TUE G. BANKE, PH.D.

PROFESSIONAL EXPERIENCE

Emory University School of Medicine – Atlanta, GA
Instructor, Department of Pharmacology and Chemical Biology 2020-present

- Utilize patch-clamp and field electrophysiology techniques to record from acute (*ex vivo*) brain slices from wild-type and NMDA Receptor knock-out mice.
- Utilize electrophysiology techniques to record from human embryonic kidney (HEK-293) cells expressing NMDARs.
- Drug screening of compounds against various NMDAR subtypes (2-electrode voltage clamp of *Xenopus* oocytes).

University of Washington – Seattle, WA
Acting Assistant Professor, Department of Physiology and Biophysics 2018 –2020

- Performed biophysical and pharmacological characterization of glutamate receptor dysfunction in Fragile X syndrome mice, Western blots, RT-PCR, calcium imaging.
- Utilized patch-clamp techniques to record from acute slices from Fmr1 knock-out and wild-type mice.
- Used various *in vitro* techniques, including biocytin labeling/confocal microscopy for post-hoc morphological processing of the recorded cells.

AARHUS UNIVERSITY – Aarhus, Denmark 2012 – 2018
Associate Professor, Department of Biomedicine

- Oversaw research program and managed laboratory focused on Fragile X syndrome using field and patch-clamp recording techniques (synaptic plasticity experiments: LTD and LTP), Western blots, immunohistochemistry, fixed tissue dye tracing, and spine morphology analysis. Used Imaris software to visualize and analyze Golgi-stained tissue.
- Characterized transient receptor potential channels in neocortex using patch-clamp techniques in acute brain slices and cell-based calcium fluorescence techniques (FlexStation).
- Taught medical and dental students in drug discovery, pharmacology, and neuroscience.

AFRAXIS – San Diego, CA 2010 – 2012
Scientist II, Neurobiology Department

- Developed methods for labeling of spines and analyzed and interpreted spine morphology data.
- Performed cardio-perfusion of rodents and confocal microscopy for post-hoc morphological processing.
- Built and optimized dual field-recording rig; screened compounds in long-term potentiation (LTP) assay from acute brain slices (visual cortex and hippocampus).
- Presented and discussed data at weekly management meetings.
- Supervised two laboratory technicians.

JOHNSON & JOHNSON – San Diego, CA 2007 – 2010
Post-Doctoral Fellow

- Performed biophysical and pharmacological characterization of transient receptor potential (TRP) channels.
- Supported team by characterizing structure-activity relationship for TRP channels using high-throughput assays (TETRA, FLIPR, manual and automated patch clamp).
- Developed novel dye uptake assays and screened compounds on TRP channels using electrophysiology, calcium influx assays, and dye uptake assays (TETRA, FLIPR, VIPR).
- Utilized in vitro electrophysiology techniques to record from TRP channels expressed in a variety of cell lines and dorsal root ganglia primary neurons.
- Used chimeric proteins and Western blot to investigate interactions between TRP channels and regulatory proteins.

NATIONAL INSTITUTE OF CHILD HEALTH & DEVELOPMENT (NIH) – Bethesda, MD 2003 – 2007
Research Fellow, Cellular & Synaptic Neurophysiology

- Examined interneuron role in feed-forward inhibition of pyramidal neurons in hippocampus of acute mouse brain slices.
- Discovered developmental profile of transporters NKCC1 and KCC2 in interneurons are different from principal neurons.
- Used various in vitro techniques, including field, perforated-, pair- and whole-cell patch clamp recordings; calcium imaging; and biocytin labeling/confocal microscopy for post-hoc morphological processing of the recorded cells. Used biotinylation techniques and Western blots to label surface proteins.

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EMORY UNIVERSITY – Atlanta, GA 2000 – 2003

Post-Doctoral Fellow, Department of Pharmacology

- Conducted biophysical characterization of glutamate receptors.
- Utilized in vitro electrophysiology techniques to record from human embryonic kidney cells expressing NMDA or AMPA type glutamate receptors.
- Recorded from outside-out patches. Obtained data about channels in non-desensitized state by applying drugs (agonists or antagonists) with a fast piezo-driven application system to patches.
- Analyzed single channel and macroscopic currents using software (ChanneLab, SCAN, QUB, NPM, pClamp, ClampFit).

ROYAL DANISH SCHOOL OF PHARMACY – Copenhagen, Denmark 1994 – 1995

Research Scientist, Department of Pharmacology

- Used electrophysiology techniques to record from *Xenopus* oocytes expressing a variety of receptors (glycine receptors, GABA(A) receptors, 5-HT receptors, glutamate receptors). Techniques included 2-electrode voltage clamp and pulling outside-out patches from Xenopus oocytes, growing primary neuronal cell cultures, extracting mRNA from cell cultures and whole brains, making point mutations/chimeras, and generating plasmid DNA.

TEACHING EXPERIENCE

EMORY UNIVERSITY SCHOOL OF MEDICINE 2022-

Instructor, Department of Pharmacology and Chemical Biological

Teaching Neuroscience classes for 1st-year medical students

AARHUS UNIVERSITY MEDICAL SCHOOL – Aarhus, Denmark 2013 – 2018

Associate Professor, Department of Biomedicine

Taught pharmacology classes, including Epilepsy and Treatments, and Monoamines and Depression.

- Developed and delivered lectures for ~200 medical students followed by six smaller classes with ~30 medical students per class to reinforce lecture materials.
- Created course content, including tests and exams; graded written tests.
- Supervised undergraduate students, including medical students on three-month assignments in Neuroscience Department; mentored students in writing research papers.
- Oversaw graduate students, mentoring in laboratory-based research projects and master's theses.
- Participated as member of master's thesis committee, serving as an opponent for Ph.D. and master's student theses and as final thesis defense.

ACADEMIC SERVICE

REVIEWED FOR THE FOLLOWING JOURNALS: Philosophical Transactions of the Royal Society B, MDPI.com/Cells, MDPI.com/Brain Sciences, Ecotoxicology and Environmental Safety

EDUCATION

UNIVERSITY OF COPENHAGEN – Copenhagen, Denmark

Ph.D., Neuropharmacology (Nov 8, 1999)
Master of Science (M.Sc.), Biochemistry (1994)
Bachelor of Science (B.Sc.), Biochemistry (1992)

FELLOWSHIPS & GRANTS

FRAXA Foundation Fellowship	2019 - 2021
Riisfort Foundation	2016 - 2017
Danish Medical Research Council Grant	2014 - 2017
Lundbeck Foundation	2013 - 2018
Maersk Foundation (A.P. Møller og Hustru Chastine Mc-Kinney Møllers Fond til almene Formaal)	2013

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Carlsberg Foundation	2012 - 2014
Danish Medical Research Council Fellowship – Biophysical Characterization of Glutamate Receptors	2002 - 2004
Epilepsy Foundation – Ifenprodil's Block of NMDA Receptors	2002 - 2003
Alfred Benzon Fellowship – Proton Block of NMDA Receptors	2000 - 2004

PEER-REVIEWED PUBLICATIONS

N.N.U. Farooqi, J.R. Nyengaard, and **T.G. Banke**. A decline in dendritic architecture in aging hippocampal CA1 principal neurons in a mouse model of Fragile X Syndrome. (submitted, *Developmental Neurobiology, 2024*).

T.G. Banke, S.F. Traynelis, A. Barria. Early Expression of GluN2A-Containing NMDA Receptors in A Model of Fragile X Syndrome. *J of Neurophysiology, (2024)131: 768-777.*

J.E. Hanson, H. Yuan, R.E. Perszyk, **T.G. Banke**, H. Xing, M.-C. Tsai, F. S. Menniti, S.F. Traynelis. Therapeutic potential of N-methyl-D-aspartate receptor modulators in psychiatry. Neuropharmacology, *(2023)49: 51-66.*

C.R. Camp, A. Vlachos, C. Klockner, I. Krey, **T.G. Banke**,..,S.F. Traynelis. Loss of Grin2a Causes a Transient Delay in the Electrophysiological Maturation of Hippocampal Parvalbumin Interneurons: A Possible Mechanism for Transient Seizure Burden in Patients with Null GRIN2A Variants. *Communications Biology, (2023)6: 952.*

R.E. Perszyk, Z. Zheng, **T.G. Banke**, J. Zhang, L. Xie, M.J. McDaniel, B.M. Katzman, S.C. Pelly, H. Yuan, D.C. Liotta, S.F. Traynelis. The Negative Allosteric Modulator EU1794-4 Reduces Single-Channel Conductance and Ca2+ Permeability of GluN1/GluN2A N-Methyl-D-Aspartate Receptors. *Mol Pharm*, (2021) 99: 399-411.

K.L. Strong, M.P. Epplin, K.K. Ogden, P.B. Burger, T.M. Kaiser, T.J. Wilding, H. Kusumoto, C.R. Camp, G. Shaulsky, S. Bhattacharya, R.E. Perszyk, D.S. Menaldino, M.J. McDaniel, J. Zhang, P. Le, **T.G. Banke**, K.B. Hansen, J.E. Huettner, D.C. Liotta, S.F. Traynelis. Distinct GluN1 and GluN2 Structural Determinants for Subunit-Selective Positive Allosteric Modulation of *N*-Methyl-D -aspartate Receptors. *ACS Chem Neuroscience* (2021) 12: 79-98.

T.G. Banke and A. Barria. Transient Enhanced GluA2 Expression in Young Hippocampal Neurons of a Fragile X Mouse Model**.** *Front Synaptic Neuroscience* (2020) 12: 588295.

C. Lundbye, A.K. Toft, and **T.G. Banke** Inhibition of GluN2A NMDA receptors ameliorates synaptic plasticity deficits in the Fmr1-/y mouse model. *The Journal of Physiology*, (2018) 596: 5017-5031.

M. Chatterjee, C.J. Lundbye, A.K. Toft, J. Kwon, J. Benedict, M. Kamceva, **T.G. Banke**, and P. Lombroso. STEP inhibition reverses behavioral, electrophysiological, and synaptic abnormalities in Fmr1 KO mice. *Neuropharmacology,* (2018) 128:43-53.

A.K. Toft, C.J. Lundbye, and **T.G. Banke**. Dysfunctional NMDA receptor regulation of long-term depression in mouse model of Fragile X Syndrome. *Journal of Neuroscience*, (2016) 36(38):9817-9827.

T.G. Banke. TRPV1 channels suppress long-term potentiation in the Entorhinal Cortex. Pflugers Archive - *European Journal of Physiology* (2016) 468(4):717-26.

E.M. Sørensen, F. Bertelsen, P. Weikop, M.M. Skovborg, **T.G. Banke**, K.R. Drasbek, J. Scheel-Krüger. Hyperactivity and lack of social discrimination in the adolescent Fmr1 knockout mouse. *Behavioral Pharma* (2015) 26:733-40.

A.S. Kristensen, M.A. Jenkins, **T.G. Banke**, A. Schousboe, R. Huganir, and S.F. Traynelis. Mechanism of CaMKII regulation of AMPA receptor gating. *Nature Neuroscience* (2011) 14:727-735.

T.G. Banke. The dilated TRPA1 channel pore state is blocked by amiloride and analogues. *Brain Research* (2011) 1381: 21-30.

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J.C. Rech, W.A. Eckert III, M.P. Maher, **T.G. Banke**, A. Bhattacharya, and A.D. Wickenden. Recent advances in the biology and medicinal chemistry of TRPA1. *Future Med. Chem.* (2010) 2: 843-858.

T.G. Banke, S. Chaplan, and A.D. Wickenden. Dynamic Changes in TRPA1 selective filter leads to pore dilation. *American Journal of Physiology – Cell Physiology* (2010) 298: C1457-68.

T.G. Banke and G. Gegelashvili. Tonic activation of Group I mGluRs modulates inhibitory synaptic strength by regulating KCC2 activity. *Journal of Physiology* (2008) 586: 4925-34.

M. Maher, H. Ao, **T.G. Banke**, N. Nasser, N.T. Wu, J.G. Breitenbucher, S.R. Chaplan, and A.D. Wickenden. Activation of TRPA1 by farnesyl thiosalicylic acid. *Molecular Pharmacology* (2008) 73: 1225-34.

T.G. Banke and C.J. McBain. GABAergic input onto CA3 hippocampal interneurons remains shunting throughout development. *Journal of Neuroscience* (2006) 26: 11720-11725.

T.G. Banke, S.M. Dravid, and S.F. Traynelis. Protons trap the NMDA receptor in a non-conducting state. *Journal of Neuroscience* (2005) 25: 42-51.

K. Erreger, S. Dravid, **T.G. Banke**, David J.A. Wyllie, and S.F. Traynelis. Subunit-specific gating controls rat NR1/NR2A and NR1/NR2B NMDA channel kinetics and synaptic signalling profiles. *Journal of Physiology* (2005) 563.2: 345-358.

R. Jin, **T.G. Banke**, M.L. Mayer, S.F. Traynelis, and E. Gouaux. Partial agonist action defined by stabilization of specific conformational substates. *Nature Neuroscience* (2003) 6: 803-810.

T.G. Banke and S.F. Traynelis. Activation of NR1/NR2B NMDA receptors. *Nature Neuroscience* (2003) 6: 144-152.

F. Zheng, K. Erreger, C.M. Low, **T.G. Banke**, J. Lee, P.J. Conn, and S.F. Traynelis. An allosteric interaction between the zinc-binding site and glutamate-binding site causes fast desensitization of NR1/NR2A receptors. *Nature Neuroscience* (2001) 4: 894-901.

D.D. Mott, K.B. Erreger, **T.G. Banke**, and S.F. Traynelis. Open probability of homomeric murine 5-HT3A serotonin receptors depends on subunit occupancy. *Journal of Physiology* (2001) 535.2: 427-443.

T.G. Banke, J. Greenwood, J.K. Christensen, T. Liljefors, S.F. Traynelis, A. Schousboe, and D.S. Pickering. Identification of amino acid residues in GluR1 responsible for ligand binding and desensitization. *Journal of Neuroscience* (2001) 21: 3052-62.

T. Coquell, J.K. Christensen, **T.G. Banke**, U. Madsen, A. Schousboe, and D.S. Pickering. 4-Bromohomoibotenic Acid: An AMPA receptor subtype-selective agonist. *NeuroReport* (2000) 11: 2643-47.

T.G. Banke, D. Bowie, H.K. Lee, R. Huganir, A. Schousboe, and S.F. Traynelis. Control of GluR1 receptor function by cAMP-dependent protein kinase. *Journal of Neuroscience* (2000) 20: 89-102.

T.G. Banke and J.D.C. Lambert. Novel high efficacy AMPA analogues differentially affect desensitisation of AMPA receptors in cultured hippocampal neurons. *European Journal of Pharmacology* (1999) 367: 405-412.

B.S. Nielsen, **T.G. Banke**, A. Schousboe, and D.S. Pickering. Pharmacological properties of homomeric and heteromeric GluR1o and GluR3o receptors. *European Journal of Pharmacology* (1998) 360: 227-238.

L. Elster, **T.G. Banke**, U. Kristiansen, A. Schousboe, and P. Wahl. Functional properties of glycine receptors expressed in primary cultures of mouse cerebellar granule cells. *Neuroscience* (1998) 84: 519-528.

T.G. Banke, A. Schousboe, and D. Pickering. A comparison of the agonist binding site of GluR1o and GluR3o AMPA receptors. *Journal of Neuroscience Research* (1997) 49: 176-185.

P. Wahl, U. Madsen, **T.G. Banke**, P. Krogsgaard-Larsen, and A. Schousboe. Different characteristics of AMPA receptor agonists acting at AMPA receptors expressed in Xenopus oocytes. *European Journal of Pharmacology* (1996) 308: 211-218.

N. Westergaard, **T.G. Banke**, P. Wahl, U. Sonnewald, and A. Schousboe. Citrate modulates the regulation by Zn2+ of N-Methyl-D-aspartate receptor-mediated channel current and neurotransmitter release. *Proc. Natl. Acad. USA* (1995) 92: 3367-3370.

OTHER PUBLICATIONS

T.G. Banke and A.D. Wickenden. Intracellular zinc irritates TRPA1. *Nature Chemical Biology* (2009) 5:141-2.

T.G. Banke and S.F. Traynelis. Response to "NMDA Receptor Subunit Gating Uncovered." *Trends in Neuroscience* (2004) 27: 10.