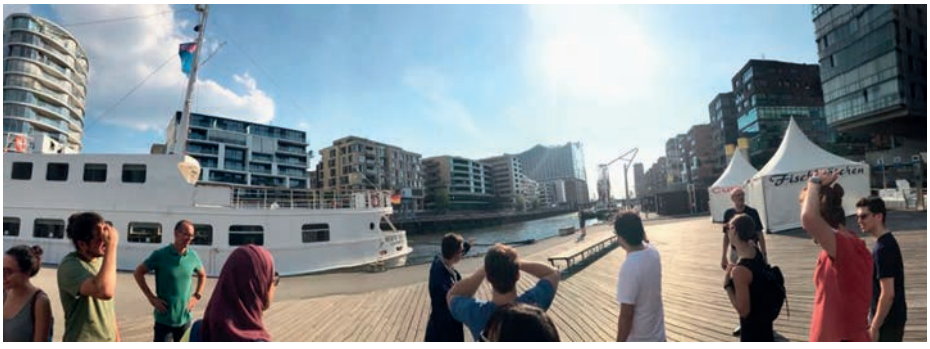
More information about the Complexity from Cells to Consciousness workshopcan be found at the following url: http://ccs2018.web.auth.gr/fromCellsToConsciousness.

Family reunion by the Kiez

The annual Neuroscience retreat was held in the vibrant city of Hamburg *by Georg Hafner*

During the master studies we see our classmates every day. We grow together like a family. There is the super smart sister, the funny brother, the cousin who always shows up late and the aunt who likes to have one too many in the evenings. Of course, there is the serious uncle who always shakes the head in disbelief when the unreflected niece asks a silly question.

After this phase everybody joins a different lab and pursues a different path of science. The family members start losing sight of each other. Except for the closest friends, former classmates become a face you greet in the Mensa or at Rewe. Therefore, a few years ago student representatives and the coordination office came up with the idea of an annual family reunion. Since then the scattered neuroscience students assemble in a place in Germany and catch up with their former classmates and the people from other batches. In 2018, the retreat was held in Hamburg from 2nd-4th of August. The



initial excitement of seeing each other at the train station already imposed a serious threat to the main mission: to reach Hamburg united. Except for the cousin who is always late, we made it as one group to the target destination, the Wälderhaus in the district of Hamburg-Wilhelmsburg. The presence of so much condensed intelligence in one spot might have overwhelmed the reception there and they took some extra time to assign the rooms. Without hesitation we jumped into the first scientific session, dominated by research on vision in fly and mouse followed by a quick poster session. The guided city tour in the evening introduced us to the spirit of a pulsating harbor city, revealed to us the story, value and cost of iconic buildings like the Elbphilharmony and encouraged us to explore the city ourselves at night.

The second day was opened with a session about the auditory system. It contained talks about how calcium regulates the release of neurotransmitter and the exciting topic of hearing restoration with optogenetic cochlear implants – perfect to finally exile the noise induced trauma caused by the loud night life at Reeperbahn.

Already empowered by the scientific discussions during the second poster session, we felt like giants in the Miniatur Wunderland. It displayed incredibly detailed models of whole countries and cities, compressing the world into a building. The visit there was framed by a boat ride through the biggest harbor of Germany in sunny weather and a dinner in the city center.

On the next morning, to blow away the brain fog caused by yesterday`s extended city tour, the students exhausted the coffee supply and listened to interesting talks about the molecular profile of a synapse and the brain-wide effects of anesthesia. The retreat was concluded by the discussion with three alumni on their career after the PhD. Amit Agarwal illuminated the career path of the academic. He emphasized the advantage to extend the PhD period as much as possible so that publications can be attributed to the PhD and not the Post-Doc period. Benjamin Wilhelm described his two very busy years at McKinsey before he settled into a more enjoyable position at Stonehaven consulting. Florentin Masarut, who had graduated this year, told about his quest to find a position in industry in Hamburg.

All in all, the retreat was a great mix of scientific and personal exchange and the family reunion we wished for.

Our new Alumni Mentoring Program

Our alumni activities of the year 2019 will focus on our new Alumni Mentoring Program. This specific one-to-one mentoring offers a targeted and intensified relationship over a period of 6 months. The mission is to facilitate meaningful connections between experienced alumni and current PhD students and junior postdocs across a wide variety of careers and research fields in- and outside of academia. Focusing on career advancement, professional development and networking, this program aims to be a rewarding and inspiring experience for all participants. In addition to the regular individual contact of the mentor-mentee pairs, the mentees can apply for travel support to meet their mentors at their workplace. Our IMPRS Offices and Career Service will offer guidance throughout the mentoring process and organize joint events and career-related workshops.

The pilot phase starting in 2019 with the first intake of 6-10 mentees will be run within the IMPRS Molbio/Neuro community. Subject to successful evaluation it will be expanded to the GGNB and GAUSS community in subsequent years. Both mentees as well as mentors need to apply for the program. The matching of each pair will be based on the mentee's successful application and interview as well as relevant expertise of the mentor. Following our basic rules set out in the mentorship agreement, they are flexible to decide together on the timing, format and content of the meetings.

We hope that this exciting opportunity will be well-received by our alumni and PhD students. We are very much looking forward to the applications for the first call in early summer.

Stefanie Klug

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