Stanford



# Paul Buckmaster, DVM, PhD

Professor of Comparative Medicine and of Neurology and Neurological Sciences

## Bio

### ACADEMIC APPOINTMENTS

- Professor, Comparative Medicine
- Professor, Neurology and Neurological Sciences
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

### ADMINISTRATIVE APPOINTMENTS

- Career Award in the Medical Sciences Advisory Committee, Burroughs Wellcome Fund, (2014-2023)
- Comparative Medicine Review Committee (RIRG-C) Study Section, NCRR, NIH, (2008-2012)
- Clinical Neuroplasticity and Neurotransmitter Study Section, NIH Center for Scientific Review, (2004-2008)
- Research Council of the Professional Advisory Board, Epilepsy Foundation, (2003-2014)

### HONORS AND AWARDS

- Career Award in the Biomedical Sciences, Burroughs Wellcome Fund (1996-2000)

### PROFESSIONAL EDUCATION

- DVM, University of California, Davis , Veterinary Medicine (1988)
- PhD, University of Washington , Physiology (1992)

## Research & Scholarship

### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Temporal lobe epilepsy is common, frequently refractory to treatment, and devastating to those affected. Our long-term goal is to better understand the pathophysiological mechanisms of this disease so that rational and effective therapies can be developed. We use electrophysiological, molecular, and anatomical techniques to evaluate neuronal circuitry in normal and in epileptic brains.

## Teaching

### COURSES

**2023-24**

- Neurosciences Anatomy Core: NEPR 205 (Aut)

### GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (PhD Program)

## Publications

### PUBLICATIONS

- **Numbers of granule cells and GABAergic boutons are correlated in shrunken sclerotic hippocampi of sea lions with temporal lobe epilepsy.** *eNeuro*
  Wyeth, M., Krucik, D. D., Thorbrogger, C. J., Field, C., Buckmaster, P. S.
  2026
- **Ventral hippocampal formation is the primary epileptogenic zone in a rat model of temporal lobe epilepsy.** *The Journal of neuroscience : the official journal of the Society for Neuroscience*
  Buckmaster, P. S., Reyes, B., Kahn, T., Wyeth, M.
  2022
- **Lack of hyper-inhibition of oriens-lacunosum moleculare cells by vasoactive intestinal peptide-expressing cells in a model of temporal lobe epilepsy.** *eNeuro*
  Wyeth, M., Buckmaster, P. S.
  2021
- **Ictal onset sites and γ-aminobutyric acidergic neuron loss in epileptic pilocarpine-treated rats.** *Epilepsia*
  Wyeth, M. n., Nagendran, M. n., Buckmaster, P. S.
  2020
- **Seizure frequency correlates with loss of dentate gyrus GABAergic neurons in a mouse model of temporal lobe epilepsy.** *journal of comparative neurology*
  Buckmaster, P. S., Abrams, E., Wen, X.
  2017; 525 (11): 2592-2610
- **High-dose rapamycin blocks mossy fiber sprouting but not seizures in a mouse model of temporal lobe epilepsy.** *Epilepsia*
  Heng, K., Haney, M. M., Buckmaster, P. S.
  2013; 54 (9): 1535-1541
- **Early Activation of Ventral Hippocampus and Subiculum during Spontaneous Seizures in a Rat Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Toyoda, I., Bower, M. R., Leyva, F., Buckmaster, P. S.
  2013; 33 (27): 11100-11115
- **Rapamycin Suppresses Mossy Fiber Sprouting But Not Seizure Frequency in a Mouse Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Buckmaster, P. S., Lew, F. H.
  2011; 31 (6): 2337-2347
- **Initial Loss but Later Excess of GABAergic Synapses with Dentate Granule Cells in a Rat Model of Temporal Lobe Epilepsy** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Thind, K. K., Yamawaki, R., Phanwar, I., Zhang, G., Wen, X., Buckmaster, P. S.
  2010; 518 (5): 647-667
- **Dysfunction of the Dentate Basket Cell Circuit in a Rat Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Zhang, W., Buckmaster, P. S.
  2009; 29 (24): 7846-7856
- **Reduced inhibition of dentate granule cells in a model of temporal lobe epilepsy** *JOURNAL OF NEUROSCIENCE*
  Kobayashi, M., Buckmaster, P. S.
  2003; 23 (6): 2440-2452
- **Axon sprouting in a model of temporal lobe epilepsy creates a predominantly excitatory feedback circuit** *JOURNAL OF NEUROSCIENCE*
  Buckmaster, P. S., Zhang, G. F., Yamawaki, R.

2002; 22 (15): 6650-6658

- **Evidence of neuronal loss and granule cell axon reorganization in the dentate gyrus of cats with temporal lobe epilepsy-like seizures.** *American journal of veterinary research*
  Baert, K., Majinski, C., Osting, S., DiPaola, E., Buckmaster, P., Cameron, S.
  2026: 1-7
- **Dogs with idiopathic epilepsy and focal epileptic seizures lack hilar neuron loss and mossy fiber sprouting of temporal lobe epilepsy.** *American journal of veterinary research*
  Baert, K., Osting, S., DiPaola, E., Buckmaster, P., Cameron, S.
  2026: 1-6
- **Rat strain differences in seizure frequency and hilar neuron loss after systemic treatment with pilocarpine.** *Epilepsy research*
  Junghans, K., Wyeth, M., Buckmaster, P. S.
  2024; 204: 107384
- **Pinniped electroencephalography: Methodology and findings in California sea lions (Zalophus californianus).** *Frontiers in veterinary science*
  Williams, D. C., Haulena, M., Dennison, S., Waugh, L., Goldstein, T., Nutter, F., Bonn, B. V., Hoard, V., Laxer, K. D., Buckmaster, P. S., Gulland, F. M., Tharp, B.
  2023; 10: 1040125
- **Cannabinoid receptor 1-labeled boutons in the sclerotic dentate gyrus of epileptic sea lions.** *Epilepsy research*
  Seelman, A., Vu, K., Buckmaster, P., Mackie, K., Field, C., Johnson, S., Wyeth, M.
  2022; 184: 106965
- **Non-invasive, neurotoxic surgery reduces seizures in a rat model of temporal lobe epilepsy.** *Experimental neurology*
  Zhang, Y., Buckmaster, P. S., Qiu, L., Wang, J., Keunen, O., Ghobadi, S. N., Huang, A., Hou, Q., Li, N., Narang, S., Habte, F. G., Bertram, E. H., Lee, et al
  2021: 113761
- **Proportional loss of parvalbumin-immunoreactive synaptic boutons and granule cells from the hippocampus of sea lions with temporal lobe epilepsy** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Cameron, S., Lopez, A., Glabman, R., Abrams, E., Johnson, S., Field, C., Gulland, F. M. D., Buckmast, P. S.
  2019; 527 (14): 2341–55
- **Testing Different Combinations of Acoustic Pressure and Doses of Quinolinic Acid for Induction of Focal Neuron Loss in Mice Using Transcranial Low-Intensity Focused Ultrasound.** *Ultrasound in medicine & biology*
  Zhang, Y., Liao, C., Qu, H., Huang, S., Jiang, H., Zhou, H., Abrams, E., Habte, F. G., Yuan, L., Bertram, E. H., Lee, K. S., Pauly, K. B., Buckmaster, et al
  2018
- **A single subconvulsant dose of domoic acid at mid-gestation does not cause temporal lobe epilepsy in mice** *NEUROTOXICOLOGY*
  Demars, F., Clark, K., Wyeth, M. S., Abrams, E., Buckmaster, P. S.
  2018; 66: 128–37
- **Hilar somatostatin interneuron loss reduces dentate gyrus inhibition in a mouse model of temporal lobe epilepsy** *EPILEPSIA*
  Hofmann, G., Balgooyen, L., Mattis, J., Deisseroth, K., Buckmaster, P. S.
  2016; 57 (6): 977-983
- **More Docked Vesicles and Larger Active Zones at Basket Cell-to-Granule Cell Synapses in a Rat Model of Temporal Lobe Epilepsy.** *journal of neuroscience*
  Buckmaster, P. S., Yamawaki, R., Thind, K.
  2016; 36 (11): 3295-3308
- **Surviving Mossy Cells Enlarge and Receive More Excitatory Synaptic Input in a Mouse Model of Temporal Lobe Epilepsy** *HIPPOCAMPUS*
  Zhang, W., Thamattoor, A. K., LeRoy, C., Buckmaster, P. S.
  2015; 25 (5): 594-604
- **Unit Activity of Hippocampal Interneurons before Spontaneous Seizures in an Animal Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Toyoda, I., Fujita, S., Thamattoor, A. K., Buckmaster, P. S.

2015; 35 (16): 6600-6618

- **Blockade of Excitatory Synaptogenesis With Proximal Dendrites of Dentate Granule Cells Following Rapamycin Treatment in a Mouse Model of Temporal Lobe Epilepsy** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Yamawaki, R., Thind, K., Buckmaster, P. S.
  2015; 523 (2): 281-297
- **Preictal Activity of Subicular, CA1, and Dentate Gyrus Principal Neurons in the Dorsal Hippocampus before Spontaneous Seizures in a Rat Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Fujita, S., Toyoda, I., Thamattoor, A. K., Buckmaster, P. S.
  2014; 34 (50): 16671-16687
- **Hippocampal Neuropathology of Domoic Acid-Induced Epilepsy in California Sea Lions (Zalophus californianus)** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Buckmaster, P. S., Wen, X., Toyoda, I., Gulland, F. M., Van Bonn, W.
  2014; 522 (7): 1691-1706
- **Does Mossy Fiber Sprouting Give Rise to the Epileptic State?** *Workshop on Issues in Clinical Epileptology - A View from the Bench held in honor of Phil*
  Buckmaster, P. S.
  SPRINGER.2014: 161–168
- **Short-term treatment with the GABAA receptor antagonist pentylenetetrazole produces a sustained pro-cognitive benefit in a mouse model of Down's syndrome.** *British journal of pharmacology*
  Colas, D., Chuluun, B., Warrier, D., Blank, M., Wetmore, D. Z., Buckmaster, P., Garner, C. C., Heller, H. C.
  2013; 169 (5): 963-973
- **Factors affecting outcomes of pilocarpine treatment in a mouse model of temporal lobe epilepsy** *EPILEPSY RESEARCH*
  Buckmaster, P. S., Haney, M. M.
  2012; 102 (3): 153-159
- **Mossy cell dendritic structure quantified and compared with other hippocampal neurons labeled in rats in vivo** *EPILEPSIA*
  Buckmaster, P. S.
  2012; 53: 9-17
- **Distinct Neuronal Coding Schemes in Memory Revealed by Selective Erasure of Fast Synchronous Synaptic Transmission** *NEURON*
  Xu, W., Morishita, W., Buckmaster, P. S., Pang, Z. P., Malenka, R. C., Suedhof, T. C.
  2012; 73 (5): 990-1001
- **Identification of new epilepsy treatments: Issues in preclinical methodology** *EPILEPSIA*
  Galanopoulou, A. S., Buckmaster, P. S., Staley, K. J., Moshe, S. L., Perucca, E., Engel, J., Loescher, W., Noebels, J. L., Pitkanen, A., Stables, J., White, H. S., O'Brien, T. J., Simonato, et al
  2012; 53 (3): 571-582
- **Increased Excitatory Synaptic Input to Granule Cells from Hilar and CA3 Regions in a Rat Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Zhang, W., Huguenard, J. R., Buckmaster, P. S.
  2012; 32 (4): 1183-1196
- **Is there a critical period for mossy fiber sprouting in a mouse model of temporal lobe epilepsy?** *EPILEPSIA*
  Lew, F. H., Buckmaster, P. S.
  2011; 52 (12): 2326-2332
- **Rapamycin suppresses axon sprouting by somatostatin interneurons in a mouse model of temporal lobe epilepsy** *EPILEPSIA*
  Buckmaster, P. S., Wen, X.
  2011; 52 (11): 2057-2064
- **Seizure-induced basal dendrites on granule cells** *EPILEPSIA*
  Ribak, C. E., Shapiro, L. A., Yan, X., Dashtipour, K., Nadler, J. V., Obenaus, A., Spigelman, I., Buckmaster, P. S.
  2010; 51: 43-43

- **Mossy fiber sprouting in the dentate gyrus** *EPILEPSIA*
  Buckmaster, P. S.
  2010; 51: 39-39
- **Excitatory Input Onto Hilar Somatostatin Interneurons Is Increased in a Chronic Model of Epilepsy** *JOURNAL OF NEUROPHYSIOLOGY*
  Halabisky, B., Parada, I., Buckmaster, P. S., Prince, D. A.
  2010; 104 (4): 2214-2223
- **Stress coping stimulates hippocampal neurogenesis in adult monkeys** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Lyons, D. M., Buckmaster, P. S., Lee, A. G., Wu, C., Mitra, R., Duffey, L. M., Buckmaster, C. L., Her, S., Patel, P. D., Schatzberg, A. F.
  2010; 107 (33): 14823-14827
- **Surviving Hilar Somatostatin Interneurons Enlarge, Sprout Axons, and Form New Synapses with Granule Cells in a Mouse Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Zhang, W., Yamawaki, R., Wen, X., Uhl, J., Diaz, J., Prince, D. A., Buckmaster, P. S.
  2009; 29 (45): 14247-14256
- **Inhibition of the Mammalian Target of Rapamycin Signaling Pathway Suppresses Dentate Granule Cell Axon Sprouting in a Rodent Model of Temporal Lobe Epilepsy** *JOURNAL OF NEUROSCIENCE*
  Buckmaster, P. S., Ingram, E. A., Wen, X.
  2009; 29 (25): 8259-8269
- **Prolonged infusion of inhibitors of calcineurin or L-type calcium channels does not block mossy fiber sprouting in a model of temporal lobe epilepsy** *EPILEPSIA*
  Ingram, E. A., Toyoda, I., Wen, X., Buckmaster, P. S.
  2009; 50 (1): 56-64
- **Synaptic input to dentate granule cell basal dendrites in a rat model of temporal lobe epilepsy** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Thind, K. K., Ribak, C. E., Buckmaster, P. S.
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- **Changes in granule cell firing rates precede locally recorded spontaneous seizures by minutes in an animal model of temporal lobe epilepsy** *JOURNAL OF NEUROPHYSIOLOGY*
  Bower, M. R., Buckmaster, P. S.
  2008; 99 (5): 2431-2442
- **Neuron-specific nuclear antigen NeuN is not detectable in gerbil subtantia nigra pars reticulata** *BRAIN RESEARCH*
  Kumar, S. S., Buckmaster, P. S.
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- **Recurrent circuits in layer II of medial entorhinal cortex in a model of temporal lobe epilepsy** *JOURNAL OF NEUROSCIENCE*
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- **Hyperexcitability, interneurons, and loss of GABAergic synapses in entorhinal cortex in a model of temporal lobe epilepsy** *JOURNAL OF NEUROSCIENCE*
  Kumar, S. S., Buckmaster, P. S.
  2006; 26 (17): 4613-4623
- **GABA(A) receptor-mediated IPSCs and alpha 1 subunit expression are not reduced in the substantia nigra pars reticulata of gerbils with inherited epilepsy** *JOURNAL OF NEUROPHYSIOLOGY*
  Kumar, S. S., Wen, X. L., Yang, Y. F., Buckmaster, P. S.
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- **Stereological analysis of forebrain regions in kainate-treated epileptic rats** *BRAIN RESEARCH*
  Chen, S. Y., Buckmaster, P. S.
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- **Prolonged infusion of cycloheximide does not block mossy fiber sprouting in a model of temporal lobe epilepsy** *EPILEPSIA*
  Toyoda, I., Buckmaster, P. S.

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- **Does a unique type of CA3 pyramidal cell in primates bypass the dentate gate?** *JOURNAL OF NEUROPHYSIOLOGY*
  Buckmaster, P. S.
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- **Laboratory animal models of temporal lobe epilepsy** *COMPARATIVE MEDICINE*
  Buckmaster, P. S.
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- **Recurrent excitation of granule cells with basal dendrites and low interneuron density and inhibitory postsynaptic current frequency in the dentate gyrus of macaque monkeys** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Austin, J. E., Buckmaster, P. S.
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- **Prolonged infusion of tetrodotoxin does not block mossy fiber sprouting in pilocarpine-treated rats** *EPILEPSIA*
  Buckmaster, P. S.
  2004; 45 (5): 452-458
- **Dendritic morphology, local circuitry, and intrinsic electrophysiology of principal neurons in the entorhinal cortex of macaque monkeys** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Buckmaster, P. S., Alonso, A., Canfield, D. R., AMARAL, D. G.
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- **Reduced inhibition and increased output of layer II neurons in the medial entorhinal cortex in a model of temporal lobe epilepsy** *JOURNAL OF NEUROSCIENCE*
  Kobayashi, M., Wen, X. L., Buckmaster, P. S.
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- **Evoked responses of the dentate gyrus during seizures in developing gerbils with inherited epilepsy** *JOURNAL OF NEUROPHYSIOLOGY*
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  2002; 88 (2): 783-793
- **Axon arbors and synaptic connections of a vulnerable population of interneurons in the dentate gyrus in vivo** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Buckmaster, P. S., Yamawaki, R., Zhang, G. F.
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- **BDNF overexpression increases dendrite complexity in hippocampal dentate gyrus** *NEUROSCIENCE*
  Tolwani, R. J., Buckmaster, P. S., Varma, S., Cosgaya, J. M., Wu, Y., Suri, C., Shooter, E. M.
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- **Heightened seizure severity in somatostatin knockout mice** *EPILEPSY RESEARCH*
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- **Intracellular recording and labeling of mossy cells and proximal CA3 pyramidal cells in macaque monkeys** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Buckmaster, P. S., Amaral, D. G.
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- **Somatostatin-immunoreactive interneurons contribute to lateral inhibitory circuits in the dentate gyrus of control and epileptic rats** *HIPPOCAMPUS*
  Boyett, J. M., Buckmaster, P. S.
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- **Highly specific neuron loss preserves lateral inhibitory circuits in the dentate gyrus of kainate-induced epileptic rats** *JOURNAL OF NEUROSCIENCE*
  Buckmaster, P. S., Jongen-Relo, A. L.
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- **Neuron loss and axon reorganization in the dentate gyrus of cats infected with the feline immunodeficiency virus** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Mitchell, T. W., Buckmaster, P. S., Hoover, E. A., Whalen, L. R., Dudek, F. E.
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- **In vivo intracellular analysis of granule cell axon reorganization in epileptic rats** *JOURNAL OF NEUROPHYSIOLOGY*
  Buckmaster, P. S., Dudek, F. E.
  1999; 81 (2): 712-721
- **Recurrent spontaneous motor seizures after repeated low-dose systemic treatment with kainate: assessment of a rat model of temporal lobe epilepsy** *EPILEPSY RESEARCH*
  Hellier, J. L., Patrylo, P. R., Buckmaster, P. S., Dudek, F. E.
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- **Axonal sprouting in hippocampus of cats infected with feline immunodeficiency virus (FIV)** *JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES*
  Mitchell, T. W., Buckmaster, P. S., Hoover, E. A., Whalen, L. R., Dudek, F. E.
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- **Neuron loss, granule cell axon reorganization, and functional changes in the dentate gyrus of epileptic kainate-treated rats** *JOURNAL OF COMPARATIVE NEUROLOGY*
  Buckmaster, P. S., Dudek, F. E.
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- **Ultrastructural localization of neurotransmitter immunoreactivity in mossy cell axons and their synaptic targets in the rat dentate gyrus** *HIPPOCAMPUS*
  Wenzel, H. J., Buckmaster, P. S., Anderson, N. L., Wenzel, M. E., Schwartzkroin, P. A.
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- **Electrophysiological correlates of seizure sensitivity in the dentate gyrus of epileptic juvenile and adult gerbils** *JOURNAL OF NEUROPHYSIOLOGY*
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- **Axon arbors and synaptic connections of hippocampal mossy cells in the rat in vivo** *JOURNAL OF COMPARATIVE NEUROLOGY*
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- **INTERNEURONS AND INHIBITION IN THE DENTATE GYRUS OF THE RAT IN-VIVO** *JOURNAL OF NEUROSCIENCE*
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  Buckmaster, P. S., Schwartzkroin, P. A.
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- **SOMATOSTATIN-IMMUNOREACTIVITY IN THE HIPPOCAMPUS OF MOUSE, RAT, GUINEA-PIG, AND RABBIT** *HIPPOCAMPUS*
  Buckmaster, P. S., Kunkel, D. D., Robbins, R. J., Schwartzkroin, P. A.
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  Buckmaster, P. S., Strowbridge, B. W., Schwartzkroin, P. A.
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