

Teresa A. Nick, Ph.D.

Department of Neuroscience

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RESEARCH POSITIONS

The University of Minnesota, Minneapolis, MN

2004 -

Assistant Professor, Department of Neuroscience

Core Faculty, Center for Neurobehavioral Development

Mechanisms of vocal learning in zebra finch

- Headed a laboratory of eleven scientists
- Mentored two postdoctoral fellows and two graduate students
- Obtained two research grants from the National Institutes of Health
- Received a Career Development Award from the National Institutes of Health
- Obtained private research grants from the John Merck Scholars Program and the Minnesota Medical Foundation
- Discovered a role for extracellular perineuronal nets in vocal development
- Found daily cycling of neural motor control during vocal learning
- Discovered that single neurons contain both sensory and motor signals in the developing song system, potentially allowing sensorimotor integration in single neurons of the vertebrate forebrain
- Described prolonged bursting in the song system during the sensorimotor critical period
- Found that song system sleep activity changes with development and correlates with behavior
- Applied multi-electrode single unit techniques to the study of the song system
- Recorded single neuron activity in awake, behaving juvenile and adult finches
- Combined multi-electrode and antidromic identification techniques for the first time in any system

California Institute of Technology, Pasadena, CA

1999 – 2003

Senior Postdoctoral Scholar, Division of Biology (PI: Masakazu Konishi)

Neural bases of vocal modulation in the zebra finch song system

- Found song system auditory gating occurs between sleep/wake states
- Discovered developmental modulation of the auditory response in the premotor song nucleus HVC
- Determined that auditory responses in HVC are biased toward the learned model song during the template-matching phase of song acquisition
- Discerned two distinct response states during song learning
- Revealed that spontaneous activity in HVC peaks during the sensorimotor period of song acquisition
- Executed the first longitudinal studies of the neural bases of song development
- Recorded brain electrical activity with chronic extracellular and acute intracellular neurophysiological recording techniques in combination with behavioral analysis

The University of Colorado Health Sciences Center, Denver, CO

1996 – 1999

Postdoctoral Fellow, Dept. Physiology and Biophysics (PI: Angeles B. Ribera)

Nerve-Muscle interactions in developing Xenopus cultures

- Found development of motor neuron electrical excitability requires synaptic activation of myocytes
- Discovered that changes in sodium and potassium currents underlie changes in

excitability

- Determined that a diffusible growth factor, Neurotrophin-3, can ameliorate some effects of synaptic blockade during development
- Found that excitability changes induced by myocytes are global, and not confined to the synapse
- Recorded whole-cell and macro-patches from cultured embryonic tissue
- Analyzed single-cell reverse-transcription polymerase chain reaction (RT-PCR) data to obtain the developmental expression profile of potassium channels of *Xenopus* neurons in culture
- Designed PCR primers and anti-sense RNA for *in situ* hybridization, ran polyacrylamide gels, performed other molecular biology techniques
- Examined spatial and temporal expression profiles of potassium channels with *in situ* hybridization

Marine Biological Laboratory, Woods Hole, MA

1996

Grass Fellow

Differential spatial expression of calcium-dependent potassium channels

- Found that calcium-dependent potassium channels expressed in the growth cone are less calcium-sensitive than those in the soma
- Recorded inside-out patch from *Rana pipiens* sympathetic neurons in culture

Yale University, New Haven, CT

1990 – 1996

Graduate Student, Interdepartmental Neuroscience Program

(Advisers: Thomas J. Carew and Leonard K. Kaczmarek)

Development of excitability in the bag cell neurons of Aplysia

- Found that developing bag cell neurons differentially regulate voltage-gated ion currents
- Determined that modulation of excitability in the bag cell neurons controls the developmental expression of reproductive behaviors
- Found that adult haemolymph affects the development of excitability in these neurons
- Analyzed developmental changes in vesicle expression and cellular morphology with electron and light microscopy
- Used extracellular and microelectrode intracellular recording on semi-intact preparations and whole-cell, outside-out, and cell-attached patch recording on dissociated neurons in culture

Radian Corporation, Austin, TX

1989 – 1990

Research Assistant II, Extraction Laboratory (Supervisor: Andrew Chen)

- Extracted hazardous organic waste from environmental samples
- Served as lab safety officer

EDUCATION

Ph.D. in Neuroscience

1996

Yale University, New Haven, CT

GPA: 3.8

M.S. and M.Phil. in Neuroscience

1992

Yale University, New Haven, CT

GPA: 3.9

B.S. in Zoology with High Honors, B.A. in Psychology with High Honors The University of Texas , Austin, TX Overall GPA: 3.8 Zoology GPA: 4.0 Psychology GPA: 3.9 Completed 2 degrees in three years, Dean's list every semester	1989
Hudson High School , Hudson, Texas Salutatorian, GPA: 4.0	1986
Early Development of <i>Xenopus laevis</i> Cold Spring Harbor Laboratory , Cold Spring Harbor, NY	1997
Neurobiology Marine Biological Laboratory , Woods Hole, MA	1994
Cellular and Molecular Basis of Learning and Memory Cold Spring Harbor Laboratory , Cold Spring Harbor, NY	1991

HONORS AND FELLOWSHIPS

Career Development Award from the National Institute on Deafness and Other Communication Disorders	2006 - 2011
The John Merck Scholars Program in the Biology of Developmental Disabilities in Children	2005 - 2009
Minnesota Medical Foundation Special Grant	2004 - 2005
Individual National Research Service Award, Postdoctoral from NINDS	1997 - 1999
Grass Fellowship	1996
Individual National Research Service Award, Predoctoral from NIMH	1994 - 1996
Carl Zeiss, Inc. Scholarship	1994
John F. Enders Fellowship from Yale Graduate School	1994
Phi Beta Kappa Honor Society	1989
Psi Chi, Psychology Honor Society	1988
Beta Beta Beta, Biology Honor Society	1988
National Merit Special Scholarship from Dresser-Rand Corp.	1986

LEADERSHIP

Organizer and Chair, Mini-Symposium Society for Neuroscience Annual Meeting, Washington, DC Organized a 6-speaker symposium that was selected by the planning committee for the annual meeting of the Society for Neuroscience entitled "Neuronal development in the context of behavior: The power of birdsong". Typically, ~30,000 scientists and clinicians attend this meeting.	2008
Member, Faculty Advisory Council University of Minnesota Academic Health Center Advised the dean of the medical school on policy initiatives.	2008 -

Chair, Colloquium Committee, Graduate Program in Neuroscience University of Minnesota Academic Health Center Directed a weekly seminar series and introduced speakers.	2007 -
Member, Graduate Program in Neuroscience Steering Committee University of Minnesota Academic Health Center Set standards for admission, determined appropriate progress of students, decided funding initiatives and faculty inclusion in the neuroscience program.	2007 -
Chair, Presidential Symposium on Neuroscience Planning Committee University of Minnesota Academic Health Center Planned a 3-day national meeting on major advances in neuroscience entitled "The Adaptive Brain". Hosted 12 renowned neuroscientists and >300 attendees at lectures, lunches, laboratory tours, and 2 dinner events.	2006 - 2007
Lecturer, Numerous undergraduate, medical, and graduate courses Yale University, University of Colorado Health Sciences Center, University of Minnesota Taught neural bases of behavior, cellular neuroscience, human neuroanatomy for medical students, neurostatistics, psychology of music, neurobiology lecture and laboratory, developmental neurobiology, ion channels.	1993 -

PROFESSIONAL ACTIVITIES

Ad-hoc Reviewer for:

National Institutes of Health
National Science Foundation
Brain Research
Developmental Neurobiology
The Journal of Neurophysiology
The Journal of Neuroscience
The Journal of Neuroscience Methods
Neuroscience

Member:

The Society for Neuroscience	1990 -
The International Society for Neuroethology	2001 -
The American Physiological Society	2006 -

RESEARCH SUPPORT

Ongoing Research Support

Grant 1 R01 DC007384

12/16/2005-11/30/2008

National Institute on Deafness and Other Communication Disorders

\$177,058/year

Mechanisms of vocal learning

This project addresses the neural bases of vocal development in a songbird model.

Role: PI

John Merck Scholars Program in the Biology of Developmental Disabilities in Children
5/11/2005-5/10/2009

The John Merck Scholars Program

\$75,000/year

The role of neuronal excitability in vocal plasticity

This research addresses the novel hypothesis that increased neuronal excitability in songbirds during song development enables learning through activity-dependent strengthening of neuronal connections.

Role: PI

Grant 1 K02 DC008521

12/01/2006-11/30/2011

National Institute on Deafness and Other Communication Disorders

\$97,800/year

Mechanisms of vocal learning in the zebra finch

This Career Development Award pays 90% of the PI's salary.

Role: PI

Grant R01-NS050436

12/01/2007 - 11/30/2009

National Institute of Neural Disease and Stroke

\$78,520/year

Integrative Study of Vocal Development

This integrative project addresses developmental song learning in the zebra finch.

Role: Subcontract PI

Completed Research Support

Grant-In-Aid of Research, Artistry, and Scholarship

9/18/2004-12/15/2006

The University of Minnesota Graduate School

The role of sleep in vocal learning

This project investigates changes in sleep activity during vocal learning and their correlations with behavior. It also manipulates sleep activity to test the hypothesis that sleep activity stabilizes song behavior.

Role: PI

Grant 3459-9221-04

5/26/2004-5/25/2005

Minnesota Medical Foundation

Cellular mechanisms of vocal learning

The major goal of this project was to determine the changes in cellular excitability that occur in step with the increases in ongoing activity by recording from individual nerve cells in brain slices.

Role: PI

PUBLICATIONS

1. Balmer, T.S., Carels, V.M., Frisch, J.L., and **Nick, T.A.** (*in preparation*). Expression and developmental regulation of perineuronal nets in the song system of the zebra finch (*Taeniopygia guttata*).
2. Kerrigan, S., Aoki, N., Nykamp, D.Q., and **Nick, T.A.** (*submitted*). Developmental modulation of neural synchrony in the song nucleus HVC.
3. Day, N.F., Kinnischtzke, A.K., Adam, M., and **Nick, T.A.** (*submitted*). Daily and developmental modulation of "premotor" activity in the birdsong system.

4. Day, N.F., Kinnischtzke, A.K., Adam, M., and **Nick, T.A.** (2008). Top-down regulation of plasticity in the birdsong system: "Premotor" activity in the nucleus HVC predicts song variability better than it predicts song features. *The Journal of Neurophysiology*, **100**:2956-2965.
5. **Nick, T.A.** (2008). Development of speech (animal model). In: *Handbook of Developmental Cognitive Neuroscience*, MIT Press, C.A. Nelson & M. Luciana, eds. pgs. 453-464.
6. Crandall, S.R., Adam, M., Kinnischtzke, A.K., and **Nick, T.A.** (2007). HVC neural sleep activity increases with development and parallels nightly changes in song behavior. *The Journal of Neurophysiology*, **98**:232-240.
7. Crandall, S.R., Aoki, N., and **Nick, T.A.** (2007). Developmental modulation of the temporal relationship between brain and behavior. *The Journal of Neurophysiology*, **97**:806-816.
8. **Nick, T.A.** and Konishi, M. (2005). Neural auditory selectivity develops in parallel with song. *The Journal of Neurobiology*, **62**(4):469-481.
9. **Nick, T.A.** and Konishi, M. (2005). Neural song preference during vocal learning in the zebra finch depends on age and state. *The Journal of Neurobiology*, **62**(2):231-242.
10. **Nick, T.A.** and Konishi, M. (2001). Dynamic control of auditory activity during sleep: Correlation between song response and EEG. *Proceedings of the National Academy of Sciences*, **98**(24):14012-14016.
11. **Nick, T.A.** and Ribera, A.B. (2000). Synaptic activity modulates presynaptic excitability. *Nature Neuroscience*, **3**(2):142-149.
12. White, B.H., **Nick, T.A.**, Carew, T.J., and Kaczmarek, L.K. (1998). Protein kinase C regulates a vesicular class of calcium channels in the bag cell neurons of *Aplysia*. *The Journal of Neurophysiology*, **80**(5):2514-2520.
13. **Nick, T.A.**, Kaczmarek, L.K., and Carew, T.J. (1996). Ionic currents underlying developmental regulation of repetitive firing in *Aplysia* bag cell neurons. *The Journal of Neuroscience*, **16**(23):7583-7598.
14. **Nick, T.A.**, Moreira, J.E., Kaczmarek, L.K., Carew, T.J., and Wayne, N.L. (1996). Developmental dissociation of excitability and secretory ability in *Aplysia* bag cell neurons. *The Journal of Neurophysiology*, **76**(5):3351-3359.
15. Wayne, N.L., **Nick, T.**, and Block, G.D. (1996). Effects of temperature on reproductive endocrine function in *Aplysia californica*. *General and Comparative Endocrinology*, **102**:351-359.
16. Lobaugh, N., Greene, P., Grant, M., **Nick, T.**, and Amsel, A. (1989) Patterned (single) alternation in infant rats after combined or separate lesions of hippocampus and amygdala. *Behavioral Neuroscience* **103**(6):1159-1167.

RECENT ABSTRACTS

1. Carels, V.M., Balmer, T.S., Frisch, J.L., and **Nick, T.A.** (2008). Perturbation of vocal development alters perineuronal net expression in the song system. *Society for Neuroscience Abstracts*, **34**:596.3.
2. **Nick, T.A.**, Balmer, T.S., Carels, V.M., and Frisch, J.L. (2008). Regulation of forebrain perineuronal nets during a critical period for vocal learning. *Xth International Conference on Cognitive Neuroscience*, P179.
3. Balmer, T.S., Carels, V.M., and **Nick, T.A.** (2007). Regulation of perineuronal nets during the sensorimotor period of song learning. *Society for Neuroscience Abstracts*, **33**:430.7.
4. Beckman, M.L. and **Nick, T.A.** (2007). Vital staining of extracellular matrix in songbird brain slices. *Society for Neuroscience Abstracts*, **33**:430.12.
5. **Nick, T.A.**, Kinnischtzke, A.K., and Adam, M. (2007). Rhythmic spiking in HVC during singing increases during the day and decreases after a night of sleep. *8th International Congress of Neuroethology*.
6. Crandall, S.R. and **Nick, T.A.** (2006). Development of timing precision in a sensorimotor circuit. *Society for Neuroscience Abstracts*, **32**:818.18.
7. Aoki, N. and **Nick, T.A.** (2006). Sensorimotor integration in the song system: a neuronal analysis. *Society for Neuroscience Abstracts*, **32**:818.19.