

## CURRICULUM VITAE

Charles M. Gray, Ph.D.

The Center for Computational Biology  
Department of Cell Biology and Neuroscience  
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### EDUCATION:

1981                    B.S. in Biochemistry, University of Arizona  
1986                    Ph.D. in Neuroscience, Baylor College of Medicine

### POSTDOCTORAL TRAINING:

1986-1989 Post Doctoral Fellow, Max-Planck-Institute for Brain Research, Frankfurt, Germany.

### ACADEMIC APPOINTMENTS:

1990-1993 Assistant Professor, The Salk Institute for Biological Studies  
1993-1996 Assistant Professor, University of California at Davis  
1997-2000 Associate Professor, University of California at Davis  
2000-            Professor, Montana State University

### AWARDS AND HONORS:

1981 - Graduated with Honors in Cellular and Molecular Biology, University of Arizona  
1991 - Klingenstein Fellowship in the Neurosciences  
1991 - Sloan Fellowship in the Neurosciences  
1991 - McDonnell-Pew Fellowship in Cognitive Neuroscience

### SOCIETIES:

Member, Society for Neuroscience, United States  
Member, American Physiological Society  
Member, American Museum of Natural History

### MAJOR RESEARCH INTERESTS:

1. neuronal mechanisms underlying visual perceptual grouping and object recognition
2. mechanisms controlling the temporal coordination of distributed neuronal processes
3. distributed neuronal interactions underlying visual working memory and pattern recognition
4. mechanisms underlying the analysis of natural images
5. the contribution of intrinsic membrane properties to cortical network behavior
6. the development of new technologies for multi-electrode neurophysiological studies in monkeys

### PUBLICATIONS:

#### Journals

Gray, C.M., Freeman, W.J. and Skinner, J.E. (1986) Chemical Dependencies of Learning in the Olfactory Bulb: Acquisition of the Transient Spatial Pattern Change Depends on Norepinephrine. Behavioral Neuroscience, 100(4):585-596.

- Gray, C.M. and Skinner, J.E. (1987) Event-related spatial patterns of activity in the rabbit olfactory bulb: acquisition depends on centrifugal input. *Electroencephalogr. Clin. Neurophysiol. Suppl.*, 40:468-472.
- Skinner, J.E., Beckman, K.J. and Gray, C.M. (1987) Detection of the cardiac patient at risk using the event-related slow potential. *Electroencephalogr. Clin. Neurophysiol. Suppl.*, 40:543-548.
- Gray, C.M., Freeman, W.J. and Skinner, J.E. (1987) Induction and Maintenance of Epileptiform Activity in the Rabbit Olfactory Bulb Depends on Centrifugal Input. *Exp. Brain Res.*, 68:210-212.
- Gray, C.M. and Skinner, J.E. (1988) Centrifugal Regulation of Neuronal Activity in the Olfactory Bulb of the Waking Rabbit as Revealed by Reversible Cryogenic Blockade. *Exp. Brain Res.*, 69:378-386.
- Gray, C.M. and Skinner, J.E. (1988) Field Potential Response Changes in the Rabbit Olfactory Bulb Accompany Behavioral Habituation During the Repeated Presentation of Unreinforced Odors. *Exp. Brain Res.*, 73:189-197.
- Gray, C.M. and Singer, W. (1989) Stimulus-Specific Neuronal Oscillations in Orientation Columns of Cat Visual Cortex. *Proc. Nat. Acad. Sci.*, 86:1698-1702.
- Gray, C.M., Koenig, P., Engel, A.K. and Singer, W. (1989) Stimulus-Specific Neuronal Oscillations in Cat Visual Cortex Exhibit Inter-Columnar Synchronization Which Reflects Global Stimulus Properties. *Nature*, 338:334-337.
- Gray, C., Engel, A.K., Koenig, P. and Singer, W. (1990) Stimulus-Dependent Neuronal Oscillations in Cat Visual Cortex: Receptive Field Properties and Feature Dependence. *Eur. J. Neurosci.*, 2:607-619.
- Engel, A.K., Koenig, P., Gray, C.M. and Singer, W. (1990) Stimulus-Dependent Neuronal Oscillations in Cat Visual Cortex: Inter-Columnar Interaction as Determined by Cross-correlation Analysis. *Eur. J. Neurosci.*, 2:588-606.
- Singer, W., Gray, C.M., Engel, A.K., Koenig, P., Artola, A. and Broecher, S. (1991) Formation of Cortical Cell Assemblies. *Cold Spring Harbor Symposium on Quantitative Biology*, Volume LV:939-952.
- Gray, C.M., Engel, A.K., Koenig, P. and Singer, W. (1992) Synchronization of Oscillatory Neuronal Responses in Cat Striate Cortex: Temporal Properties, *Visual Neuroscience*, 8:337-347.
- Jagadeesh, B., Gray, C.M. and Ferster, D. (1992) Visually-Evoked Oscillations of Membrane Potential in Neurons of Cat Striate Cortex Studied with In Vivo Whole Cell Patch Recording. *Science*, 257:552-554.
- Gray, C.M. (1993) Temporal Correlations in Visual Cortex: Functional Implications. *Dynamics of Perception*, 14(suppl4):15-20.
- Rhodes, P. and Gray, C.M. (1994) Simulations of Intrinsically Bursting Neocortical Pyramidal Neurons. *Neural Computation*, 6:1086-1110.
- Gray, C.M., Maldonado, P., Wilson, M. and McNaughton, B. (1995) Tetrodes Markedly Improve the Reliability and Yield of Multiple Single Unit Isolation from Multiunit Recordings in Cat Striate Cortex. *J. Neurosci. Meth.*, 63:43-54.
- Maldonado, P. and Gray, C.M. (1996) Heterogeneity in Local Distributions of Orientation Selective Neurons in the Cat Primary Visual Cortex. *Vis. Neurosci.*, 13:509-516.
- Gray, C.M. and McCormick, D.A. (1996) Chattering Cells: Superficial Pyramidal Neurons Contributing to the Generation of Synchronous Oscillations in Visual Cortex. *Science*, 274:109-113.
- Gray, C.M. and Viana Di Prisco, G. (1997) Stimulus Dependent Neuronal Oscillations and Local Synchronization in Striate Cortex of the Alert Cat. *J. Neurosci.*, 17(9):3239-3253.

- Maldonado,P.E., Goedecke,I., Gray,C.M. and Bonhoeffer,T. (1997) Orientation Selectivity in Pinwheel Centers of Cat Striate Cortex. *Science*, 276:1551-1555.
- Azouz,R., Gray,C.M., Nowak,L.G. and McCormick,D.A. (1997) Physiological Properties of Inhibitory Interneurons in Cat Striate Cortex. *Cerebral Cortex*, 7:534-545.
- Hurtado,J.M., Gray,C.M., Tamas,L.B. and Sigvardt,K.A. (1999) Dynamics of Tremor-Related Oscillations in the Human Globus Pallidus: A Single Case Study. *Proc. Natl. Acad. Sci.*, 96:1674-1679.
- Azouz,R. and Gray,C.M. (1999) Cellular Mechanisms Contributing to Response Variability of Cortical Neurons *In Vivo*. *J. Neurosci.*, 19:2209-2223.
- Azouz,R. and Gray,C.M. (2000) Dynamic Spike Threshold Reveals a Mechanism for Synaptic Coincidence Detection in Cortical Neurons *In Vivo*. *Proc. Natl. Acad. Sci.*, 97(14): 8110-8115.
- Hurtado, J.M., Lachaux,J-P., Beckley, D.J., Gray, C.M. and Sigvardt, K.A. (2000) Inter- and Intra-Limb Oscillator Coupling in Parkinsonian Tremor. *Movement Disorders*, 15:683-691.
- Friedman-Hill,S.R., Maldonado,P.E. and Gray,C.M. (2000) Dynamics of Striate Cortical Activity in the Alert Macaque: I. Incidence and Stimulus-Dependence of Gamma-Band Neuronal Oscillations. *Cerebral Cortex*, 10:1105-1116.
- Maldonado,P.E., Friedman-Hill,S.R. and Gray,C.M. (2000) Dynamics of Striate Cortical Activity in the Alert Macaque: II. Fast Time Scale Synchronization. *Cerebral Cortex*, 10:1117-1131.
- Azouz, R. and Gray, C.M. (2003) Adaptive Coincidence Detection and Dynamic Gain Control in Visual Cortical Neurons *In Vivo*. *Neuron*, 37:513-523.
- Nowak, L.G., Azouz, R.A., Sanchez-Vives, M.V., Gray, C.M. and McCormick, D.A. (2003) Electrophysiological Classes of Cat Primary Visual Cortical Neurons *In Vivo* as Revealed by Quantitative Analyses. *J. Neurophysiol.*, 89:1541-1566.
- Yen, SC, Baker, J, and C.M. Gray (2007) Heterogeneity in the Responses of Adjacent Neurons to Natural Stimuli in Cat Striate Cortex. *J. Neurophysiol.*, 97:1326-1341.
- Gray, C.M., Goodell, A.B. and Lear, A.T. (2007) A Multi-Channel Micromanipulator and Chamber System for Recording Multi-Neuronal Activity in Alert, Non-Human Primates. *J. Neurophysiol.*, 98:527-536.
- Azouz, R. and Gray, C.M. (2008) Stimulus Selective Spiking is Driven by the Relative Timing of Synchronous Excitation and Disinhibition in Cat Striate Neurons *in vivo*. *In Press*.

#### Book Chapters and Review Articles

- Engel,A.K., Koenig,P., Gray,C.M. and Singer,W. (1989) Synchronization of Oscillatory Responses: A Mechanism for Stimulus-Dependent Assembly Formation in Cat Visual Cortex. In: *Parallel Processing in Neural Systems and Computers*, R.Eckmiller, G.Hartmann and G.Hauske (Eds.), Elsevier Science Publishers.
- Gray,C., Koenig,P., Engel,A.K. and Singer,W. (1990) Synchronization of Oscillatory Responses in Visual Cortex: A Plausible Mechanism for Scene Segmentation. In: *Synergetics of Cognition*, H.Haken (Ed.), Springer-Verlag.
- Engel,A.K., Koenig,P., Kreiter,A.K., Gray,C.M. and Singer,W. (1991) Temporal Coding by Coherent Oscillations as a Potential Solution to the Binding Problem: Physiological Evidence. In: *Nonlinear Dynamics and Neural Networks*, H.Schuster (Ed.).
- Gray,C.M., Engel,A.K., Koenig,P. and Singer,W. (1991) Temporal Properties of Synchronous Oscillatory Neuronal Interactions in Cat Striate Cortex. In: *Nonlinear Dynamics and Neural Networks*, H.G.Schuster (Ed.), pg.27-56, VCH, Weinheim.

- Gray,C.M., Engel,A.K., Konig,P. and Singer,W. (1991) Synchronous Neuronal Oscillations in Cat Visual Cortex: Functional Implications. In: Representations of Vision: Trends and Tacit Assumptions in Vision Research, Andrei Gorea Ed., Cambridge University Press, pgs.83-96.
- Gray,C.M., Engel,A.K., Koenig,P. and Singer,W. (1992) Mechanisms Underlying the Generation of Neuronal Oscillations in Cat Visual Cortex. In: Induced Rhythms in the Brain, T.Bullock and E.Basar (Eds.), pgs. 29-45, Burkheuser, Boston.
- Gray,C.M. (1993) Rhythmic Activity in Neuronal Systems: Insights Into Integrative Function. Lectures in Complex Systems (L.Nadel and D.Stein, Eds.), Santa Fe Institute Studies in the Sciences of Complexity, Lecture Volume V, pgs. 89-161, Addison-Wesley.
- Gray,C.M. (1994) Synchronous Oscillations in Neuronal Systems: Mechanisms and Functions. J. Comp. Neurosci., 1:11-38.
- Singer,W. and Gray,C.M. (1995) Visual Feature Integration and the Temporal Correlation Hypothesis. Ann. Rev. Neurosci., 18:555-586.
- Gray,C.M. (1997) Response Synchronization in the Visual Cortex. Encyclopedia of Neuroscience.
- Gray CM (1999) The Temporal Correlation Hypothesis of Visual Feature Integration: Still Alive and Well. Neuron, 24:31-47.

#### SOME RECENT INVITED SYMPOSIA AND LECTURES:

- International Conference Celebrating the 100<sup>th</sup> Anniversary of the Birth of Ragnar Granit, Helsinki, Finland, October, 2000
- 4<sup>th</sup> International Dynamic Brain Forum, Freiburg, Germany, September, 2001.
- Co-organizer of international conference on “Cooperative Dynamics of Neocortex”, Pucon, Chile, April, 2002.
- Center for Neural Science, New York University, New York, NY, November, 2002.
- Center for Vision Science, Cornell Medical College, New York, NY, November, 2002.
- International Conference on Visual Processing, Jackson Hole, WY, February, 2003.
- Center for Complex Systems, University of California at San Diego, La Jolla, CA, February, 2003.
- Woods Hole Course on Computational Neuroscience, Woods Hole, MA August, 2003.
- Redwood Neurosciences Institute, Menlo Park, California, February 2004.
- 65<sup>th</sup> Anniversary Celebration for Edward G. Jones, University of California, Davis, CA, March, 2004.
- Gordon Conference, Oxford, England, September 2004.
- Mathematical Science Research Institute, Berkeley, CA, February, 2005.
- Department of Psychology, Cornell University, Ithaca, NY, November, 2005.
- University of Texas Health Sciences Center, Houston, TX, March 2006.
- McGovern Institute for Brain Research at MIT, May, 2006.
- International conference on Brain Network Dynamics, U.C. Berkeley, January, 2007.
- International conference on “Grand Challenges in Neural Computation”, Santa Fe, NM, February, 2007.
- International conference on “Information Processing in the Visual System”, Ohio State University, April, 2007.
- Allen Institute for Brain Research, Seattle, WA, May, 2007.
- California Institute for Technology, Pasadena, CA, March, 2008.