

**CURRICULUM VITAE**  
**Michael R. Markham**

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**EDUCATION**

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**University of New Mexico**

Doctor of Philosophy, Psychology	1994
Master of Science <i>with distinction</i> , Psychology	1991
Bachelor of Arts, <i>summa cum laude</i> , Psychology	1990

**ACADEMIC POSITIONS and LEADERSHIP APPOINTMENTS**

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**University of Oklahoma, Dodge Family College of Arts and Sciences**

Associate Dean for Academic Programs and Liaison Dean for the Natural Sciences	2020–...
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**University of Oklahoma, Department of Biology**

Case-Hooper Professor	2023–...
Acting Chair	2019
Assistant Chair	2016–2019
Case-Hooper Associate Professor	2015–2023
Case-Hooper Assistant Professor	2011–2015

**University of Texas at Austin, Section of Neurobiology**

Lecturer	2008–2011
Research Scientist	2006–2011

**Florida International University, Department of Biological Sciences**

Research Associate Professor	2002–2006
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**Florida International University, Department of Psychology**

Assistant Professor	1994–2002
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**HONORS AND AWARDS**

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2018	Sam K. Viersen Family Foundation Presidential Professor of Excellence, OU
2014	CAREER Award – National Science Foundation
2014	Irene Rothbaum Outstanding Assistant Professor Award, OU College of Arts & Sciences
2010	Young Investigator Award, International Society for Neuroethology
1994	Graduate Student Valedictorian, University of New Mexico
1994	Benjamin F. Haught Memorial Research Lecture, University of New Mexico
1993	Outstanding Graduate Student Researcher, University of New Mexico
1990	Phi Beta Kappa

**RESEARCH INTERESTS**

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Neurobiology of animal communication systems; Energetic constraints on animal communication systems; Real-time interactions of behavior, ion channels, and excitable cell plasticity

**EXTRAMURAL FUNDING (total funding = \$3,415,637)**

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National Science Foundation IOS–1644965 (2017–2022) \$1.5M, IOS EDGE: Enabling genotype-phenotype studies in weakly electric fish. PI: J Gallant; Co-PIs: Markham, Sawtell, Warren, Zakon

National Science Foundation IOS-1350753 (2014–2020) \$719,286, CAREER: The energetic costs of active sensory and communication signals: Integrating research and education through organismal, cellular, and molecular approaches. PI: Markham

National Science Foundation IOS–1257580 (2013–2016) \$379,351, Cellular mechanisms of rapid hormonal modulation in vertebrate communication signals. PI: Markham

National Institute of Mental Health, NIH 1K01MH064550 (2003–2008) \$594,000, Ion channels in regulation of excitable membranes. PI: Markham

National Institute of General Medical Sciences NIH S06GM08205 (1998 – 2000) \$223,000, An animal model of arbitrary stimulus classes and class-based transfer of stimulus functions. PI: Markham

**INTERNAL FUNDING**

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University of Oklahoma Faculty Senate, Ed Cline Faculty Development Award (2013) \$2000, Development of public domain instructional software for neuroscience classes.

University of Oklahoma Research Council (2012) \$15,000, Transcriptomic analysis of ion channel structure and function.

Florida International University Faculty Development Grant (1996) \$800.00, Subconscious operant conditioning of an imperceptible myoelectrical response.

University of New Mexico Research Allocations Committee (1993) \$3461.00, Emergent stimulus relations in rats.

Sigma Xi Grants-in-Aid-of-Research (1991) \$400.00 Comprehensive investigation of complex stimulus relations and transfer of function in human subjects.

**PUBLICATIONS (June 2023: h-index=24; i10-index 30; total citations: 2013)**

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**\*invited; \*\*editors highlight; underlined names indicate undergraduate authors**

**Manuscripts in Preparation**

46. Chu Z, Markham MR (in preparation). Amplitude-frequency tradeoffs in the active sensory and communication signals of a weakly electric fish.
45. Wisner S, Markham MR (in preparation). Electrosensory and metabolic response of weakly electric fish to changing water conditions.
44. Todorovic J, Immani S, Ghezzi A, Lu Y, York J, Moller P, Pirro S, Sullivan J, Markham M, Gallant J, Zakon H (in preparation). Parallel amino acid substitutions in a potassium channel shape species-specific communication signals.

## Submitted Manuscripts

43. Ban Y, Maltby RC, Markham MR (under review) Spike-frequency dependent coregulation of multiple ionic conductances in fast-spiking cells forces a metabolic tradeoff. BioRxiv manuscript: <https://www.biorxiv.org/content/biorxiv/early/2021/03/09/2021.03.08.434486.full.pdf>

## Publications – Neurobiology

42. Nourbakhsh M, Markham MR (2021). Leptinergic regulation of vertebrate communication signals. *Integrative and Comparative Biology*, 61, 1946-1954. <https://dx.doi.org/10.1093/icb/icab173>
41. \*\*Saenz DE, Gu T, Ban Y, Winemiller KO, Markham MR (2021) Derived loss of signal complexity and plasticity in a genus of weakly electric fish. *Journal of Experimental Biology*, 224, jeb242400. <https://doi.org/10.1242/jeb.242400>
- Selected as Editor's Choice for June 2021 issue and featured in the "Inside JEB" column: Knight, K. (2021) Brachyhypopomus bennetti are simplifying their bolts of electricity. *Journal of Experimental Biology*, 224, jeb242965. <https://doi.org/10.1242/jeb.242965>
40. Chacron MJ, Markham MR (2021) Recent advances in electroreception and electrogeneration. *Frontiers in Integrative Neuroscience*, 15, <https://doi.org/10.3389/fnint.2021.668677>
39. Markham MR (2019) Biophysical basis of electric signal diversity. in: Carlson, B.A., Sisneros, J.A., Popper, A.N., Fay, R.R. (Eds.), *Electroreception: Fundamental Insights from Comparative Approaches*. Springer International Publishing, Cham (Switzerland), pp. 125-161.
38. \*\*Swapna I, Ghezzi A, York JM, Markham MR, Halling DB, Lu Y, Gallant JR, Zakon HH (2018) Electrostatic tuning of a potassium channel in electric fish. *Current Biology*, 28, 2094-2102.
37. Joos B, Markham MR, Lewis JE, Morris CE (2018) A model for studying the energetics of sustained high frequency firing. *PLoS One*, 13(4), e0196508.
36. Markham MR, Ban Y, McCauley AG, Maltby RC (2016) Energetics of sensing and communication in electric fish: A blessing and a curse in the Anthropocene? *Integrative and Comparative Biology*, 56, 889-900
35. Ban Y, Smith BE, Markham MR (2015). A highly-polarized excitable cell separates sodium channels from sodium-activated potassium channels by more than a millimeter. *Journal of Neurophysiology*, 114, 520-530.
34. Sinnett PM, Markham MR (2015) Food restriction reduces the amplitude of an active sensory and communication signal in a weakly electric fish. *Hormones and Behavior*, 71, 31-40.
33. Markham MR, Zakon HH (2014) Ionic mechanisms of microsecond-scale spike timing in single cells. *The Journal of Neuroscience* 34: 6668-6678.
32. \*\*Lewis JE, Gilmour KM, Moorhead MJ, Perry SF, Markham MR (2014) Action potential energetics at the organismal level reveal a trade-off in efficiency at high firing rates. *The Journal of Neuroscience* 34: 197-201.

Selected by the editor as a highlight in the journal's "This week in the journal" feature.

31. Markham MR, Stoddard PK (2013) Cellular mechanisms of developmental and sex differences in the rapid hormonal modulation of a social communication signal. *Hormones and Behavior* 63: 586-597.
30. Markham MR (2013) Electrocyte physiology: 50 years later. *The Journal of Experimental Biology* 216: 2451-2458.
29. Markham MR, Kaczmarek LK, Zakon HH (2013) A sodium-activated potassium channel supports high-frequency firing and reduces energetic costs during rapid modulations of action potential amplitude. *Journal of Neurophysiology* 109: 1713-1723.
28. \*\*Markham MR, McAnelly ML, Stoddard PK, Zakon HH (2009) Circadian and social cues regulate ion channel trafficking. *PLoS Biology* 7: e1000203.

Accompanied by the "Primer and Commentary": Fortune ES, Chacron MJ (2009) From Molecules to Behavior: Organismal-Level Regulation of Ion Channel Trafficking. *PLoS Biol* 7(9): e1000211. <https://doi.org/10.1371/journal.pbio.1000211>

27. Markham MR, Allee SJ, Goldina A, Stoddard PK (2009) Melanocortins regulate the electric waveforms of gymnotiform electric fish. *Hormones and Behavior* 55: 306-313.
26. \*\*Allee SJ, Markham MR, Stoddard PK (2009) Androgens enhance plasticity of an electric communication signal in female knifefish, *Brachyhypopomus pinnicaudatus*. *Hormones and Behavior* 56: 264-273.
25. \*Stoddard PK, Markham MR (2008) Signal Cloaking by Electric Fish. *Bioscience* 58: 415-425.
24. Allee SJ, Markham MR, Salazar VL, Stoddard PK (2008) Opposing actions of 5HT(1A) and 5HT(2)-like serotonin receptors on modulations of the electric signal waveform in the electric fish *Brachyhypopomus pinnicaudatus*. *Hormones and Behavior* 53: 481-488.
23. Stoddard PK, Markham MR, Salazar VL, Allee S (2007) Circadian rhythms in electric waveform structure and rate in the electric fish *Brachyhypopomus pinnicaudatus*. *Physiology and Behavior* 90: 11-20.
22. Stoddard PK, Zakon HH, Markham MR, McAnelly L (2006) Regulation and modulation of electric waveforms in gymnotiform electric fish. *Journal of Comparative Physiology A, Sensory, Neural, and Behavioral Physiology* 192: 613.
21. Markham MR, Stoddard PK (2005) Adrenocorticotrophic hormone enhances the masculinity of an electric communication signal by modulating the waveform and timing of action potentials within individual cells. *The Journal of Neuroscience* 25: 8746-8754.
20. Stoddard PK, Markham MR, Salazar VL (2003) Serotonin modulates the electric waveform of the gymnotiform electric fish *Brachyhypopomus pinnicaudatus*. *Journal of Experimental Biology* 206: 1353-1362.

### **Publications – Basic and Applied Psychology**

19. \*Markham RG, Markham MR (2002) On the role of covarying functions in stimulus class formation and transfer of function. *Journal of the Experimental Analysis of Behavior* 78: 509-525.

18. Markham MR, Dougher MJ, Augustson EM (2002) Transfer of operant discrimination and respondent elicitation via emergent relations of compound stimuli. *The Psychological Record* 52: 325-350.
17. Lumpkin PW, Silverman WK, Weems CF, Markham MR, Kurtines WM (2002) Treating a heterogeneous set of anxiety disorders in youths with group cognitive behavioral therapy: A partially nonconcurrent multiple-baseline evaluation. *Behavior Therapy* 33: 163-177.
16. Augustson EM, Dougher MJ, Markham MR (2000) Emergence of conditional stimulus relations and transfer of respondent eliciting functions among compound stimuli. *The Psychological Record* 50: 745-770.
15. \*Markham MR, Gallogly RH (1997) Does language make humans more than clever apes? *Journal of Applied Behavior Analysis* 30: 185-186.
14. Peláez-Nogueras M, Gewirtz JL, Markham MR (1996) Infant vocalizations are conditioned both by maternal imitation and motherese speech. *Infant Behavior and Development* 19: 670-671.
13. Roth WE, Gewirtz JL, Markham MR (1996). Maternal Attention to a Twin Sibling Evokes, and Contingent Maternal Attention Reinforces Jealous Behavior in Twin Infants. *Infant Behavior & Development*, 19, 206.
12. Markham MR, Butt AE, Dougher MJ (1996) A computer touch-screen apparatus for training visual discriminations in rats. *Journal of the Experimental Analysis of Behavior* 65: 173-182.
11. Markham MR, Branscum E, Finlay C, Roark R (1996). Experimental analysis of respondent conditioning in humans. *Experimental Analysis of Human Behavior Bulletin*, 14, 7-10.
10. Dougher MJ, Markham MR (1996). Stimulus classes and the untrained acquisition of function. T. R. Zentall and P. M. Smeets (Eds.) *Advances in Psychology Series: The Formation of Stimulus Classes*. North Holland: Elsevier Science Publishers.
9. Greenway DE, Dougher MJ, Markham MR (1995). S+/S- reversal procedures may not result in functional equivalence. *Experimental Analysis of Human Behavior Bulletin* 13: 16-17.
8. Markham MR (1995). Truth, philosophy and behavioral science: A reply to Hocutt. *Behavior and Philosophy*, 23, 73-78.
7. Dougher MJ, Augustson EM, Markham MR, Greenway DE, Wulfert E (1994). The transfer of respondent eliciting and extinction functions through stimulus equivalence classes. *Journal of the Experimental Analysis of Behavior*, 62, 331-351.
6. Dougher MJ, Markham MR (1994). Stimulus equivalence, functional equivalence, and the transfer of function. In S. C. Hayes, M. Sato, L. Hayes, & K. Ono (Eds.), *Language and Cognitive Events: A Behavior Analytic Perspective*. Reno, NV: Context Press.
5. Augustson EM, Markham MR, Dougher MJ (1994). A methodological note regarding human classical conditioning. *Experimental Analysis of Human Behavior Bulletin* 12: 6-7.
4. Markham MR, Dougher MJ (1993). Compound stimuli in emergent stimulus relations: Extending the scope of stimulus equivalence. *Journal of the Experimental Analysis of Behavior* 60: 529-542.
3. Markham MR (1993). An interface for controlling external devices via the IBM PC/XT/AT parallel port. *Behavior Research Methods, Instruments, & Computers* 25: 477-478.

2. Markham MR, Dougher MJ, Wulfert E (1993). Social contingencies and the effects of punishment in alcoholics and nonalcoholics. *Behavior Therapy* 24: 277-284.
1. Markham MR, Miller WR, Arciniega L (1993) BACCuS 2.01: Computer software for quantifying alcohol consumption. *Behavior Research Methods, Instruments, & Computers* 25: 420-421.

### **Undergraduate Textbook**

Purdy JE, Markham MR, Schwartz BL, Gordon WC (2001). *Learning and memory (2e)*. Pacific Grove, CA:Brooks/Cole. (now Cengage Learning)

### **INVITED LECTURES / SEMINARS**

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2019	Marine Biological Laboratory Neuroimaging Seminar
2018	Michigan State University, Department of Integrative Biology
2018	University of Ottawa, Department of Biology
2018	Marine Biological Laboratory Neural Systems and Behavior
2017	Marine Biological Laboratory Neural Systems and Behavior
2016	Michigan State University, Neuroscience Program
2016	Michigan State University, Ecology, Evolutionary Biology, and Behavior Program
2015	Wednesday Night Lecture, Marine Biological Laboratory, Woods Hole, MA
2015	Keynote address: Concord University annual Undergraduate Research Day
2014	University of Oklahoma Health Sciences Center.
2014	Colorado State University, Department of Biology
2014	University of Texas, Section of Integrative Biology
2013	Wichita State University, Department of Biology
2012	New Mexico State University
2011	Bernstein Center for Computational Neuroscience, Munich, Germany.
2010	Hunter College / City University of New York, Department of Psychology

### **INVITED CONFERENCE PRESENTATIONS**

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- Markham MR, Nourbakhsh-Rey M, Wiser SD, Maltby, RC (2022) Multiple hormonal pathways modulate active sensory and communication signals in weakly electric fish. Annual Meeting of the Society for Integrative and Comparative Biology.
- Markham MR, Maltby R, Riedmann H, Sinnett PM, Ban Y (2016) Energetic adaptations and constraints in active sensory and communication signals. Annual Meeting of the Society for Integrative and Comparative Biology, Portland OR.
- Markham MR (2011) Neural networks and communication: Integrating neuroethology and computational neuroscience. The Gordon Research Seminar in Neuroethology, Easton MA, Stonehill College.
- Markham MR (2010) Circadian and social cues regulate ion channel trafficking. International Congress of Neuroethology, Salamanca, Spain.
- Markham MR (1997) Puzzles and possibilities: Stimulus classes, respondent conditioning and the experimental analysis of human behavior. Annual convention of the Southeastern Association for Behavior Analysis, Chapel Hill, NC.

Markham MR (1995) Control by complex stimuli: Toward a theory of stimulus equivalence. Annual convention of the Northern California Association for Behavior Analysis, Oakland, CA.

Markham MR, Dougher MJ (1992) Compound stimuli in emergent stimulus relations: Toward a unified theory of stimulus equivalence. Fifteenth Symposium on Quantitative Analyses of Behavior, Cambridge, MA.

Dougher MJ, Markham MR (1992) Stimulus equivalence, functional equivalence, and the transfer of function. 4th Verbal Relations Institute, Fuji Zakaraso, Japan.

### **CONTRIBUTED ORAL CONFERENCE PRESENTATIONS (undergraduate authors underlined)**

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Saenz DE, Winemiller KO, Markham MR (2020) Derived loss of signal plasticity in a genus of weakly electric fish. Annual Meeting of the Society for Integrative and Comparative Biology, Austin, TX.

Markham MR, Nourbakhsh M, Maltby M, Ban Y (2019) Intrinsic and extrinsic metabolism sensing mechanisms of the electric organ cells in a weakly electric fish. Gordon Research Conference on Neuroethology: Behavior, Evolution and Neurobiology, Dover VT

Ban Y, Maltby RC, Riedmann HL, Nourbakhsh M, Markham MR (2018) Cellular mechanisms of high-frequency firing in *Eigenmannia virescens* electrocytes. Electric Fish Satellite Meeting of the International Congress for Neuroethology, Brisbane QLD Australia.

Ban Y, Smith BE, Maltby R, Connolly C, Markham MR (2016) Spatial uncoupling between sodium activated potassium channels and voltage gated sodium channels in electrocytes of the weakly electric fish *Eigenmannia virescens*. Annual Meeting of the Society for Integrative and Comparative Biology, Portland OR.

Markham MR, Ban Y, Smith BE, Sinnett PM (2015). Two views on the energetics of EOD production in *Eigenmannia virescens*. Annual Electrosensory Meeting, Montreal, QC, Canada.

Markham MR (2014). Energetics of active sensory and communication signals in the weakly electric fish *Eigenmannia virescens*: organismal, cellular, and molecular perspectives. Annual meeting of the J.B. Johnston Club for Evolutionary Neuroscience. Washington, DC.

Riedmann HL, Ahadizadeh EN, Maltby R, Zheng F, Markham MR (2014) Molecular adaptations of the Na<sup>+</sup>/K<sup>+</sup> ATPase in gymnotiform electrocytes. Annual Electrosensory Meeting, Montreal, QC, Canada.

Ban Y, Smith BE, Markham MR (2014) Fine morphology of *Eigenmannia virescens* electrocytes with localization of ion channels and ion transporters. Annual Electrosensory Meeting, Montreal, QC, Canada.

Markham MR, Sinnett PM, Ban Y, Ahadizadeh EN (2014) Energetics of active sensory and communication signals in the weakly electric fish *Eigenmannia virescens*: Organismal, cellular, and molecular perspectives. Annual meeting of the Society for Integrative and Comparative Biology, Austin TX.

Markham MR (2013). Energetics of electrical signaling in fish: A cellular perspective. Annual electrosensory meeting, Montreal, QC, Canada.

- Markham MR, Kaczmarek LK & Zakon HH. (2012). A sodium-activated potassium channel in the electric organ of *Eigenmannia virescens* maintains high action potential frequencies and reduces energetic costs. Weakly Electric Fish satellite of the International Congress of Neuroethology, College Park, MD.
- Markham MR (2011). Ionic mechanisms of microsecond-scale spike timing in gymnotiform electrocytes. Annual electrosensory meeting, Montreal, QC, Canada.
- Markham MR, McAnelly ML, Stoddard PK, Zakon HH (2008). Peptide hormones enhance an electric communication signal via a cAMP/PKA pathway that regulates ion channel trafficking. Annual meeting of the J.B. Johnston Club, Washington, DC.
- Stoddard PK, Markham MR (2006) Evolution from obsolete parts: signal plasticity in electric communication. Symposium on the evolution of sensory and signaling systems, Animal Behavior Society, Snowbird Resort, Salt Lake City.
- Finlay CG, Markham MR (1998). Respondent effects of aversive stimulation in humans. Annual convention of the Association for Behavior Analysis, Orlando, FL.
- Roth WE, Matos M, Rodriguez IM, Markham MR (1997). The use of public posting and performance lotteries to improve the quality of staff-resident interactions in geriatric nursing homes. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Alexander S, Gewirtz JL, Lubin D, Markham MR, Silverman W (1997). Antecedent reinforcement schedule exposure can determine responding denoting self-control. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Markham MR, Finlay CG (1997). Dissociations in the interaction of Pavlovian conditioning and stimulus classes. Division 25 meeting, annual convention of the American Psychological Association, Chicago, IL.
- Markham MR, Dougher MJ (1995). Transfer of operant discrimination and respondent elicitation via emergent relations of compound stimuli. Annual convention of the Association for Behavior Analysis, Washington, DC.
- Markham MR (1994). Resisting repression post-Skinner: Staying the course of American Pragmatism. Annual convention of the Association for Behavior Analysis, Atlanta, GA.
- Markham MR, Dougher MJ (1994). Conditional vs. compound stimulus control in complex human behavior. Annual convention of the Association for Behavior Analysis, Atlanta, GA.
- Markham MR, Augustson EM, Dougher MJ, Hackbert, L. (1994). Transfer of respondent elicitation via emergent relations of compound stimuli. Annual convention of the Association for Behavior Analysis, Atlanta, GA.
- Markham MR, Butt AE, & Dougher MJ (1994). Using touch-screen technology to train serial reversals of concurrent visual discriminations in hooded rats. Annual convention of the Association for Behavior Analysis, Atlanta, GA.
- Markham MR, Hackbert L, Augustson EM, & Dougher MJ (1994). Increased task difficulty as an unconditioned stimulus in classical conditioning with human subjects. Annual convention of the Association for Behavior Analysis, Atlanta, GA.



- Markham MR (1993). Transcending transcendence in the quest for epistemology. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Markham MR, Dougher MJ, Butt AE, Augustson EM (1993). Work in progress: Looking for emergent stimulus relations in albino rats. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Perkins DR, Dougher MJ, Markham MR (1993). Rule governed and contingency shaped stimulus classes: Sensitivity to different degrees of change. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Augustson EM, Dougher MJ, Markham MR (1993). The transfer of conditioned eliciting and extinction functions via stimulus equivalence classes. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Markham MR (1992). The truth about contextualism. Annual International Congress on Behaviorism and the Sciences of Behavior, Guadalajara, Mexico.
- Greenway DE, Dougher MJ, Markham MR (1992). Functional vs. stimulus equivalence. Annual International Congress on Behaviorism and the Sciences of Behavior, Guadalajara, Mexico.
- Perkins DR, Dougher MJ, Markham MR (1992). Degree of insensitivity as a function of change in rule governed equivalence classes. Annual International Congress on Behaviorism and the Sciences of Behavior, Guadalajara, Mexico.
- Markham MR (1992). Interpretive behaviorism and methodological anarchy. Annual convention of the Association for Behavior Analysis, San Francisco, CA.
- Markham MR, Dougher MJ, Schwartz K (1992). Emergence of contextual, conditional and discriminative stimulus functions via sequence training. Annual convention of the Association for Behavior Analysis, San Francisco, CA.
- Perkins DR, Markham MR, Dougher MJ (1992). Transfer of function via rule governed stimulus classes. Annual convention of the Association for Behavior Analysis, San Francisco, CA.
- Perkins DR, Markham MR, Dougher MJ (1992). Emergence of stimulus functions in the five-term contingency: Empirical findings and theoretical implications. Annual convention of the Association for Behavior Analysis, San Francisco, CA.
- Markham MR, Dougher MJ, Wulfert E (1991). Social contingencies and the effects of punishment in alcoholics and nonalcoholics. Annual convention of the Association for the Advancement of Behavior Therapy, New York, NY.
- Markham MR (1991). Wittgenstein's *On Certainty* and its relevance for radical behaviorism. Annual convention of the Association for Behavior Analysis, Atlanta, GA.
- Markham MR & Dougher MJ (1991). Expanding stimulus equivalence to include the Associative Relationship: Effects of training with compound stimuli. Annual convention of the Association for Behavior Analysis, Atlanta, GA.
- Markham MR, Augustson EM, Dougher MJ (1991). Transitivity and symmetry with compound stimuli. Annual convention of the Association for Behavior Analysis, Atlanta, GA.

- Markham MR, Dougher MJ (1991). Social contingencies and the effects of punishment in alcoholics. Annual convention of the Association for Behavior Analysis, Atlanta, GA.
- Markham MR (1990). Scrutinizing the hand that feeds: Theoretical issues in the experimental analysis of logic and reasoning. Annual convention of the Association for Behavior Analysis, Nashville, TN.
- Markham MR (1990). Induction as a distinguishing characteristic of radical behaviorism. Annual convention of the Association for Behavior Analysis, Nashville, TN.
- Markham MR, Greenway DE, Dougher MJ (1989). Pathfinder analysis of equivalence data: Structural representations of functional relationships. Annual convention of the Association for Behavior Analysis, Milwaukee, WI.

### **POSTER PRESENTATIONS (undergraduate authors underlined)**

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- Maltby RC, Willis KL, Markham MR (2020) Weakly Electric Fish as Charismatic Midi-fauna: Lessons in Neuroscience Broader Impacts. Annual Meeting of the Society for Integrative and Comparative Biology, Austin, TX.
- Wiser SD, Markham MR (2020) Electrosensory and metabolic responses of weakly electric fish to changing water conductivity. Annual Meeting of the Society for Integrative and Comparative Biology, Austin, TX.
- Nourbakhsh-Rey M, Markham MR (2020) Metabolism Sensing Mechanisms in the Electric Organ Cells of a Weakly Electric Fish. Annual Meeting of the Society for Integrative and Comparative Biology, Austin, TX.
- Maltby RC, Nourbakhsh M, Markham MR (2019) Metabolism sensing mechanisms in the electric organ cells of a weakly electric fish. Annual Meeting of the Society for Integrative and Comparative Biology, Tampa, FL.
- Markham MR, Ban Y, Maltby RC, Nourbakhsh M (2018) Molecular mechanisms of sustained high-frequency firing in the electric organ cells of *Eigenmannia virescens*. International Congress for Neuroethology, Brisbane QLD Australia.
- Joos B, Ban Y, Lewis JE, Markham MR, Morris CE (2018) NaV, AChR and Na/K PUMP densities as a function of EOD frequency: Predictions for and observations from the weakly electric fish *Eigenmannia*, Annual meeting of the Biophysical Society, San Francisco, CA.
- Joos B, Markham MR, Lewis JE, Morris CE (2017) A model for assessing ATP demands of sustained high frequency firing. Annual meeting of the Biophysical Society, New Orleans, LA.
- Ban Y, Maltby RC, Markham, MR. (2016, November) Regulation of electric organ discharge frequency by the Slack and Slick sodium activated potassium channels in the weakly electric fish *Eigenmannia virescens*. Annual meeting of the Society for Neuroscience. Washington, DC.
- Joos B, Markham MR, Steimle Y, Lewis JE, Morris CE. (2016) Modeling the Oscillating Dipole Properties of Electric Organ Discharge in the Weakly Electric Fish, *Eigenmannia*. *Biophys J*. 110(3):631a.
- Joos B, Markham MR, Lewis JE, Morris CE. (2015). The energetics of high frequency discharge in electrocytes: A mathematical model with explicit pumps. Annual meeting of the Biophysical Society, Baltimore MD.

- Riedmann HL, Ahadizadeh EN, Maltby R, Markham MR. (2014). Comparative analysis of Na<sup>+</sup>/K<sup>+</sup> ATPase alpha subunits from the electric organs of weakly electric fish with low and high discharge rates. Annual meeting of the Society for Integrative and Comparative Biology, Austin TX.
- Markham MR (2014) Electrophysiology of the Neuron 2014: Open access neural simulation software to promote active learning in neurobiology. Annual meeting of the Society for Integrative and Comparative Biology, Austin TX.
- Markham MR, Kaczmarek LK, Zakon HH (2012). A sodium-activated potassium channel maintains high action potential frequencies and reduces energetic costs during rapid modulations of action potential amplitude in a weakly electric fish. Annual meeting of the Society for Neuroscience. Washington, DC.
- Markham MR, Kaczmarek LK, Zakon HH (2012) Ultra-rapid sodium channel kinetics and a sodium-activated potassium channel maintain high action potential frequencies during rapid modulations of action potential amplitude in a weakly electric fish. International Congress for Neuroethology, College Park, MD.
- Markham MR, Stoddard PK (2010). Cellular mechanisms of developmental and sex differences in plasticity of a social communication signal. International Congress of Neuroethology, Salamanca, Spain.
- Markham MR, McAnelly ML, Stoddard PK, Zakon, H.H. (2009). Circadian and social cues regulate ion channel trafficking. *Society for Neuroscience Abstracts*, Program No. 456.5
- Stoddard PK, Allee SJ, Goldina A, Markham MR (2007). Synergy between androgens and melanocortins in regulation of gymnotiform electric waveforms. International Congress for Neuroethology. Vancouver, British Columbia.
- Goldina A, Markham MR, Stoddard PK (2007). The evolution of electrifying diversity: melanocortins modulate communication signals differently across the order Gymnotiformes. International Congress for Neuroethology. Vancouver, British Columbia.
- Goldina A, Markham MR, Stoddard PK (2006) Evolution of circadian and melanocortin-induced plasticity in the communication signals of Gymnotiform electric fish. *Society for Neuroscience Abstracts Program No. 579.8*.
- Markham MR, Stoddard PK (2005) The melanocortin ACTH modulates an electric communication signal by modulating the waveform and timing of action potentials in individual cells. *Society for Neuroscience Abstracts Program No. 1001.8*.
- McAnelly ML, Markham MR (2005) ACTH modulates electrocommunication via effects on the electrocyte sodium current. *Society for Neuroscience Abstracts*, Program No. 205.1
- Markham MR, Haskell-Luevano C, Stoddard PK (2004) A melanocortin receptor modulates electrocyte action potentials via a cAMP/PKA pathway. *Society for Neuroscience Abstracts*, Program No. 334.7
- Markham MR, Stoddard PK (2003) A melanocortin receptor modulates the amplitude and repolarization time of electrocyte action potentials in male electric fish, *Brachyhyppopomus pinnicaudatus*. *Society for Neuroscience Abstracts*, Program No. 828.16

- Salazar VL, Markham MR, Stoddard PK (2002) Serotonin rapidly enhances sexually dimorphic characters of the electric waveform of the gymnotiform electric fish *Brachyhypopomus pinnicaudatus*. *Society for Neuroscience Abstracts*, Program No. 87.8
- Finlay CG, Markham MR (1999, May). An investigation of respondent blocking by class-derived conditioned stimuli. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Haas AJ, Colbert CL, Portocarrero J, Markham MR (1999, May). Tests for functional equivalence and transitivity in long-evans rats. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Aguilera C, Markham MR (1998, May). Compound stimulus discriminations and tests for emergent matching-to-sample in rats. Annual convention of the Association for Behavior Analysis, Orlando, FL.
- Crooks N, Pelaez-Nogueras M, Gewirtz JL, Markham MR (1998). Contingent relations description facilitates rule-following in a generalization task. Annual convention of the Association for Behavior Analysis, Orlando, FL.
- Finlay CG, Pacheco M, Markham MR (1997). Conditioned eyeblink elicitation does not transfer via equivalence relations. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Roth WE, Flores M, Botner T, Markham MR (1997). Using card-sort procedures to assess stimulus class formation. Annual convention of the Association for Behavior Analysis, Chicago, IL.
- Gallogly RH, Roth WE, Estrella JF, Markham MR (1996). Are Conditional Stimulus Control and Discriminative Stimulus Control Independent Processes? Annual convention of the Southeastern Association for Behavior Analysis, Wilmington, NC.
- Roth WE, Gallogly RH, Branscum EE, Markham MR (1996). Training Configurations of Baseline Conditional Discrimination Results in Differential Disruption of Stimulus Class Formation by Incongruent Simple Discrimination Training. Annual convention of the Southeastern Association for Behavior Analysis, Wilmington, NC.
- Branscum EE, Gallogly RH, Estrella J, Markham MR (1996). Disruption of Stimulus Equivalence Classes Following Functional Discrimination of Equivalence Class Members. Annual convention of the Association for Behavior Analysis, San Francisco, CA.
- Finlay CG, Roark R, Branscum EE, Markham MR (1996). Transfer of Conditioned Skin Conductance Responses via Within-Compound Stimulus Relations. Annual convention of the Association of Behavior Analysis, San Francisco, CA.
- Haas AJ, Frank JS, Markham MR (1996, May). Effects of Intertrial Timeout Following Incorrect Responses During Simultaneous Visual Discrimination Procedures in Rats. Annual convention of the Association for Behavior Analysis, San Francisco, CA.
- Isava D, Branscum EE, Roth WE, Markham MR (1996). Functional Equivalence Classes in Rats Following Serial Acquisitions of Novel Auditory Discriminations. Annual convention of the Association for Behavior Analysis, San Francisco, CA.
- Frank J, Haas AJ, Ehrenzweig D, Markham MR (1995). Serial reversals of concurrent visual discriminations in rats: Evidence for savings. Annual convention of the Southeastern Association for Behavior Analysis, Charleston, SC.

Gallogly RH, Estrella J, Hyman J, Roth WE, Markham MR (1995). Can stimulus control of behavior occur without controlling subject's verbal behavior? Annual convention of the Southeastern Association for Behavior Analysis, Charleston, SC.

Roark R, Finlay CG, Branscum EE, Markham MR (1995). Human skin conductance conditioning: Elicitation of skin-conductance responses by CS- following unreinforced presentations of CS+. Annual convention of the Southeastern Association for Behavior Analysis, Charleston, SC.

Totan S, Branscum EE, Markham MR (1995). Differential eyeblink conditioning to visual stimuli in humans. Annual convention of the Southeastern Association for Behavior Analysis, Charleston, SC.

Friedman SD, Butt AE, Cooper BG, Hagen MH, Markham MR, Hodge GK. (1994). Delayed non-match to position performance is impaired in rats given high dose of methamphetamine. Society for Neuroscience Abstracts, 24, 203.

## **TEACHING and ADVISING**

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### **Undergraduate Lecture / Laboratory Courses**

Introduction to Neurobiology, University of Oklahoma (OU), 7 semesters  
 Intro. Zoology Laboratory, Faculty Supervisor, OU, 2 semesters: 14-28 sections per semester.  
 Neurobiology Laboratory, University of Texas, 10 semesters  
 Introduction to Psychology, Florida International University (FIU), 5 semesters  
 Introduction to the Experimental Analysis of Behavior, FIU, 11 semesters  
 Introduction to Biopsychology, FIU, 5 semesters  
 Advanced Behavior Analysis Lecture/Lab, FIU, 2 semesters

### **Graduate Courses**

Neurobiology, OU, 4 semesters  
 Introduction to Matlab Programming for Life Sciences, OU, 1 semester  
 Biological Bases of Behavior, FIU, 2 semesters  
 Single-case Research Methods, FIU, 2 semesters  
 Theories of Learning, FIU, 1 semester  
 History and Systems of Psychology, FIU, 1 semester  
 Proseminar in Experimental Analysis of Behavior, FIU, 2 semesters

### **Graduate Students (major advisor)**

2022–... Shannon Wiser, Biology Ph.D. program  
 2020–... Donglin Han, Biology Ph.D. program  
 2017–... Mehrnoush Nourbakhsh, Cellular and Behavioral Neurobiology Ph.D. program  
 2019–2022 Shannon Wiser, M.S. Thesis: "Electrosensory and metabolic responses of weakly electric fish to changing water conductivity."  
 2014–2018 Yue Ban, Ph.D. Thesis: "Biophysical mechanisms for the generation of electrosensory and communication signals in the weakly electric fish *Eigenmannia virescens*."  
 2015–2017 Zhicong "Bernard" Chu, M.S. Thesis: "Amplitude-frequency tradeoffs in the active sensory and communication signal of a weakly electric fish."  
 2013–2016 Hiliary Riedmann, M.S. Thesis: "Molecular evolution of Na,K-ATPase in weakly electric fish."  
 1998–2000 Maria Sotolongo, M.S. Thesis: "Applying the response disequilibrium hypothesis to anxiety disorders in children."  
 1998–1999 Carlos G. Finlay, M.S. Thesis: "Pavlovian blocking by stimulus class-based transfer of respondent elicitation."

**Service on Graduate Student Advisory Committees**

2023-...	Sarah Newbolds, Psychology (advisor Dr. Michael Wenger)
2022-...	Kyle Zumpano, Biology (advisor Dr. Chris Lemon)
2022-...	Jordan Norris, Psychology (advisor Dr. Lauren Ethridge)
2018-...	Emma Auger, Psychology (advisor Dr. Lauren Ethridge)
2018-...	Madison Morris, Biology (advisor Dr. Ari Berkowitz)
2018-...	Kathryn Gallman, Biology, NJ Institute of Technology (advisor Dr. Eric Fortune)
2018-...	Mehrnaz Afkhami, Biology (advisor Dr. John P. Masly)
2018-2022	Nicholas Woodruff, Psychology (advisor, Dr. Lauren Etheridge)
2018-2020	Ph.D., Fan Zhang, Biomedical Engineering (advisor Dr. Han Yuan)
2017-2020	Ph.D., David Saenz, Biology – Texas A&M University (advisor Dr. Kirk Winemiller)
2018-2020	Ph.D., Doug Bryant, Psychology (advisor Dr. Eugenia Fuenzalida)
2018-2019	Ph.D., Nathan Losey, Microbiology (advisor Dr. Michael McInerney)
2015-2018	Ph.D., Tian Yuan, Biology (advisor Dr. David McCauley)
2014-2018	Ph.D., Anuj Guruvacharya, Biology (advisor Dr. Richard Broughton)
2014-2017	Ph.D., Nathan Wages, Health and Exercise Science, advisor Dr. Michael Bembem)
2013-2015	M.S., Caitlyn Crowder, Chemistry and Biochemistry (advisor Dr. Anthony Burgett)
2012-2013	Ph.D., Bryan Crable, Microbiology (advisor Dr. Michael McInerney)

**Postdoctoral Advisees**

2015-2017	Katie Willis, Ph.D.
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**Undergraduate Honors Students Supervised (current status if known)**

2021-...	Emma Clary
2020-2022	Jonah Harman, currently teaching for Japan Exchange and Teaching program
2018-2019	Bridget Parrish, currently in Ph.D. program, OU Health Sciences Center
2017-2019	Mattie Cassaday, MPH candidate, Colorado School of Public Health
2015-2017	Austin Budd, enrolled in MD program, OU Health Sciences Center
2016-2016	Chris Bender, completed MD, Florida State University
2013-2014	Filip Holy, completed MD, OU Health Sciences Center
2012-2014	Christine Connolly, completed MD, OU Health Sciences Center
2011-2013	Shahn Ijaz, completed MD, OU Health Sciences Center
2011-2013	Vivek Koduri, completed MD, University of Texas Medical School
1997-1998	Carolina Aguilera, Director, Business and Digital Transformation, Canon Inc.
1995-1997	Andrea Haas
1995-1996	Connie Colbert, completed Ph.D., University of Florida

**Undergraduate Honors Thesis Committees**

2019	Mina Makvandi	(advisor Dr. Ashlee Rowe)
2019	Emily Huff	(advisor Dr. Ari Berkowitz)
2016	Megan Mont	(advisor Dr. Douglas Gaffin)
2015	Gretchen Scheel	(advisor Dr. Susan Schroeder)
2014	Matt Elson	(advisor Dr. Ari Berkowitz)
2014	Corinne Dinges	(advisor Dr. Chris Lemon)
2014	Zack McDonald	(advisor Dr. Chris Lemon)
2013	Monte Simms	(advisor Dr. Randy Hewes)

**Undergraduate Research Assistants (OU only, current status if known)**

2021-2022	Tyler Overbeek, enrolled in Auburn University Medical School
2019-2021	Brandon Holler, enrolled in OU Health Sciences Center Medical School
2017-2019	Shannon Wiser, currently Ph.D. student, University of Oklahoma
2016-2017	Rachel Lusher, completed Physician Assistant program
2015-2016	Nicholas Simmons, Data Scientist, Prodigy Consulting
2014-2016	Troy Young, laboratory manager, Supreme Medical Laboratories

2013–2014	Emily Ahadizadeh; Completed MD, Northwestern University
2013–2014	Eric Leung, completed Ph.D., University of Oregon
2012–2013	Shyam Javajji, completed MD, UT Southwestern University
2011–2012	Helen Vu, completed Pharm.D., OU Health Sciences Center
2011–2012	Philip Sinnett, completed DO degree, Oklahoma State University

## SERVICE

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### Service to the Profession – International

2020	Grant reviewer, Natural Sciences and Engineering Research Council of Canada
2018	Co–Organizer, Electric Fish Satellite Meeting; International Congress for Neuroethology, Brisbane, Australia
2017–2019	Summer Course faculty, Neural Systems and Behavior, Marine Biological Laboratory
2017–2018	Grant reviewer, UK Biotechnology and Biological Sciences Research Council
2017	External dissertation reviewer, McGill University, Canada
2016	Grant reviewer, Belgian Fund for Scientific Research (FNRS)
2015	External dissertation reviewer, University of Tubingen, Germany

### Service to the Profession – National

#### Grant Reviewing

2013–...	Review panelist, National Science Foundation (2013, 2014, 2015, 2016, 2017, 2019, and 2022)
2005–...	Grant reviewer (ad hoc), National Science Foundation (2005, 2006, 2008, 2011, 2014, 2018, 2020, 2021)
2014	Grant reviewer (ad hoc), National Geographic Society

#### Editorial

2018–2019	Associate Editor for the special journal issue: Advances in Electoreception and Electrogeneration, <i>Frontiers in Integrative Neuroscience</i>
1998–2001	Editorial Board, <i>The Behavior Analyst</i>
1997–2000	Association for Behavior Analysis Annual Convention Program Committee,
1997	Association for the Advancement of Behavior Therapy Annual Convention Program Committee
1995–1998	Editorial Board, <i>Experimental Analysis of Human Behavior Bulletin</i>

*External reviewer for tenure and promotion:* Research 1 Universities (2018, 2019)

#### Service for Journals as Ad-hoc Reviewer (number of manuscripts reviewed if more than one)

Advances in Physiology Education	Journal of Physiology-Paris (3)
Behavioral Ecology and Sociobiology	Nature Communications
Brain Behavior and Evolution (3)	Neuroscience
Brain Research	Physiological Reports
Current Biology (3)	Proceedings of the Royal Society B (3)
Developmental Neurobiology	Transactions on Biomedical Engineering
Fish Physiology	Journal of the Experimental Analysis of Behavior (3)
Fish Physiology and Biochemistry (2)	Journal of Applied Behavior Analysis
Frontiers in Cellular Neuroscience (2)	Journal of Behavior Therapy and Experimental Psychiatry (2)
Frontiers in Integrative Neuroscience (5)	The Behavior Analyst (7)
Hormones and Behavior (3)	The Psychological Record (3)
Journal of Experimental Biology (9)	
Journal of Fish Biology (2)	
Journal of Neurophysiology (4)	

**University Service**

2022–...	Teaching and Learning Technology Advisory Committee
2021–...	Asia Programs Task Force
2020–...	Provost's Advisory Committee for Learning Outcomes Assessment
2020	Research Strategic Framework Development Task Force, Team Lead
2015–2018	Faculty Senate
2014–2015	Provost's Advisory Committee for General Education Oversight
2013–2014	Faculty Search Committee, Department of Physics and Astronomy
2012–2020	Biology Representative, National Merit Scholars Recruitment Office
2001–2006	Minority Access to Research Careers fellowship selection committee
1995–1999	Chair, Institutional Animal Care and Use Committee,
1999–2001	Member, Institutional Animal Care and Use Committee
1997–1998	Award committee, Provost's office Research Project Funding Competition
1995–1997	University Research Council

**College Committee Service**

2019–2020	College of Arts and Sciences Nominations Committee
1994–1996	College of Arts & Sciences Curriculum Committee

**Department Committee Service**

2019–2020	Faculty Search Committee: Cluster hire in Biology of Behavior (3 positions)
2019	Acting Chair, Department of Biology (Jan–July)
2016–2020	Assistant Chair, Department of Biology
2015–2017	Executive Committee (Committee A) Department of Biology
2017–2018	Chair, Faculty Search Committee, Behavioral Geneticist
2015–2017	Chair, Faculty Search Committee: Behavioral biology (2 positions)
2013–2016	Chair, Biology Web Page and Publicity Committee
2013–2015	Faculty Search Committee: Cluster hire in geographical ecology (3 positions)
2011–2012	Faculty Search Committee, Neurobiologist
2011–2013	Graduate Studies Committee
2011–2013	Undergraduate Awards Committee
2011–...	Steering Committee, Cellular and Behavioral Neurobiology Ph.D. Program
1995–1998	Chair, Human Subjects Review Committee
1994–2001	Lifespan Development Ph.D. Committee
1994–2001	Behavior Analysis MS Committee

**Ad-hoc Service to the University**

2015, 2016	NSF CAREER proposal development workshop, OU Center for Research Program Development and Enhancement
2015	Research Discussion Panel, OU New Faculty Orientation, August
2013–2014	Table tennis club faculty advisor,
2013	Vice President for Research's STEM Education charrette member
2014	Provost's Dream Degree design charrette member
2014	University Commencement Faculty Marshal

**Host for Departmental Seminar speakers:**

2019	Ingo Braasch, Michigan State University
2019	Kim Hoke, Colorado State University
2015	Kenneth Catania, Vanderbilt University
2015	Jason Gallant, Michigan State University
2015	Will Crampton, University of Central Florida
2014	Ashlee Rowe, Michigan State University
2012	Daphne Soares, University of Maryland



2012 Len Kaczmarek, Yale University

**Community Outreach and Service**

2011–... Faculty Senate Speakers Service  
2011–... "Electric Fish Roadshow" – an educational outreach presentation and demonstration with electric fish:

Pioneer Library System Science Café, Norman, OK; August 2019  
GoKids Childcare Summer Program, Norman OK; August 2018  
Crooked Oak School System STEM Night, Oklahoma City, OK; May 2018  
GoKids Childcare Summer Program, Norman OK; August 2017  
Rivermont Retirement Community, Norman, OK; April 2013; 2017  
Community After-School Program, McKinley Elementary, Norman OK; May 2017  
Trinity Lutheran Church Seniors Group, Norman OK, 2015; 2017  
Science Museum Oklahoma, July 2012

2005–2006 Supervision of High School Interns: Liberal Arts & Sciences Academy, Austin TX  
1999–2001 Supervision of High-school Interns from Miami Dade Public Schools Advanced Academic Achievement Program, 1999–2001

**Membership in Professional Associations**

2012–... Sigma Xi  
2011–... Society for Integrative and Comparative Biology  
2012–... Animal Behavior Society  
2003–... International Society for Neuroethology  
2001–... J. B. Johnston Club for Neuroethology  
2002–2014 Society for Neuroscience  
1996–2001 American Psychological Association  
1987–2002 Association for Behavior Analysis