Tim Benke MD, PhD
Curriculum Vitae

BENKE

Summary:

- Demonstrated abilities to create, lead, grow and sustain successful educational, translational research, clinical research and clinical service teams across large institutions.
- Commitment to mentorship and teaching of students, post-doctoral fellows, residents and junior faculty in order to establish and maintain the next generations of clinician-scientists.
- Track-record of academic success in basic, translational and clinical research. *h-index = 40*.
    - Basic science: mechanisms of synaptic plasticity
    - Translational science: mechanisms of altered plasticity mediated by early-life seizures and genetic epileptic encephalopathies
    - Clinical science: outcome measures in genetic encephalopathies and interventional clinical trials
- Recognized international thought-leader in Developmental and Epileptic Encephalopathies (DEEs: Rett Syndrome and *MeCP2*-related disorders, CDKL5 Deficiency Disorder, GRIN disorders, etc.).
    - Successful leveraging of institutions and patient advocacy groups towards:
        - development, implementation and utilization of patient registries,
        - consultation, initiation, management and participation in interventional clinical trials (conventional, ASO and gene replacement),
        - development of novel multidisciplinary clinics,
        - advocacy and lobbying in support of patients to Colorado state government and
        - development of novel, successful and sustaining philanthropic efforts.

1. Current Position

Timothy Andrew Benke M.D., Ph.D.
Ponzio Family Endowed Chair in Neurology Research
Children's Hospital Colorado
Professor with Tenure
Dept. of Pediatrics, Neurology, Pharmacology and Otolaryngology
University of Colorado School of Medicine
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2. Education:

Doctor of Medicine
Baylor College of Medicine, Houston, TX, 1995

Doctor of Philosophy
Baylor College of Medicine, Houston, TX, 1994
Department: Neuroscience
Advisor: Kimon Angelides, Ph.D.
Research area: Synaptic transmission in the central nervous system.
Thesis title: Distribution of Conantokin-G sensitive N-methyl-D-aspartate receptors and dendritic sodium channels on neurons: Implications for synaptic amplification and plasticity

Master of Science
Rice University, Houston, TX, 1989
Department: Electrical and Computer Engineering
Advisor: John Clark, Ph.D.
Research area: Nerve regeneration and mathematical modeling.
Thesis title: Studies in Nerve Electrophysiology

Bachelor of Science
Vanderbilt University, Nashville, TN, 1986
Discipline: Biomedical Engineering and Chemistry (double major), summa cum laude

Post-Doctoral Research Training:

- Research Assistant, Department of Anatomy, University of Bristol, Bristol, U.K. Project: Post-synaptic mechanisms of long-term potentiation in the rat hippocampus, 1995-1996. Supervisor: Prof. Graham L. Collingridge, Ph.D., F.R.S.

Post-Doctoral Clinical Training:
- Pediatric Resident, Department of Pediatrics, Baylor College of Medicine, Houston, TX, 1996-1998. Supervisor: Dr. Martin Lorin, M.D.
- Child Neurology Resident, Department of Pediatrics, Division of Child Neurology, Baylor College of Medicine/Texas Children's Hospital, Houston, TX, 1998-2001. Supervisor: Dr. Marvin Fishman, M.D.

Academic Honors:
- Dean's List; High Honors, Vanderbilt University, Nashville, TN.
- Tau Beta Pi (Engineering Honorary), Senior Chemistry Research Prize, Alpha Lambda Delta and Phi Eta Sigma (freshman honoraries), Vanderbilt University, Nashville, TN.
- Eta Kappa Nu Electrical Engineering Honorary, Rice University, Houston, TX.
- Sigma Xi Thesis Award (Ph.D.), 2nd Place, Baylor College of Medicine, Houston, TX, 1994.
- Texas Neurological Society Young Investigator Award, 2nd Place, 1999.

Leadership Training
- Center for Creative Leadership, Colorado Springs, CO, 2006
- CCTSI, Co-Mentor Program, 2016

3. Academic Appointments:
- Professor with Tenure, Departments of Pediatrics, Neurology, Pharmacology and Otolaryngology, University of Colorado, School of Medicine Denver, CO, 2019-present.
- Associate Professor, Departments of Pediatrics, Neurology, Pharmacology and Otolaryngology, University of Colorado, School of Medicine Denver, CO, 2012-2019.
- Associate Professor, Departments of Pediatrics, Neurology and Pharmacology, University of Colorado, School of Medicine Denver, CO, 2008-present.
- Assistant Professor, Departments of Pediatrics, Neurology and Pharmacology, University of Colorado, School of Medicine Denver, CO, 2002-2008.
- Child Neurology Section Chief (Interim), Children's Hospital Colorado, Denver, CO, 2006-2008.
- Neuroscience Graduate Training Program, University of Colorado, School of Medicine Denver, CO, member, 2006-present.
- Child Neurology Residency Program Director, University of Colorado, School of Medicine Denver, CO, 2002-2007.
- Assistant Professor, Pediatrics, Division of Child Neurology, Baylor College of Medicine, Houston, TX, 2001-2002.

4. Hospital Positions, government, other positions:
Hospital Positions
- Medical Director, Rett Clinic, Children's Hospital Colorado, 2011-present.
- Attending Physician, Division of Child Neurology, Children's Hospital Colorado, Denver, CO, 2002-present.
- Clinical Director, Child Neurology Clinic, Ben Taub General Hospital, Houston, TX, 2001-2002.
- Attending Physician, Division of Child Neurology, Texas Children's Hospital, Houston, TX, 2001-2002.

Consulting/Scientific Advisory Boards
- AveXis/Novartis pharmaceuticals, Aug 2017-2020
- Marinus pharmaceuticals, Sep 2017-2022
- Loulou Foundation, Oct 2017-present.
- International Foundation for CDKL5 research, Nov 2017-present.
- International Rett Syndrome Foundation/RettSyndrome.Org, Jul 2018-present
- Lennox-Gastaut Foundation, Sep 2018-Mar 2022; LGSF Leadership Circle Mar 2022.
- GRIN2B Foundation, Sep 2018-present
- Neuren/Acadia pharmaceuticals, Oct 2018-present
- Takeda/Ovid pharmaceuticals, Mar 2019-2021
- GW pharmaceuticals, Apr 2019-2021
- CureGRIN, Jan 2020-present

- Alycone, Feb 2021-April 2022
- Taysha, March 2021-11/2023
- GrinTherapeutics, October 2021-present
- Neurogene, January 2022-present

5. Honors and Recognition

- American Neurological Association, elected 2011
- Ponzio Family endowed Chair in Neurology Research, 2014
- International Foundation for CDKL5 Research, Star Thrower Award, 2015.
- "Top Provider, Patient-Family Experience Excellence in Patient Care Award" For achieving 90% or higher with 9/10 ratings on Overall Provider Experience, Children's Hospital Colorado, 2016, 2017, 2018, 2019, 2023
- Loulou Foundation, Champion of Progress Award, 2019
- CureGri Foundation, Clinician of the Year, 2023

6. Membership in Professional Societies (past/present):

- Fellow, American Academy of Pediatrics (past)
- Child Neurology Society
- Society for Neuroscience
- Biophysical Society (past)
- American Neurological Association
- American Epilepsy Society
    - Special Interest Group Leader 2015-2019
    - Research and Recognition Awards committee, 2017-2020
    - Early-career grant committee, 2019-2021

7. Service Responsibilities

University of Colorado School of Medicine (UC-SOM) Service Responsibilities

School of Medicine

- Committee on Research Ethics, ad hoc panel member, 2003
- Medical Scientist Training Program, applicant interviewer, 2010-present.
- Dean's Research Advisory Committee, 2012-2015; Chair 2014-2015
- Child Health Research Enterprise Committee, 2017-2020

Departmental

- Pediatrics
    - Neurosciences Institute, Director of Research, Children's Hospital Colorado/University of Colorado, School of Medicine Denver, 2008-present. *The Neurosciences Institute Administrative Research Team (NART) provides a full-service pathway to support industry and investigator initiated studies from start to finish across the Neurosciences Institute for Pediatric Neurology, Developmental Pediatrics, Neurosurgery and Rehabilitation Departments/Sections. Startup, contracting, regulatory, finance, EMR and study coordination by internally trained clinical research professionals allows investigators to focus more on the science of clinical research studies. Investigators are trained to follow good clinical practice and standard operating procedures. Our unique model, copied across Children's Hospital Colorado, allows for re-investment of clinical research revenue into staff support, internal projects and resources.*
        - Growth: Founding Director. Began in 2008 with 1 research coordinator and 3 projects.
        - Current state Reports/Hires: 4 research project managers, ~35 study coordinators, and 1-6 undergraduate clinical research interns. Monthly interface with finance, contracting and regulatory specialists.
        - Current state Oversight: 150-180 clinical trials and projects, industry-sponsored and investigator-initiated (second in volume to Children's Hospital Colorado Cancer Institute).
        - Current state Oversight: 8 groups (Neuromuscular, Neuroimmunology/demyelinating, Epilepsy, Neurogenetics, Neurosurgery, Headache, Developmental Pediatrics, Rehabilitation Medicine) and 37 Principal Investigators
        - Development of clinical research best practices, policies and procedures, including gene-replacement clinical trials

        - Philanthropic Initiatives:
            - Instituted annual Burn's Night fundraiser to support Neuroscience Institute research; Master of Ceremonies; 2013-present
- Division of Child Neurology
    - Rett Clinic Medical Director/Founder, 2011-present. *The Rett Clinic at Children's Hospital Colorado was established by the partnership of the Director with Rocky Mountain Rett Association in 2011. Through their philanthropy, the clinic has grown in frequency while maintaining its dedication to providing family-centric, one-stop massively multidisciplinary care for people and families with Rett/MECP2, CDKL5 and FOXG1 disorders across their lifespan. Since our families often travel over large distances with a disabled child, providing this convenience has set us apart from other similar clinics in the US. Families come from across the US and from overseas to be served by our unique clinic.*
        - Reports: Full-time RN clinic coordinator
        - Directs: 16 faculty/staff providers across multiple clinical disciplines (Cardiology, GI/Nutrition, Rehabilitation, Genetics, Psychology, Psychiatry, Developmental Pediatrics, Occupational Therapy, Physical Therapy, Speech therapy) in Rett Clinic
        - Featured in Children's Hospital Colorado Annual Report, 2012
        - International Foundation for CDKL5 Research Center of Excellence
        - RettSyndromge.Org (IRSF) Center of Excellence
        - FOXG1 Research Foundation Center of Excellence
        - Philanthropic support: Initiated, developed and maintains partnership between Rocky Mountain Rett Association, International Foundation for CDKL5 Research and Children's Hospital Colorado Foundation.
            - Annual budget: ~$200,000; renewed every 3 years.
            - Direct support for Medical director (10%) and RN coordinator (38h/week) and several faculty (3-10% each).
            - Medical Director participation in 3-4 fundraisers/year
    - Co-PI of The Colorado Neurosciences Academic Development Award (NSADA K12, K12 NS089417, NIH/NINDS, 07/01/2015-06/30/2020). *Program based at the University of Colorado School of Medicine and Children's Hospital Colorado to leverage the combined resources of our large, active neuroscience research community, an outstanding university infrastructure for training in clinical-translational research and one of the best children's hospitals in the country to provide exceptional basic-translational pediatric neuroscience research training for the next generation of academic pediatric neurology leaders.*
        - On-going National Faculty member of Child Neurologist Career Development Program (successor to NSADA) (CNCDP, NIH/NINDS K12NS098482, Schlaggar, PI). *Goal is to mentor early career pediatric neurology physician scientists via annual program meeting and direct mentorship of scholars locally and at other participating institutions.*
    - Junior Faculty Mentees (past/present)
        - Tim Bernard, MD (Pediatric Neurology, Stroke Program founder)
        - Marco Gonzales, PhD (Pediatric Neurology)
        - Yogi Raol, PhD (Pediatric Neurology)
        - Audrey Yee, MD (Pediatric Neurology)
        - Andrew White, MD PhD (Pediatric Neurology)
        - Kendra Bjoraker, PhD (Pediatric Neurology)
        - Scott Turner, MSN, FNP (Pediatric Neurology)
        - Abigail Collins, MD (Pediatric Neurology, Movement Disorders)
        - Peter Baker, MD (Section of Genetics and Metabolism)
        - Cindy Keator, MD (Pediatric Neurology, Epilepsy)
        - Scott Demarest, MD (Pediatric Neurology, NSADA fellow)
        - Andra Dingman, MD (Pediatric Neurology, NSADA fellow)
        - Josh Bear, MD (Pediatric Neurology, NSADA fellow)
        - Robert Dietz, MD/PhD (Section of Neonatology)
        - Melissa Gibbons, MS-GC (Pediatric Neurology)
        - Kaitie Angione, MS-GC (Pediatric Neurology)
        - Heather Olson, MD (Asst Prof, Harvard/Boston Children's)

- Matthew Elrick, MD/PhD (Asst Prof, Johns Hopkins, CNCDP-K12 fellow)
- Jennifer Hranilovich, MD (K23, CNCDP-K12 fellow)
- Allyson Alexander, MD/PhD (K23 Neurosurgery)
- Jordan Cole, MD (CNCDP-K12 fellow)
- Meagan Abbott, MD (Pediatric Neurology, NeuroNext fellow)

▪ Neurology Section Chief (Interim), Children's Hospital Colorado, Denver, CO, 2006-2008. *Managed and grew section from 8 to 17 clinical faculty and a budget that grew from $1.5M to $3M. Supported recruitment of permanent section head.*

Academic Recruits:

- Tim Bernard, MD-Stroke Program (2007)
- Abbie Collins, MD-Movement Disorders Program (2008)
- Jennifer Armstrong-Wells, MD-Stroke Program (2008)
- Susan Koh, MD-Epilepsy Program(2008)
- Kristen Park, MD-Epilepsy Program (2008)
- Dan Arndt, MD (2008)
- Jennifer Flack, RN/NP (2008)
- Jean Milholland, PA (2008)
- Scott Turner, RN/NP (2008)

▪ Movement-Genetic-MS (MGM) Team Leader, Children's Hospital Colorado/ University of Colorado, School of Medicine Denver, 2008-2019.
- Reports: 3 faculty, 2 genetic counselors, 4 RNs, 1 staff assistant

▪ Clinical Service (Children's Hospital Colorado)
- Outpatient general child neurology: 1 half-days/month
- Rett Multidisciplinary Clinic: twice monthly full days (Additional care/coordination of patients with 16 sub-specialists)
- Attending, Neurology Service (Doc-of-the-week): 1-2 weeks/year
- Prior Clinical Service:
  - NeuroGenetic Clinic: (1 half-day/month)
  - In-patient Neurology Service, including critical care (1 month/year)

o Division of Child Neurology and <u>Department of Neurology</u>

▪ Child Neurology Program Training Director, 2002-2007. *Developed and maintained academic and clinical training curricula to national standards. Recruited, advised and trained child neurology physicians. Increased training from 0-1 trainees/year to 2 trainees/year.*

Trainees recruited and graduated:

- Carter Wray, MD (2004-2009)
- Ed Jernigan, MD (2004-2009)
- Lucy Zawadzki, MD (2003-2008)
- Tim Bernard, MD (2001-2006)
- Brendan Mull, MD (2004-2005)

▪ Child Neurology Residency program applicant interviewer, 2002-present.

o Neuroscience Content Lead for Children's Hospital Colorado Research Organization (2015-2020)
o Research Executive Steering Committees (2015-2021)
o Strategic Planning Committee (2017)
o Child Heath Research Enterprise (2017)
o Genomics Workgroup/Precision Medicine Governing Board (2017-2021)
o Promotions Committee, 2010-2022.
o Search Committees
▪ Chair, Search committee for Linda Crnic Down Syndrome Institute Clinic Director (2012)
▪ Hematology/Oncology (2015-16)
▪ Genetics (2017)
▪ Developmental Pediatrics (2021)
▪ St Geme Lectureship (2018-present)
▪ Chair, Search committee for Linda Crnic Down Syndrome Institute Clinic Director (2022)
o IDDRC (Intellectual and Developmental Disabilities Research Center)
▪ Member 2008-2012

        - NEXUS Study Review Committee (reviews applications for research access to NEXUS bio-repository of DNA samples) (2008-2016)
        - Animal Behavior Core, Co-Director (2008-9)
        - Executive Committee (2009-2012)
    - CCTSI/Pediatrics/K12 Junior Faculty Training program
        - Mentor, Dr Peter Baker, 2016-2018
        - Executive Committee, 2017-2022
    - Summer Research Training program
        - Admissions committee, mentor, 2012-present
    - Pediatric Residency program, applicant interviewer, 2003-present.
- Departments of Pharmacology (T32), Otolaryngology (T32), MSTP, Developmental Psychobiology Research Group/Psychiatry (T32) and Neuroscience (T32 & P30) Graduate Training Programs:
    - Core Director (P30), BINC (Behavior and in vivo Neurophysiology Core), 2015-2019
    - PhD program applicant interviewer, 2008-present.
    - Mentor and advisor (see Teaching below)

Community Service:

- American Epilepsy Society, active member
    - Basic Mechanisms, Special Interest Group (SIG) leader 2012-14
    - Neonatal Seizures, Special Interest Group (SIG) leader 2015-17
    - Pediatric Content Committee, 2015-16
    - Epilepsy Research Benchmarks Committee, 2014-16
    - Research and Recognition Awards Committee, 2017-2020
- Child Neurology Society, active member
    - Member, Long-Range Planning Committee, 2010-2013
- Board member, Lennox-Gastaut Foundation, 2018-2022
- Board member, GRIN2B Foundation, 2018-present
- Medical Advisor, International Rett Syndrome Foundation, 2018-present
- Board member, Rocky Mountain Rett Association (local parent/family/patient support group to support the Rett Clinic at Children's Hospital Colorado), 2008-present
    - Presentations to family via family-centered conferences and facebook live, 2008-present
    - Related media appearances/promotions
        - Fox News Denver, 2012, 2019
        - Channel 4 News, Denver, 2008, 2006
        - Channel 9 News, Denver, 2017, 2018, 2019 https://www.9news.com/article/news/local/family-shares-devastating-rett-syndrome-diagnosis/73-543400445
- Rare Disease Day, Presentation to State Lawmakers, Colorado State Capitol, 2/2016
    - CBS and Fox News coverage http://denver.cbslocal.com/2016/02/29/rare-diseases-perisylvian-syndrome-awareness-leap-year-day/
- Rare Disease Day, Presentation to State Lawmakers, Colorado State Capitol, 2/2018
- Testimony in support of HB-1147 (to permit licensure of Genetic Counselors), Colorado State Capitol, 2/2015.
- Testimony in support of HB-1114 (to permit licensure of Genetic Counselors), Colorado State Capitol, 2/2018.
- Day with a Doctor (mentorship of university students interested in medicine, neurology and pediatrics), 2-6 mentees/year, 2004-present.
- High school senior science project outside mentor, Brandon Skogen, Grand View High School, "An EEG human-computer interface", 2012-2013.
- High school senior science project outside mentor, Jason Cyrus, Grand View High School, "Evoked Potentials", 2013-14.

8. Licensure and Board Specializations

Medical License:

- Texas State Board of Medical Examiners, entered 1998-2009.
- Colorado State Board of Medical Examiners, entered 2002. Active.
- Montana State Board of Medical Examiners, 2009-3/31/2015. Expired.

Medical Board Specialization (U.S.):

- American Board of Pediatrics, 2001-2008.

- American Board of Psychiatry and Neurology, special certification in Child Neurology, Passed 2002, Re-certification passed 2013. Status: Active.

9. Inventions, intellectual property and patents held or pending.

10. Review and Referee Work
Scientific Review:

- Neuropharmacology, **Editorial Board 2011-2013**
- Epilepsy Currents, **Editorial Board 2012-2015**
- Journal of Neuroscience
- Neurology
- JAMA Neurology
- Neurobiology of Disease
- Journal of Neurophysiology
- Proceedings of the Royal Society, Philosophical Transactions B
- Epilepsia,
- Epilepsy Research
- Journal of Neuroscience Methods
- Glia
- Brain Pathology
- Biological Cybernetics
- Brain Research
- Trends in Neuroscience
- Journal of Physiology
- Neuroscience
- Scientific Reports
- eNeuro
- eLife
- Methods and Findings in Experimental and Clinical Pharmacology
- Human Medical Genetics
- Journal of Child Neurology
- Brain
- European Journal of Neuroscience
- European Journal of Pediatric Neurology
- Experimental Neurology
- Nature

Grant Review:

- Wellcome Trust (ad hoc)
- Epilepsy Foundation (ad hoc)
- Human Frontiers Science Program (ad hoc)
- Dr Hadwen Trust for Humane Research (ad hoc)
- FDA, Orphan Products Development Program: 2010-2014
- NIH/NINDS, Epilepsy Eureka, 2011 (ad hoc)
- NIH/NINDS, F03A, Neurodevelopment, Synaptic Plasticity and Neurodegeneration Fellowship Panel, 2012-present (ad hoc)
- Epilepsy Research UK, 2014
- NIH-NICHD/NINDS SEP, 2013-present (ad hoc)
- NIH-SBIR, 2015-present (ad hoc)
- NIH-NINDS DBD, 2018-present (ad hoc)
- Cure Foundation, (ad hoc) 2011-present
- Colorado Clinical Translational Science Institute
    - Child and Maternal Health: 2008-present
    - K12: 2011-present
    - Novel Clinical and Translational Methods: 2011-present
- Boetcher Foundation 2017
- Loulou Foundation 2017-present
- LGS Foundation 2018-present
- Bow Foundation 2019
- GRIN2B Foundation 2019

11. Invited Lectures

Local

1. “Modulation of a glutamate receptor conductance by synaptic plasticity”, Dept. of Pediatrics, Section of Child Neurology, UCHSC, Denver, CO, May 2001.

2. “S(e)izing up glutamate receptors”, Neuroscience Program, UCHSC, Denver, CO, December 2005.

3. “Perils, Problems and Pitfalls: Modeling Human Disease with Rodent Models and Our Experiences with a Model of Early Life Seizures in Rats” IDDRC symposium, UCHSC, Denver, CO, June 2011.

4. “Early-life seizures: acute and chronic effects on synaptic physiology”, MCHB Keynote Speaker, University of Colorado/School of Medicine, Mar 2017.

5. “Rett and Rett-related disorders research update”, Rett Family Conference, Children’s Hospital Colorado, Oct 2017.

6. “Rett and Rett-related disorders”, Christopher Ward Neuroscience Nursing Conference, Children’s Hospital Colorado, Feb 2018.

7. “Development of a CDD Severity Assessment in the IFCR Centers of Excellence”, IFCR Family conference, Denver, June 2018.

8. “Rett and Rett-related disorders research update”, Rett Family Conference, Children’s Hospital Colorado, Sep 2018.

9. “Rett Syndrome: Learning Collaborative”, I hosted the International Rett Syndrome Foundation Learning Collaborative at CHCO May 2019. Clinicians from Rett Clinics across the country shadowed us in Rett Clinic followed by a half-day session to develop clinical consensus guidelines for the care of Rett patients. I planned and led the half-day discussion to develop clinical consensus guidelines for Epilepsy, GI, Cardiac, and Speech Therapies.

10. “Rett Clinic: Clinical Research Overview”, Face-book live for Rocky Mountain Rett Association, October 2019.

11. “Clinical Research Infrastructure in Pediatric Neurology”, Department of Otolaryngology T32 Seminar, November 2024.

National

1. “Mechanisms of developmental synaptic plasticity” (symposia with El-Husseini, A., Collingridge, G.L. and Taira, T.), Winter Conference on Brain Research, Copper Mountain, CO, January 2004.

2. “S(e)izing up glutamate receptors”, Dept of Neuroscience, MUSC, Charleston, SC, October 2006.

3. “Neonatal Seizures and Consequences”, Department of Neuroscience, University of California-Irvine, Irvine, CA, October, 2008.

4. "Do neonatal seizures per se cause brain damage? New insights from mutations of potassium channels", AES Investigators workshop, Boston, MA, Dec 2009.

5. "Basic Neuroscience: cognitive deficits after early life seizures", Special interest group meeting, AES, Boston, MA, Dec 2009.

6. “Translocation of FMRP and PP2A underlie enhancement of mLTD in adult rats following early life seizures”, American Neurological Association, Annual Meeting, Epilepsy Special Interest Group Presentation and Poster, Sept, 2011.

7. “Translocation of FMRP and PP2A underlie enhancement of mLTD in adult rats following early life seizures”, Colorado State University, Fort Collins, CO, Oct, 2011.

8. “First-line treatment of Neonatal seizures: Evidence from basic science”, American Epilepsy Society, Special Interest Group lecture, San Diego, Dec 2012.

9. “Altered behavior and plasticity after early life seizures: Molecular mechanisms”, University of Chicago, May, 2013.

10. “Altered behavior and plasticity after early life seizures: Molecular mechanisms”, Yale University School of Medicine, May, 2013.

11. “Altered behavior and plasticity after early life seizures: Molecular mechanisms”, OCNS Symposium, University of Oklahoma School of Medicine, September, 2013.

12. “Intractable epilepsy in Rett and CDKL5 syndromes”, IRSF/IFCR Family Conference, Washington, DC, June 2014.

13. “Are seizure medicines so bad?”, American Epilepsy Society, Pediatric State of the Art Symposium, Dec, 2014, Seattle, WA.

14. “Early-life seizures cause latent synaptic changes in FMRP-mediated signaling, altered plasticity and an autistic phenotype”, Pathways of Neurodevelopmental Disorders, Keystone Symposia, March 2015, Tahoe City, CA

15. “Neonatal seizures: a menagerie of models-A tour of animal models of neonatal seizures”, Special Interest Group Coordinator, AES, Philadelphia, PA, Dec, 2015.

16. “The role of fragile X mental retardation protein in epilepsy, ion channels and behavioral comorbidities”, Panel speaker, AES, Philadelphia, PA, Dec, 2015.

17. “Neurocognitive effects of Early Life Seizures”, Panel Chair and Speaker, Winter Conference on Brain Research, Jan, 2016.

18. “Early-life seizures: acute and chronic effects on synaptic physiology and behavior”, Seattle Children’s Hospital Research Institute, February 2016.

19. “Updates, progress and priorities from CDKL5 Centers of Excellence”, 3rd International CDKL5 Research Symposium, Chicago, IL, June 2016.

20. “Neurophysiological correlates and biomarkers: Rett syndrome, MECP2 duplications and Rett-related disorders Consortium”, 14th Rett Syndrome Research Symposium, Chicago, IL, June 2016.

21. “Epilepsy Management: Treatments, Emergencies, SUDEP”, IRSF/IFCR Family Conference, Chicago, IL, June 2016.

22. “Neonatal seizures: Genetic causes of neonatal epileptic encephalopathies”, Special Interest Group Coordinator, AES, Houston, TX, Dec, 2016.

23. “Acute and chronic effects of early-life seizures on hippocampal synaptic physiology”, Neurology and Neurosciences Seminar Series, University of Illinois Apr 2017.

24. “Multidisciplinary approach to CDKL5 syndrome”, Grand Rounds, University of Illinois, Apr 2017.

25. “Acute and chronic effects of early-life seizures on hippocampal synaptic physiology”, University of Alabama, May, 2017.

26. “Acute and chronic effects of early-life seizures on hippocampal synaptic physiology”, invited speaker, 40th Anniversary MD/PhD symposium, Baylor College of Medicine, Sep 2017.

27. “CDKL5 Deficiency syndrome”, Invited speaker, Takeda Research Forum, Boston, MA, Nov 2017.

28. “CDKL5 syndrome: Towards a clinical severity scale”, Invited speaker, session leader, CDKL5 Forum, Boston, MA, Nov 2017

29. “Neonatal seizures: seizure detection”, Special Interest Group Coordinator, AES, Washington, DC, Dec, 2017.

30. “Rett and Rett-related disorders: Multidisciplinary Approach”, Child Neurology Grand Rounds, New York University Hospital, Jan 2018.

31. “Neurophysiological Correlates and Biomarkers: Rett Syndrome, *MECP2* Duplications, and Rett-Related Disorders Consortium”, Rett-Syndrome Research Trust Symposium, Boston, MA, May 2018.

32. “GRIN Variant Patient Registry (GVPR)”, CFERV annual conference, Atlanta, GA, Sept 2019.

33. “CDKL5 Deficiency Disorder (CDD): Overview for PFDD FDA”, Patient focused drug development for US FDA, Bethesda, MD, October, 2019.

34. “Severity Assessments in Developmental and Epileptic Encephalopathies”, Investigators Workshop, American Epilepsy Society, December, 2019.

35. “Clinical and translational approaches to developmental and epileptic encephalopathies”, Invited speaker, Baylor College of Medicine/Texas Children’s Hospital, April 2021.

36. “Multi-Site Validation of Biomarkers and Core Clinical Outcome Measures for Clinical Trials Readiness in CDKL5 Deficiency Disorder: NIH/NINDS U01NS114312”, CDKL5 Forum, Boston, MA (virtual), November 2021.

37. “CDKL5 Deficiency Disorder (CDD): moving towards disease modifying therapies”, Cleveland Clinic, Neurology Grand Rounds, July, 2022.

38. “CDKL5 Deficiency Disorder (CDD): moving towards disease modifying therapies”, University of Washington, Medical Genetics Grand Rounds Jan, 2023.

39. “CDKL5 Deficiency Disorder (CDD): moving the clinic into science”, University of Iowa, Neurobiology Seminar, July, 2023.

40. “GRINs: Gain and Loss of Function. What to do with this information”, GRIN2B Family Foundation, Aug, 2023.

41. “Multidisciplinary care for Rett, MECP2-related, CDKL5 and FOXG1 disorders: The Rocky Mountain Way”, WUSTL, Neurology rounds, September, 2023.

42. “Therapeutic advances in developmental encephalopathies: Rett and CDKL5 disorders”, Western Society of Pediatric Research, David Rimoin Genetics State of the Art Invited Lectureship, Carmel, CA, January 2024.

43. “CDKL5 deficiency disorder: bringing the clinic into science”, WUSTL, IDDRC Seminar Series, St Louis, MO, March, 2024.

44. “A spotlight on Rett Syndrome”, LSU Neurology Grand Rounds, Baton Rouge, LA (virtual) April, 2024.

45. “Communication challenges in neurodevelopmental disorders: Rett, CDKL5 and FOXG1 syndromes”, 1st WORKSHOP ON VOICE FOR PATIENTS WITH PROFOUND INTELLECTUAL AND MULTIPLE DISABILITIES (PIMD) University of Notre Dame, Notre Dame, IN (virtual), October 24-25, 2024.

46. “Updates on Seizures and Sleep”, FOXG1 Research Foundation Parent Congress, Ft. Lauderdale, FL, November, 2024.

International

1. “Impact of early-life seizures on plasticity and behavior”, MRC Centre for Synaptic Plasticity, University of Bristol, Bristol, UK, May 2004.

2. “CDKL5 syndrome: clinical issues in research”, CDKL5 Forum, London, UK, October, 2015.

3. “Early-life seizures: acute and chronic effects on synaptic physiology and behavior”, MRC Centre, Laboratory of Molecular Biology, Cambridge, UK, Aug 2016.

4. “Clinical Assessments of Common and Uncommon Phenotypes in CDKL5 Syndrome”, International CDKL5 meeting, Invited speaker and session leader, Rome, Italy, June, 2017

5. “Modulation of hippocampal mGlu-LTD by L-type calcium channels: mechanisms and chronic alteration by early life seizures”, Invited speaker, 9th International Conference on metabotropic glutamate receptors, Taormina, IT, Oct 2017.

6. “Development of a CDD Severity Assessment in the IFCR Centers of Excellence”, CDKL5 Forum, London, UK, Oct 2018.

7. “Development of a CDD Severity Assessment in the IFCR Centers of Excellence”, presented along with patient examinations at a) IRCCS Fondazione Stella Maris, Pisa, IT, b) University of Bologna, Di Neuropsichiatria Infantile Su Casi Clinici Complessi, Bologna, IT and c) Policlinico Gemelli, Catholic University, Rome, IT, Nov 2018.

8. “An approach to developmental encephalopathies associated with early-life seizures”, Invited speaker, University of Toronto/Sick Kids Research Institute, Toronto, CA, May 2019.

9. “Development of a CDD Severity Assessment in the IFCR Centers of Excellence”, CDKL5 Alliance, Edinburgh, UK, June 2019.

10. “Development of a CDD Severity Assessment in the IFCR Centers of Excellence/Standards of Care”, CDKL5 Asia, ICRN, Tokyo, Japan, September 2019.

11. “Symptom Management in CDD” CDKL5 Alliance Virtual Family Conference, UK/EU/USA, June 2021.

12. “CDKL5 Deficiency Disorder (CDD): Overview”, EPIGENS, Barcelona, Spain, May 2022 (virtual)

13. “Multidisciplinary Care for Rett Syndrome”, AIRETT Congress, Peschiera del Garda, Italy, June 2022 (virtual).

14. “Multi-Site Validation of Biomarkers and Core Clinical Outcome Measures for Clinical Trials Readiness in CDKL5 Deficiency Disorder” CDKL5 Forum, Boston, MA, Oct 2022.

15. “CDKL5 Deficiency Disorder (CDD): moving the clinic into science”, University of Toronto/Hospital for Sick Kids, Neurobiology Seminar, August, 2023.

16. “Recognizing Rett Syndrome”, Child Neurology Society Meeting, Vancouver, September, 2023.

17. “Discovery and characterization of a specific inhibitor of serine-threonine kinase cyclin dependent kinase-like 5 (CDKL5) demonstrates role in hippocampal CA1 physiology”, CDKL5 Forum, London, November, 2023.

18. “CDKL5 Deficiency Disorder (CDD): bringing the clinic into science”, World Rett Syndrome Congress, Gold Coast, QLD, AUS, October, 2024.

19. “Acute inhibition of CDKL5 and CDKL5-KO in perinatal hippocampal slices unmasks interneuron-specific giant depolarizing currents”, CDKL5 Forum, Boston, MA, October, 2024

20. “Leveraging local and international resources in rare neurodevelopmental disorders toward new therapies”, Bloorview Institute Research Symposium, Toronto, CA, November 2024

21. “Leveraging local and international resources in rare neurodevelopmental disorders toward new therapies for all”, University of Edinburgh, Institute for Neuroscience and Cardiovascular Research, March, 2025.

22. “Where we are with understanding CDKL5 (the biology) and CDD (the disorder)”, CDKL5 Insieme verso la Cura, Rome, Italy, June 2025.

12. Teaching Record:

UC-SOM

- PHCL 7614: Membrane Biophysics. Graduate level class for Neuroscience Program, Physiology and Pharmacology graduate students covering the physical basis of excitable membranes. Course Director. I taught all lectures in this 12 week, 2 hour credit course, 2003-2006.
- PHCL 7605: Ethics in Research. I led a discussion group of (8-12) students that met weekly for 6 weeks. 2006-2013.
- NSC 7600: Cellular and Molecular Neuroscience. I provide one lecture on brain-slice electrophysiological techniques. 2012-present.
- Clinical training in child neurology of pediatric, adult neurology and child neurology residents during ward rotations at Children’s Hospital Colorado.
- Lectures in related child neurology topics to residents and graduate students in pharmacology, pediatrics, genetics, development, neurology, psychiatry and neurosurgery.
    - The Pediatric Neurological exam: January 2007, 2008
    - Pediatric Stroke: March 2007
    - Pediatric Neurogenetic disorders: April 2007
    - Genetics of CNS malformations: 2003-2016
    - Genetics of Intellectual Disability: 2010-2016
    - Anticonvulsants: 2007-present (Molecules to Medicine Course for MSTP program)
    - Neonatal Seizures: Nov 2009, 2010, 2011, 2012 (Pharmacology Intro Course)
    - Neurology Grand Rounds
        - Neurometabolic disorders, November 2004
        - Jumpy legs and a review of membrane biophysics, Sept 2006
        - Neonatal Seizures, January 2008
        - A teenager with encephalitis associated with NMDA receptor antibodies, Dec 2008
        - Pontocerebellar Hypoplasia, Jan 2010
        - Chronic translocation of FMRP and enhanced mGluR-LTD after early life seizures, July 2011

        - Early-life seizures cause latent synaptic changes in FMRP-mediated signalling, altered synaptic plasticity and an autistic phenotype, August 2014
- Graduate student advisor and PhD thesis committee member
    - Chris Dulla, Neuroscience program (PhD-2004)
    - Christina Rapp, Neuroscience program (PhD-2005)
    - Audrey Brumback, Neuroscience program (PhD-2007)
    - Susan Goebel, Neuroscience program (PhD-2007)
    - Eric Horne, Pharmacology (PhD-2007)
    - Holly Hudson-Robertson, Pharmacology (PhD-2008)
    - Tianna Hicklin, Neuroscience (PhD-2009)
    - Anna Nelson, Pharmacology (PhD-2009)
    - Matt Pink, Neuroscience, (PhD-2010)
    - Julie Milder, Neuroscience (PhD-2010)
    - Sruthi Pandipati, Neuroscience, (PhD-2010)
    - Rinaldo Disouza, Neuroscience, (PhD-2011)
    - Heather O'Leary, Neuroscience, (PhD-2012)
    - Jonah Scott-McKean, Neuroscience, (PhD-2012)
    - Jeffrey Taylor Juergens, Physiology, (PhD-2013)
    - Shane Rowley, Neuroscience, (PhD 2014)
    - Kelsey Barcomb, Pharmacology, (PhD 2015)
    - Ajay Thomas, Neuroscience, (PhD 2015)
    - Jennifer Pearson, Neuroscience, (PhD 2016)
    - Brooke Sinnen, Pharmacology (PhD 2018
    - Dayton Goodell, Pharmacology (PhD 2017)
    - Alicia Purkey, Neuroscience (PhD 2019)
    - Veronica Fregoso, CDB (PhD 2019)
    - Aaron Bowen, MSTP/Neuroscience (PhD 2017)
    - Alex Ferber, MSTP/Neuroscience (PhD 2017)
    - Ashley Bourke, Pharmacology (PhD 2020)
    - Sarah Cook, Pharmacology (PhD 2021)
    - Emma Boxer, Neuroscience (PhD 2022)
    - Matt Svalina, MSTP/Neuroscience (PhD 2021)
    - Sarah Zych, MSTP/Neuroscience (PhD 2022)
    - Deen Kareemo, Neuroscience (PhD 2024)
    - Brigit High, Neuroscience (PhD 2023)
    - Jose Vigil, Neuroscience (PhD 2024)
    - Jinyeol Lee, Physiology, University of Toronto (PhD 2023, external examiner)
    - Carly Miller, Neuroscience/MSTP (PhD 2025)
    - Meagan Sullivan, Pharmacology, University of Toronto (PhD 2025, external examiner)
    - Madison Barker, Pharmacology
    - Victoria Chang, Neuroscience
    - Joy Adler, Pharmacology
    - Paige Hoffman, Neuroscience
    - Selin Ekici, Neuroscience/MSTP
- Summer undergraduate research program trainees (subsequent graduate training programs listed)
    - Vivian Carlson-2012 (MBA)
    - Greg Grecco-2015 (MD/PhD, University of Indiana)
    - Drayton Harvey-2016 (MD/PhD, Mayo Clinic)
    - Lauren Keener-2018 (MD, University of New Mexico)
    - Lauren Moment-2019 (MD/PhD, NYU)
    - Sophie Hicks-2020-2023 (PhD, UCL)
    - Aviva Weiser (2022) (BS, Wesleyan)
    - Galen Resler(2023) (MD candidate, University of Buffalo)
    - Vrushali Patel (2023) (MD/PhD candidate, University of Colorado)
- PhD Thesis supervisor
    - Brandon Cornejo, Pharmacology, MD/PhD graduate, 2006
        - Current: Psychiatrist, Clinical Investigator, Kaiser Permanente, Center for Health Research, Portland, OR
    - Elizabeth Stubblefield, Pharmacology, PhD graduate, 2008.

        - Current: Assistant Professor, Psychology & Neuroscience, University of Colorado Boulder
    - Allison Gehrke, Computer Science (co-mentor), PhD graduate, 2015
        - Current: Product development, Intel, Davis, CA.
- Post-doctoral fellows/associates/Research Assistant Professors
    - Paul Bernard, PhD, 2008-2018
        - Current: Assistant Professor, University of PEI, Charlottetown, PEI, Canada
    - Elizabeth Stubblefield, PhD,2009-2010
        - Current: Assistant Professor, Psychology & Neuroscience, University of Colorado Boulder
    - Heather O'Leary-Caballes, PhD,2012-2019; T32 (DPRG) mentee
        - Current: Consultant, Citrus Health Group
    - Jessica Cao, PhD, 2019-2021; T32 (DPRG) mentee
        - Current: Clinical Research Organization, Denver, CO
    - Chad Camp, PhD, 2023-present. T32 (Otolaryngology & DPRG) mentee

13. Grant Support

Research Interests

- Synaptic signaling molecules and mechanisms that underlie DEEs, intellectual disability and autism
- Impact of early-life seizures on hippocampal physiology and related behavior
- Pharmacology, gating and modeling of ligand-gated and ion-gated receptors
- Mathematical modeling of neuronal signaling
- Natural history, outcome measures, genetic discovery and interventional clinical trials in rare genetic disorders associated with epilepsy and intellectual disability (DEEs: Rett, CDKL5, Rett-related, GRIN disorders, FOXG1, Down syndrome and Infantile Spasms).
- Cross-disciplinary research in stroke, vestibular function and cardiology.

Interventional Clinical Trials:

1. Role of Memantine on cognition in young adults with Down Syndrome. Role: co-PI. Status: closed/completed. Sponsor: Forrest Pharmaceuticals.

2. A Safety Study of NNZ-2566 in Pediatric Rett Syndrome. Role: Site PI. Status: closed/completed. Sponsor: Neuren Pharmaceuticals.

3. A Double-blind, Randomized, Placebo-controlled Trial of Adjunctive Ganaxolone Treatment in Children and Young Adults with Cyclindependent Kinase-like 5 (CDKL5) Deficiency Disorder (CDD) Followed by Long-term Open-label Treatment. Role: Site Co-PI. Status: closed/completed. Sponsor: Marinus.

4. A Randomized, Double-Blind, Placebo-Controlled, Cross-Over Study to Assess the Safety, Tolerability, and Efficacy of Oral Ketamine in Patients with Rett Syndrome. Role: Site PI. Status: closed/completed. Sponsor: RSRT.

5. Open-Label Study in patients with CDKL5 deficiency disorder. Role: site Co-PI, Status: closed. Sponsor: Ovid/Takeda.

6. A Randomized, double-blind,placebo-controlled, trial to investigate the efficacy and safety of cannabidiol oral solution (GWP42003-P, CBD-OS) in patients with Rett Syndrome. Role Site PI. Status: closed. Sponsor: GW/Premier.

7. Lavendar and Lilac: Phase 3 trial of trofinetide in Rett Syndrome. Role: site PI, master-rater. Status: closed/completed. Sponsor: Acadia/Neuren/Precision. NCT04988867, NCT04776746, NCT04279314, NCT04181723, FDA has approved trofinetide for Rett Syndrome.

8. NGN RTT-401: A novel, regulated gene therapy (NGN-401) Study for female children with Rett Syndrome. Role: site PI. Status: open to accrual. Sponsor: Neurogene. NCT05898620

9. DOD PR221983: Umbrella Clinical Trial to Evaluate Repurpose Compounds in Rett Syndrome Role: Site PI/MPI. Status: pre-IND, clinical hold. Sponsor: DOD.

10. ATTUNE: A Study to Evaluate the Safety, Tolerability, Pharmacokinetics, and Pharmacodynamics of Intrathecally-Administered ION440 in Participants With Methyl CpG Binding Protein 2 (MECP2) Duplication Syndrome (MDS) ClinicalTrials.gov ID NCT06430385. Status: open to accrual. Sponsor: Ionis

Non-interventional Clinical Trials:

1. "Genetic studies in patients and families with infantile spasms" COMIRB# 12-0482, Questcor Pharmaceuticals, Inc (PI: Benke).

2. "Establishing a CDKL5 Center of Excellence at Children's Hospital Colorado/Rett and Rett-Related Disorders Clinical Registry" COMIRB# 13-2020, Rocky Mountain Rett Association, International Foundation for CDKL5 Research (PI: Benke).

3. "Outcome Measures and Biomarkers Development for Rett Syndrome" COMIRB# 16-1844, Rett Syndrome Research Trust, (PI: Percy).

4. "Rett Syndrome, MECP2 Duplication and Rett-Related Disorders Natural History Study" Ceded to UAB IRB COMIRB# 15-2332; "Neurophysiological Correlates in Rett Syndrome, MECP2 Duplications, and Rett-Related Disorders" COMIRB# 16-1480; Biobanking of Rett Syndrome and Related Disorders" COMIRB# 16-1471; NIH/NICHD (PI: Percy/Neul)

5. "Functional and clinical evaluations of glutamate receptor mutations in epileptic encephalopathies" COMIRB# 16-1520; CURE, GRIN2B Foundation, Simons Foundation (PI: Benke, Traynelis)

6."Rett Syndrome Real World Data Observational Registry" COMIRB# 22-1246, International Rett Syndrome Foundation (PI: multiple).

7. "Multi-site validation of biomarkers and core clinical outcome measures for clinical trials readiness in CDKL5 Deficiency Disorder", COMIRB#19-2756, International CDKL5 Research Network (ICCRN), NIH/NINDS (PD: Benke, PI: Demarest).

8. "The Diagnostic Experience of male Rett Syndrome" COMIRB# 23-0075 International Rett Syndrome Foundation, Rocky Mountain Rett Association (PI: Benke).

9. "Characterization of translatable neurophysiological biomarkers to enhance therapeutic development in Rett syndrome", COMIRB# 23-0668, NIH/NINDS (PI: Neul/Marsh).

Fellowships, grants and other support:
Active:

1. Rocky Mountain Rett Association (Benke) 11/01/2011-present
Role: Rett Clinic director. .
Person months per budget period: 1.2 calendar, $167,000/year

2. Children's Hospital Foundation (Benke) 4/1/2014-indefinite
Ponzio Family Endowed Chair in Neurology Research (Benke)
Funds to support chair-holder's research programs.
Person months per budget period: 0.6 calendar, $100,000

3. U01NS114312-01A1 (Benke) 2/01/2021-1/31/2026
NIH/NINDS
Multi-site validation of biomarkers and core clinical outcome measures for clinical trials readiness in CDKL5 Deficiency Disorder
Role: PI/PD. Oversee clinical trial readiness network; oversee all aspects of the project.
The goal of this project is to validate biomarkers and clinical outcome measures for CDKL5 Disorder across multiple sites.
As Project Director (PD), I oversee a talented, international collaboration of 10 Principal investigators (PIs) and research coordinators in order to develop novel outcome measures for CDKL5 disorder. Through our productivity (12 published manuscripts) and our ongoing longitudinal study, we are establishing clinical trial readiness for interventional clinical trials that will broadly translate to other similar DEEs.
Person months per budget period: 2.4 calendar, $902,257

4. Simons Foundation (Traynelis) 02/01/2021-5/31/2025
Functional and Clinical Evaluation of NMDA Receptor Mutations in Epileptic Encephalopathy

Role: coPI. Functional and clinical evaluations of glutamate receptor mutations in epileptic encephalopathies. This is a multi-site effort to determine the phenotypic characteristics of subjects with GRIN mutations and epileptic encephalopathy.
Person months per budget period: 1.2 calendar, $110,000

5. NIDCD R01 DC018786 (Rennie) 04/01/2021-03/31/2026
Ion channels and excitability in the peripheral vestibular system
Role: CoI. This award supports studies to investigate the role of sodium and potassium conductances in afferent firing in vestibular primary afferents.
Person months per budget period: 0.84 calendar, $247,579

6. NIDCD R01 AG073997 (Rennie/Peng) 09/01/2021-08/30/2026
Aging and dysfunction in the peripheral vestibular system
Role: CoI. This award supports studies to investigate aging in the vestibular system.
Person months per budget period: 0.84 calendar, $395,392

7. International Rett Syndrome Foundation 12/15/2022-12/14/2024/NCE
Diagnostic experience of male Rett syndrome
Role: PI/PD. This award supports qualitative and quantitative studies of male Rett syndrome in partnership with IRSF Centers of Excellence and 3 clinical sites to advance understanding and treatment.
Person months per budget period: 0.6 calendar, $250,000

8. NINDS R61NS130216 (Marsh/Neul) 01/01/2023-12/31/2027
Development of translatable neurophysiological biomarkers to accelerate therapeutic development in Rett syndrome
Role: PI. Will develop neurophysiological biomarkers that can fulfil a specific primary Context of Use (COU), an early treatment.
Person months per budget period: 1.2 Calendar, $404,786

9. NINDS U24NS133991 (Bennett, Benke, Piquet (MPI)) 07/01/2023 – 06/30/2028
University of Colorado Rocky Mountain NeuroNEXT (UNCOMON) Clinical research Consortium
Role: MPI. The goal of the NeuroNEXT Network is to conduct efficient Phase II studies of treatments for neurological disease through partnerships with academia, private foundations and industry.
Person months per budget period: 0.6 calendar year $427,850

10. Rocky Mountain Rett Association (Benke) 1/1/2024-2/28/2026
Diagnostic experience of male Rett syndrome/Caregiver Speaks
Role: PI/PD. (Supplement to #7) This award supports qualitative and quantitative studies of male Rett syndrome in partnership with IRSF Centers of Excellence and 3 clinical sites to advance understanding and treatment. A spin-off project addresses a caregiver mental health intervention.
Person months per budget period: 0.12 calendar, $120,000

11. International Rett Syndrome Foundation (Benke) 7/1/2021-6/30/2027
Rett Clinic Center of Excellence
Role: PI/PD. This award supports real-world natural history study of Rett syndrome in partnership with IRSF Centers of Excellence.
Person months per budget period: 0.0 calendar, $30,000

Pending

1. NINDS (R01 Benke) 04/01/2026-03/31/2031
CDKL5 regulation of synapses and plasticity
Role: PI. Goals: Characterize role of CDKL5 regulation of synapses and plasticity across development utilizing electrophysiological and advanced (nanoscale) microscopy.
Person months per budget period: 3 calendar; Total Award: $3,759,469
Status: pending review Dec 2025

2. NINDS (R21 Benke) 04/01/2026-03/31/2028
CDKL5 regulation of dorsolateral striatum medium spiny neuronal function
Role: PI. Goals: Dissect which medium spiny neurons (MSNs) and synapses are impacted by a clinically relevant kinase, CDKL5, in dorsolateral striatum (DLS), the key regulatory waypoint between cortical activity, motor learning and purposeful movement.
Person months per budget period: 0.6 calendar; Total Award: $429,001

Status: resubmission fall 2026

Prior/completed funding:

DOD PR221983 (Neul) 07/01/2023– 06/30/2028
Umbrella Clinical Trial to Evaluate Repurpose Compounds in Rett Syndrome
Role: Site PI/MPI This proposal will focus on the PRMP Strategic Goal of Treatment: the evaluation of repurposed drugs to determine whether they are safe and efficacious to improve the health and quality of life in individuals living with RTT.
Person months per budget period: 0.3-1.2 calendar year; total Award Amount (including Indirect Costs): $13,068,224

R21 NS112770 (Benke) 04/01/2020-03/31/2022 (NCE)
NIH/NINDS
Role of CDKL5 kinase activity in modulating synaptic plasticity
Role: PI. The goal of this project is to characterize potential specific CDKL5 kinase inhibitors in order to determine their role in synaptic plasticity. Comparisons are made to CDKL5-knock out rodents to determine the role of the acute kinase function in this model of pediatric epileptic encephalopathy.
0.06 calendar, $175,000

U54 HD061222 (Percy) 09/30/2003-07/31/2019 (NCE)
Rare Disease CRC for New Therapies and New Diagnostics
Role: Site PI. Rare Disease multisite initiative to provide natural history studies leading to possible therapies for Rett syndrome, MECP2 Duplication Disorder, and Rett-related Disorders Natural History.
1.8 calendar, $55,921

GRIN2B (Benke) 11/01/2019-10/31/2020 (NCE)
Functional and Clinical Evaluation of NMDA Receptor Mutations in Epileptic Encephalopathy
Role: PI. Functional and clinical evaluations of glutamate receptor mutations in epileptic encephalopathies. This is a rolling foundation-funded grant from GRIN2B foundation. This is a multi-site effort to determine the phenotypic characteristics of subjects with GRIN mutations and epileptic encephalopathy.
0.06 calendar, $60,953

R01 NS081248 (Bayer) 04/01/2017-03/30/2021 (NCE)
NIH/NINDS
CaMKII autophosphorylation in opposing directions of synaptic plasticity.
PI: Ulli Bayer, PhD
Role: CoI, provide electrophysiological expertise to read-outs of plasticity.
0.06 calendar, $250,000

R21 NS101288 (Benke) 09/01/2017 - 08/30/2019
Exploratory determination of the role of L-type calcium channels in mediating abnormal plasticity and behavior after early life seizures
Role: PI. The goal of this project is to determine the mechanistic role of L-type calcium channels in neurocognitive disorders associated with early-life seizures.

Questcor (Pharma) 01/01/2012 - 12/31/2020
PI: Tim Benke, MD, PhD
Whole-exome sequencing and ACTH responsiveness in infantile spasms.
Role: PI. The goals of this project are to determine 1) the effectiveness of whole-exome sequencing in determining causation of infantile spasms and 2) determine phamacogenomic profiles of patients treated with ACTH for this disorder.

K12 NS089417
Co-PI: Tim Benke, MD, PhD 07/01/2015-06/30/2020
NIH/NINDS
Colorado Neurological Sciences Academic Development Award (NSADA)
The Colorado Neurosciences Academic Development Award (NSADA K12) program based at the University of Colorado Anschutz Medical Campus (UCAMC) and Children's Hospital Colorado (CHC) will leverage the combined resources of our large, active neuroscience research community, an outstanding university infrastructure for training in clinical-translational research and one of the best children's hospitals in the country to provide exceptional basic-translational pediatric neuroscience research training for the

next generation of academic pediatric neurology leaders. (MPI with Brooks-Kayal, non-funded mentorship and leadership effort)

CURE (PI-Traynelis) 08/01/2016-12/31/2019
Functional and Clinical Evaluation of NMDA Receptor Mutations in Epileptic Encephalopathy
Role: Site PI. Establish treatment guidelines and database for retrospective study of treatment outcomes in patients with alterations in GRINs.
0.06 calendar, $35,757

Rett Syndrome Research Trust (Percy) 09/01/2016-08/31/2019
Outcome Measures and Biomarkers Development for Rett Syndrome: Multi-site development of standardized assessments for use in clinical trials
Role: Site PI. The goal of this project is to establish novel biomarkers for the assessment of treatment outcomes in patients with Rett syndrome.
0.06 calendar, $89,401

UPenn Orphan Disease program (Marsh/Benke) 01/01/2017 - 12/31/2019
5212 Extension Study: AEP/VEP/EEG in CDKL5 deficiency syndrome Role: co-PI. The goal of this project is to determine electrophysiologic biomarkers in CDKL5 deficiency syndrome.
0.03 calendar, $15,112

1U10NS077277 (Vollmer) 09/30/2011-08/31/2018
NIH/NINDS
PI: Tim Vollmer, MD
Role: Co-I.
Rocky Mountain Network for Neuroscience Clinical Studies (RMNNCS)
The goal of this NeuroNext grant is to support the local infrastructure necessary for multisite clinical trials in neurological disorders.
1.2 calendar, $200,000

UPenn Orphan Disease program (Benke) 05/01/2017 - 10/30/2018 (NCE)
Mechanisms and treatment of paradoxical hyperexcitability in CDKL5 deficiency syndrome. Role: PI. The goal of this project is to determine the mechanisms and possible treatment of CDKL5 deficiency syndrome.
1.2 calendar, $150,000

R01 NS076577
PI: Tim Benke, MD, PhD 9/01/2011-08/31/2016
NIH/NINDS
Molecular mechanisms linking early life seizures, autism and intellectual disability
Role: PI. The goal of this project is to characterize the signalling mechanisms involved in the permanent alterations of hippocampal excitatory transmission, mGluR-LTD and in vivo behavior alterations following early life seizures. 20% effort funded.

International CDKL5 Foundation
PI: Tim Benke, MD, PhD 04/01/2013-2014
Role: International CDLK5 Foundation Center of Excellence, clinic director. We are the founding/initial site to establish a clinical research network of sites for advancing the treatment of patients with CDKL5 syndrome; clinic runs concurrently with Rett clinic. 3% effort funded.

Autism Treatment Network
PI: Ann Reynolds, MD 2009-2014
Role: Consultant Neurologist to local Autism Treatment Network (ATN) site. 2% effort funded. The ATN is a multi-site, collaborative, clinical network designed to advance the diagnosis and treatment of autism.

R01 NS40701
PI: Mark Dell'Acqua, Ph.D. 08/01/2001-07/30/2013
NIH/NINDS
Regulation of AKAP79 Postsynaptic Membrane Targeting
Role: Co-Investigator. The goals of this project are to further characterize the mechanism and regulation of AKAP79/150 targeting to the postsynaptic membrane of excitatory synapses in hippocampal neurons with an emphasis on early, rapid regulation of AMPA receptors during induction phases of hippocampal synaptic plasticity. 10% effort

Children's Hospital Colorado Research Institute
PI: Tim Benke, MD, PhD 05/01/2010-04/30/2011

Impact of Early life Seizures on Glutamate Receptors and Synaptic Function
Role: PI. The goal of this project was to characterize the mechanisms involved in the impairment of synaptic plasticity by a single seizure in early life, with an emphasis on investigating the properties of glutamate receptors.

Epilepsy Foundation Pediatric Partnership for Epilepsy Research (190295)
PI: Tim Benke, MD, PhD 1/01/2011-12/31/2011
Impact of Early life Seizures on Glutamate Receptors
Role: PI. The goal of this project was to characterize the mechanisms involved in the early alterations of glutamate receptors and cell signalling by a single seizure in early life. 10% effort.

NIH RO1 NS052644
PI: Ulli Bayer, PhD 1/30/07-11/30/11
NIH/NINDS
CaMKII activation and translocation in neuronal function
Role: Co-investigator: I assisted with electrophysiological characterization of effects of CamKII activation on glutamate receptors in cultured, transfected hippocampal neurons. 2.5% effort, unfunded.

W81XWH-10-1-0380
PI: Audrey Yee, MD 6/1/2010 – 5/31/2011
DOD
Epilepsy and the Wnt Signaling Pathway.
Role: Consultant. The major goal of this project was to determine how wnt pathway signalling affects epileptogenic signalling in the hippocampus. 3% effort.

CCTSI (Colorado Clinical Translational Sciences Institute)
PI: Dr Alberto Costa 6/01/2009-5/31/2011
Clinical Trial: Role of Memantine on cognition in young adults with Down Syndrome.
Role: co-PI and mentor to Jonah Scott-McKean, PhD student. 1% effort

K02 NS056090
PI: Tim Benke, MD, PhD 05/01/2007-04/30/2010
NIH/NINDS
Impact of early life seizures on glutamate receptors
Role: PI. The goal of this project was to characterize the mechanisms involved in the impairment of synaptic plasticity by a single seizure in early life, with an emphasis on investigating the properties of glutamate receptors. 75% effort

NIH RO1 DC0082797
PI: Katie Rennie, PhD 5/1/2007-4/20/2011
NIH/NIDCD
Neurotransmission at the vestibular calyx synapse
Role: Co-investigator: I assisted with electrophysiological analyses and mathematical modelling of neurotransmission at the calyx synapse in the vestibular periphery. 5% effort

K08 NS041267-05
PI: Tim Benke, MD, PhD 09/06/2001-08/31/2006
NIH/NINDS
Impact of Early-Life Seizures on Synaptic Plasticity
Role: PI. The goal of this project was to characterize the mechanisms involved in the impairment of synaptic plasticity by a single seizure in early life, with an emphasis on investigating the properties of glutamate receptors. 75% effort

R01 AA014021
PI: Paula Hoffman, Ph.D. 02/01/2005-01/31/2010
NIH-NIAAA
Regulation of NMDA Receptor Localization by Chronic Ethanol Exposure
Role: Co-Investigator. The focus was on mechanisms of adaptation in synaptic localization of NMDA receptors in response to chronic ethanol exposure. 2.5% effort

American Hearing Research Foundation
PI: Katie Rennie, Ph.D. 2004-2005
Ionic mechanisms underlying neuronal firing in vestibular calyx afferents
Role: Co-investigator. 5% effort.

F32 NS09894 National Research Service Award
PI: Tim Benke MD, PhD 1995-1996
NIH/NINDS
Pharmacological dendritic glutamate changes in LTP.
University of Bristol, Department of Anatomy.

National Institutes of Health Pre-Doctoral Fellowship, Baylor College of Medicine, Houston, TX, 1986-88.

Dr. Hadwen Trust for Humane Research, University of Bristol, Department of Anatomy, 1996-1997.

Achievement Rewards for College Scientists (ARCS) Scholar, Baylor College of Medicine, Houston, TX, 1988-1995.

W.M. Keck Foundation Equipment Grant, Baylor College of Medicine, Houston, TX, 1992.

Human Frontiers of Science Program sponsored Research Externship in laboratory of Graham Collingridge, Ph.D., Department of Pharmacology, University of Bristol, United Kingdom, 1989-1991.

National Science Foundation Travel Award, Rice University, Houston, TX, 1988.

14. Bibliography

Peer Reviewed Publications:

1. Wilson, O.B., Clark, J.W., Ganapathy, N., Benke, T.A. Signal processing methods for inverse problems in electrophysiology, *Twenty-second Asilomar Conference on Signals, Systems and Computers*, Chen, R.R., Ed., Vol. 2, pp. 938-944, 1988.

2. Benke, T.A., Clark, J.W., Wisoff, P.J., Schneider, S., Balasubramanian, C., Hawkins, H.K., Laurent, J., Perling, L., Shehab, A. Comparative study of suture and laser-assisted anastomoses in rat sciatic nerves, *Lasers in Surgery and Medicine* 9, 602-15, 1989.

3. Benke, T.A., Jones, O.T., Collingridge, G.L., Angelides, K.J. NMDA receptors are localized and immobilized to apical dendrites of cortical neurons, *Proc. Natl. Acad. Sci. U.S.A.*, 90, 7819-7823, 1993.

4. Wilkemeyer, M. F., Smith, K. L., Zarei, M. M., Benke, T. A., Swann, J. W., Angelides, K. J., Eisensmith, R. C. Adenovirus-mediated gene transfer into dissociated and explant cultures of rat hippocampal neurons, *Journal of Neuroscience Research*, 43, 161-174, 1996.

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