

CURRICULUM VITAE

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**EDUCATION**

**Ph.D.**, Department of Multidisciplinary Studies, University of Tokyo, 1997.  
**M. S.**, Department of Multidisciplinary Studies, University of Tokyo, 1992.  
**B. A.**, Department of Natural and Artificial Systems, University of Tokyo, 1990.

**RESEARCH EXPERIENCE**

**Team Leader** Laboratory for Integrated Theoretical Neuroscience, RIKEN Brain Science Institute  
*January 2006 – present.*

**Staff Scientist** Laboratory for Mathematical Neuroscience, RIKEN Brain Science Institute  
*April 2005 – December 2005.*

**Research Scientist** Laboratory for Mathematical Neuroscience, RIKEN Brain Science Institute  
*April 2000 – March 2005.*

**Special Postdoctoral Researcher** Laboratory for Information Synthesis, RIKEN Brain Science Institute  
*April 1997 – March 2000.*

**Visiting Graduate** Department of Cognitive Science, University of California, San Diego  
*December 1993 - April 1996.*

**TEACHING EXPERIENCE**

**Adjunct Professor** Department of Computational Intelligence and Systems Science, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology  
*October 2007 - present*

**Visiting Associate Professor** Department of Knowledge System Science, School of Knowledge Science, Japan Advanced Institute of Science and Technology  
*October 2000 - March 2003.*

**Visiting Lecturer** Graduate School of Science and Technology, Meiji University  
*April 1998 – March 2001.*

**Teaching Assistant** Department of Natural and Artificial Systems, University of Tokyo  
*September 1992 – September 1993.*

### **HONORS, AWARDS and FELLOWSHIPS (Selected)**

Young Investigator Award, Japan Neuroscience Society, *July 2004*.  
Special Postdoctoral Fellowship, Brain Research Institute, RIKEN, *1997-2000*.  
JSPS Research Fellowship, Japan Society for the Promotion of Science for Young Scientists, *1996-1997*.  
Rotary International Ambassadorial Scholarship, Rotary One Foundation, *1994-1995*.  
Study-Abroad Fellowship, University of Tokyo, *1993-1994*.

### **COMMITTEE SERVICES**

Planning Group Member (PGM) (Medical/Neuroscience section), the 3rd Japanese-French Frontiers of Science Symposium, January 2009.  
Co-organizer for International Workshop "Open Problems in Neuroscience of Decision Making", OIST, Okinawa, Japan, (October 2008).  
Editor for *Neural Networks*, (April 2008 --- Present).  
Editor for Biological Cybernetics, (January 2007 ---- Present).  
Editor for Computational Intelligence and Neuroscience, (April 2006 --- Present).  
Editor for Neural Networks (September 2003 --- May 2005).  
Committee member for Neurocomputing Technical Group, Information and Systems Society, The Institute of Electronics, Information and Communication Engineers (2002-2008).  
Assistant Secretary, Neurocomputing Technical Group, Information and Systems Society, The Institute of Electronics, Information and Communication Engineers (2000-2002).  
RIKEN BSI Retreat Organizing Committee (2001).  
RIKEN BSI International Summer School Organizing Committee (2000).

### **PUBLICATIONS**

#### **Journal Articles**

Bissmark, F., **Nakahara, H.**, Doya, K., & Hikosaka, O. (2008). Combining modalities with different latencies for optimal motor control. *Journal of Cognitive Neuroscience*. 20(11): pp. 1966-1979.

Plessy, C., Fagiolini, M., Wagatsuma, A., Harasawa, N., Kuji, T., Asaka-Obam, A., Kanzaki, Y., Fujishima, S., Waki, K., **Nakahara, H.**, Hensch, T, K., & Carninci, P. (2008). A Resource for Transcriptomic Analysis in the Mouse Brain. *PLoS ONE*. 3(8): e3012.

Takenaka, K., Nagasaka, Y., Hihara, S., **Nakahara, H.**, Iriki, A., Kuniyoshi, Y., & Fujii, N. (2007). Linear Discrimination Analysis of Monkey Behavior on an Alternative Free Choice Task. *Journal of Robotics and Mechatronics*. 19(4): pp.416-422.

**Nakahara, H.**, Nakamura, K., & Hikosaka, O. (2006). Extended LATER model can account for trial-by-trial variability of both pre- and post-processes. *Neural Networks*. 19(8): pp.1027-1046.

**Nakahara, H.**, Morita, K., Wurtz, R.H., & Optican, L.M. (2006). Saccade-Related Spread of Activity Across Superior Colliculus May Arise From Asymmetry of Internal Connections. *Journal of Neurophysiology*. 96(2): pp.765-774.

Amari, S., & **Nakahara, H.** (2006). Correlation and independence in the neural code. *Neural Computation*. 18(6): pp.1259-1267.

- Hikosaka, O., Nakamura, K., & **Nakahara, H.** (2006). Basal ganglia orient eyes to reward. *Journal of Neurophysiology*. 95(2): pp.567-584.
- Nakahara, H.**, Amari, S., & Richmond, B. J. (2006). A comparison of descriptive models of a single spike train by information-geometric measure. *Neural Computation*. 18(3): pp.545-568.
- Nelson, B., Nishimura, S., Kanuka, H., Kuranaga, E., Inoue, M., Hori, G., **Nakahara, H.**, & Miura, M. (2005). Isolation of gene sets affected specifically by polyglutamine expression: Implication of the TOR signaling pathway in neurodegeneration. *Cell Death and Differentiation*. 12(8): pp.1115-1123.
- Amari, S., & **Nakahara, H.** (2005). Difficulty of singularity in population coding. *Neural Computation*. 17(4): pp.839-858.
- Inoue, M., Nishimura, S., Hori, G., **Nakahara, H.**, Saito, M., Yoshihara, Y., & Amari, S. (2004). Improved parameter estimation for variance-stabilizing transformation of gene-expression microarray data. *Journal of Bioinformatics and Computational Biology*. 2(4): pp.669-679.
- Wu, S., Amari, S., & **Nakahara, H.** (2004). Information processing in a neuron ensemble with the multiplicative correlation structure. *Neural Networks*. 17(2): pp.205-214.
- Nakahara, H.**, Itoh, H., Kawagoe, R., Takikawa, Y., & Hikosaka, O. (2004). Dopamine neurons can represent context-dependent prediction error. *Neuron*. 41(2): pp.269-280.
- Kasai, H., Matsuzaki, M., Noguchi, J., Yasumatsu, N., & **Nakahara, H.** (2003). Structure-stability-function relationships of dendritic spines. *Trends in Neurosciences*. 26(7): pp.360-368.
- Nakahara, H.**, Nishimura, S., Inoue, M., Hori, G., & Amari, S. (2003). Gene interaction in DNA microarray data is decomposed by information geometric measure. *Bioinformatics*. 19(9): pp.1124-1131.
- Itoh, H., **Nakahara, H.**, Hikosaka, O., Kawagoe, R., Takikawa, Y., & Aihara, K. (2003). Correlation of primate caudate neural activity and saccade parameters in reward-oriented behavior. *Journal of Neurophysiology*. 89(4): pp.1774-1783.
- Amari, S., **Nakahara, H.**, Wu, S., & Sakai, Y. (2003). Synchronous firing and higher-order interactions in neuron pool. *Neural Computation*. 15(1): pp.127-142.
- Nakahara, H.**, & Amari, S. (2002). Information geometric measure for neural spikes. *Neural Computation*. 14(10): pp.2269-2316.
- Wu, S., Amari, S., & **Nakahara, H.** (2002a). Asymptotic behaviors of population codes. *Neurocomputing*. 44-46: pp.697-702.
- Wu, S., Amari, S., & **Nakahara, H.** (2002b). Population coding and decoding in a neural field: A computational study. *Neural Computation*. 14(5): pp.999-1026.
- Takikawa, Y., Kawagoe, R., Ito, H., **Nakahara, H.**, & Hikosaka, O. (2002). Modulation of saccadic eye movements by predicted reward outcome. *Experimental Brain Research*. 142(2): pp.284-291.
- Nakahara, H.**, Amari, S., & Hikosaka, O. (2002). Self-organization in the basal ganglia with modulation of reinforcement signals. *Neural Computation*. 14(4): pp.819-844.
- Nakahara, H.**, & Amari, S. (2002). Attention modulation of neural tuning through peak and base rate in correlated firing. *Neural Networks*. 15(1): pp.41-55.
- Hikosaka, O., Nakamura, K., Sakai, K., & **Nakahara, H.** (2002). Central mechanisms of motor skill learning. *Current Opinion in Neurobiology*. 12(2): pp.217-222.

**Nakahara, H.**, Wu, S., & Amari, S. (2001). Attention modulation of neural tuning through peak and base rate. *Neural Computation*. 13(9): pp.2031-2047.

Wu, S., **Nakahara, H.**, & Amari, S. (2001). Population coding with correlation and an unfaithful model. *Neural Computation*. 13(4): pp.775-797.

**Nakahara, H.**, Doya, K., & Hikosaka, O. (2001). Parallel cortico-basal ganglia mechanisms for acquisition and execution of visuomotor sequences: A computational approach. *Journal of Cognitive Neuroscience*. 13(5): pp.626-647.

Hikosaka, O., **Nakahara, H.**, Rand, M. K., Sakai, K., Lu, X., Nakamura, K., Miyachi, S., & Doya, K. (1999). Parallel neural networks for learning sequential procedures. *Trends in Neuroscience*. 22(10): pp.464-471.

**Nakahara, H.**, & Doya, K. (1998). Near-saddle-node bifurcation behavior as dynamics in working memory for goal-directed behavior. *Neural Computation*. 10(1): pp.113-132.

### **Books and Book Chapters**

**Nakahara, H.** (2009). Decision making and its learning theory (Chapter 5; written in Japanese). *Computational theories of brain (vol 1 Brain Science series)*. pp.159-221. Tokyo, Japan. University of Tokyo Press.

**Nakahara, H.** (2008). Computational models of the basal ganglia: reinforcement learning for reward prediction and acquisition (written in Japanese). *Japanese Journal of Molecular Psychiatry*. 8(4): pp.307-313. Tokyo, Japan. Sentan Igaku-sya.

**Nakahara, H.**, Shimono M., Uchida G., Tanifuji M. (2008). Stimulus-induced pairwise interaction can be revealed by information geometric approach. *Advances in Cognitive Neurodynamics: Proceedings of the International Conference on Cognitive Neurodynamics-2007*. pp.71-75. Springer Netherlands.

**Nakahara, H.** (2007). Pleasure creates brain (Chapter 11; written in Japanese). *Frontiers of neuroscience research. Vol.2*: pp.233-297. Tokyo, Japan. Kodansya.

**Nakahara, H.** (2006). Inferring brain network and gene network (written in Japanese). *Brain 21*. 9(3): pp.11-20. Kyoto, Japan. Kinpodo.

Bismarck, F., **Nakahara, H.**, Doya, K., & Hikosaka, O. (2005). Responding to modalities with different latencies. *Advances in Neural Information Processing*. 17: pp.169-176. Cambridge, MA: MIT Press.

**Nakahara, H.** (2005). Function of Neuron and Neural Network (written in Japanese). *Encyclopedia of Artificial Intelligence*. pp.153-155. Tokyo, Japan. Kyoritsu Shuppan.

**Nakahara, H.** (2005). Development and Neural Plasticity (written in Japanese). *Encyclopedia of Artificial Intelligence*. pp.153-155. Tokyo, Japan. Kyoritsu Shuppan.

**Nakahara, H.** (2005). Computational models of the basal ganglia (Chapter 11; written in Japanese). *Computational mechanisms of the brain*. pp.140-161. Tokyo, Japan. Asakura Publishing.

**Nakahara, H.** (2005). Dopamine activity for appetitive system, as reinforcement learning signals (written in Japanese). *Seitai no Kagaku*. 56(1): pp.17-25. Tokyo, Japan. IGAKU-SHOIN Ltd.

**Nakahara, H.** (2005). Population coding, spike analysis and information geometry (written in Japanese). *Mathematical Sciences*. 3(501): pp.32-38. Tokyo, Japan. Saiensu-sya.

Saido, T., & **Nakahara, H.** (2003). Proteolytic degradation of  $A\beta$  by neprilysin and other peptidases. In T. Saido (Ed.), *A $\beta$  Metabolism and Alzheimer's Disease*: pp.61-80. Georgetown, TX: Landes Bioscience.

**Nakahara, H.**, & Amari, S. (2002). Information-geometric decomposition in spike analysis. In T.G. Dietterich, S. Becker, and Z. Ghahramani (Eds.), *Advances in Neural Information Processing Systems 14*: pp.253-260. Cambridge, MA: MIT Press.

**Nakahara, H.**, Hori, G., Inoue, M., & Nishimura, S. (2002). Mathematical neuroscience and its relation to gene data analysis (written in Japanese). *Progress in neural information and mathematical sciences (Mathematical Sciences separate volume)*: pp.133-143. Tokyo, Japan. Saiensu-sya.

Wu, S., **Nakahara, H.**, Murata, N., & Amari, S. (2000). Population decoding based on an unfaithful model. In S.A. Solla, T.K. Leen, and K. Mueller (Eds.), *Advances in Neural Information Processing Systems 12*: pp.192-198. Cambridge, MA: MIT Press.

**Nakahara, H.**, Doya, K., & Hikosaka, O. (2000). Computational theories of cortico-basal ganglia systems (written in Japanese). *Brain 21*. 3(3): pp.29-34. Kyoto, Japan. Kinpodo.

**Nakahara, H.**, Doya, K., & Hikosaka, O. (2000). Brain global networks for learning the motor sequence control (written in Japanese). *Brain Science*. 22(10): pp.101-111. Tokyo, Japan. Seiwa Shoten.

Hikosaka, O., Sakai, K., **Nakahara, H.**, Lu, X., Miyachi, K., Nakamura, K., & Rand, M. K. (2000). Neural mechanisms for learning of sequential procedures. In M.S. Gazzaniga (Ed.), *The New Cognitive Neurosciences*: pp.553-572. Cambridge, UK: MIT Press.

Ikeda, S., Amari, S., & **Nakahara, H.** (1999). Convergence of the wake-sleep algorithm. In M.S. Kearns, S.A. Solla, and D.A. Cohn (Eds.), *Advances in Neural Information Processing Systems 11*: pp.239-245. Cambridge, MA: MIT Press.

**Nakahara, H.**, & Doya, K. (1996). Dynamics of attention as near saddle-node bifurcation behavior. In D.S. Touretzky, M.C. Mozer, and M.E. Hasselmo (Eds.), *Advances in Neural Information Processing Systems 8*: pp.38-44. Cambridge, MA: MIT Press.

### Conference Proceedings/Papers

Takenaka, K., Shiina, S., **Nakahara, H.**, Iriki, A., Kuniyoshi, Y., & Fujii, N. (2006). Retrieving internal decision process of primates during alternative free choice task (in Japanese). *The 7th SICE system integration division meeting*. Sapporo, Japan. pp.870-871.

**Nakahara, H.** (2004). Comments on analysis of neural coding by information geometric measure. *2004 International Symposium on Nonlinear Theory and its Applications*. Fukuoka, Japan. pp.31-34.

Inoue, M., Nishimura, S., Hori, G., Amari, S., Saito, M., Yoshihara, Y., & **Nakahara, H.** (2002). Transformation of DNA microarray data for statistical tests (in Japanese). *Japanese Neural Network Society 2002*. Tottori, Japan. pp.37-40.

Nishimura, S., Inoue, M., Hori, G., Amari, S., & **Nakahara, H.** (2002). Inference of higher-order interactions of genes from DNA microarray data (in Japanese). *Proceedings of 5th Workshop on Information-Based Induction Sciences (IBIS2002)*. Fujiyoshida, Japan. pp.214-219.

Hori, G., Inoue, M., Nishimura, S., & **Nakahara, H.** (2001). Blind gene classification: An application of a signal separation method. *Genome Informatics Workshop*. Tokyo, Japan. pp.255-256.

Hori, G., Inoue, M., Nishimura, S., & **Nakahara, H.** (2001). Blind gene classification on ICA of microarray data. *Independent Component Analysis and Blind Signal Separation 2001*. San Diego, USA. pp.332-336.

Sakai, Y., **Nakahara, H.**, & Amari, S. (2001). Spike correlations in feed-forward neural networks (in Japanese). *Japanese Neural Network Society 2001*. Nara, Japan. pp.175-176.

Wu, S., & **Nakahara, H.** (1999). Optimize the distribution of preferred stimulus in a population code. *Proceedings of 5th International Conference on Neural Information Processing*. San Francisco, CA. pp.326-330.

Doya, K., **Nakahara, H.**, Bapi, R. S., & Hikosaka, O. (1999). Multiple representations and algorithms for sequence learning. *The 2nd International Conference on Cognitive Science*. Tokyo, Japan. pp.17-19.

Trappenberg, T., **Nakahara, H.**, & Hikosaka, O. (1998). Modeling reward dependent activity pattern of caudate neurons. *Proceedings of International Conference on Artificial Neural Network*. Skeovde, Sweden. pp.973-978.

**Nakahara, H.**, Doya, K., Hikosaka, O., & Nagano, S. (1998). Reinforcement learning with multiple representations in the basal ganglia loops for sequential motor control. *Proceedings of International Joint Conference on Neural Network*. Anchorage, USA. pp.1553-1558.

**Nakahara, H.**, & Doya, K. (1995). Dynamics of attention as near saddle-node bifurcation behavior. *Proceedings of Joint Symposium on Neural Computation of Univ. of California, San Diego and California Institute of Technology*.

**Nakahara, H.**, & Nagano, S. (1993). Everyday conversational reasoning based on naïve concepts. *Proceedings of International Symposium on Spoken Dialogue*. Tokyo, Japan. pp.107-111.

### **Conference Abstracts and Patents**

Bromberg-Martin, E., Matsumoto, M., Nakamura, K., **Nakahara, H.**, & Hikosaka, O. (2009). Multiple timescales of reward memory in lateral habenula and midbrain dopamine neurons. *COSYNE 2009*. Abst., pp: 248. Salt Lake City, USA.

Santos, G, S., Nagasaka, Y., Takenaka, K., Iriki, A., Fujii, N., & **Nakahara, H.** (2008). Social modulation of the prefrontal cortex, parietal cortex, and caudate activity for reward-oriented behavior. *Program No. 93.11. 2008 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2008*. Online.

Kaveri, S, R., **Nakahara, H.** (2008). Uncertainty and discounting of rewards for dopamine activity by dissociating internal and physical times. *Program No. 98.2. 2008 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2008*. Online.

Santos, G, S., Nagasaka, Y., Takenaka, K., Iriki, A., Fujii, N., & **Nakahara, H.** (2008). Social Reward-Oriented Behavior in the PFC, CN, and Parietal Cortex. *The 31st Annual Meeting of the Japan Neuroscience Society (Neuroscience 2008)*. P3-q12. Tokyo, Japan.

Kaveri, S, R., **Nakahara, H.** (2008). Timing in Temporal Difference Models of Dopamine. *The 31st Annual Meeting of the Japan Neuroscience Society (Neuroscience 2008)*. P2-r07. Tokyo, Japan.

Santos, G, S., Arisaka, M., Higashi, T., Plenz, D. & **Nakahara, H.** (2007). Discovery of putative causal interactions in neuronal population data. *Program No. 793.18. 2007 Neuroscience Meeting Planner*. San Diego, CA: Society for Neuroscience, 2007. Online.

- Santos, G. S., Arisaka, M., Higashi, T., Ozaki, T., Plenz, D. & **Nakahara, H.** (2007). Fine spatio-temporal interactions in multielectrode LFP signals. *The 30th Annual Meeting of the Japan Neuroscience Society/ 50th Annual Meeting of the Japanese Society for Neurochemistry/ 17th Annual Meeting of the Japanese Neural Network Society (Neuroscience2007)*. P2-k23. Tokyo, Japan. Yokohama, Japan.
- Nakamura, K., **Nakahara, H.**, Ding, L., & Hikosaka, O. (2005). Effects of relative and absolute magnitudes of reward on saccadic eye movement and caudate neuronal activity in monkeys. *Program Number :517.7. 2005 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2005. Online.*
- Vidal-Naquet, M., Miyakawa, N., Sato, T., **Nakahara, H.**, Ullman, S., & Tanifuji, M. (2005). A fragment-based approach for the characterization of V1 receptive fields. *Program Number :517.7. 2005 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2005. Online.*
- Nakahara, H.** (2004). Dopamine neurons represent context-dependent prediction error. *Neuroscience Research Supplement*. 50(1): s17.
- Nakahara, H.**, Morita, K., Optican, L.M., & Wurtz, R.H. (2004). A model with visually-symmetric intrinsic connections produces an autonomous caudal-rostral spread of neural activity in the superior colliculus. *Program No. 990.5 2004 Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience.
- Kang, S., **Nakahara, H.**, Anderson, K. C., Amari, S., Poggio, T., & Miller, E. K. (2002). Interaction of prefrontal and dorsal extrastriatal visual cortices of the monkey in delayed-matching sample task. *Program No. 282.14 2002 Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience.
- Itoh, H., **Nakahara, H.**, Kawagoe, R., Takikawa, Y., & Hikosaka, O. (2002). Context-dependent reward expectation in the basal ganglia. *Program No. 280.4. 2002 Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience.
- Nakahara, H.**, Nishimura, S., Inoue, M., Hori, G., & Amari, S. (2002). Higher-order gene interaction revealed by log-linear analysis of DNA microarrays. *Intelligent Systems for Molecular Biology (ISMB2002)*. Edmonton, Canada. p98. 11B.
- Hori, G., Inoue, M., Nishimura, S., & **Nakahara, H.** (2002). Blind gene classification: An ICA-based gene classification/clustering method. *Intelligent Systems for Molecular Biology (ISMB2002)*. Edmonton, Canada. p60. 38A(i).
- Kang, S., **Nakahara, H.**, Anderson, K.C., Amari, S., Poggio, T., & Miller, E. K. (2002). Interaction of prefrontal and dorsal extrastriatal visual cortices of the monkey in delayed-matching sample task. *Neuroscience Research Supplement*. 45(1): s88.
- Itoh, H., **Nakahara, H.**, Kawagoe, R., Takikawa, J., & Hikosaka, O. (2002). Context-dependent reward expectation in the basal ganglia. *Neuroscience Research Supplement*. 45(1): s87.
- Hori, G., Inoue, M., Nishimura, S., & **Nakahara, H.** (2001). Blind gene classification on ICA of microarray data. *3rd International Conference on Independent Component Analysis and Blind Signal Separation*. San Diego, USA. 2001. 12.
- Nakahara, H.**, Amari, S., Tatsuno, M., Kang, S., Kobayashi, K., Anderson, K., Miller, E., Poggio, T. (2001). Information geometric measures for spike firing. *31st Annual Meeting of Society for Neuroscience*. San Diego, USA. 2001. 11.
- Wu, S., Amari, S. & **Nakahara, H.** (2001). Asymptotic Behaviors of Population Codes. *10th Annual Computational Neuroscience Meeting (CNS\*01)*, San Francisco, USA. 2001. 7.

**Nakahara, H.**, Amari S., Tatsuno, M., Kang, S., Kobayashi, K., Anderson, K. C., Miller, E. K., & Poggio, T. (2001). Information geometric measures for spike firing. *Abstracts for Society for Neuroscience*. San Diego, CA. 821.46 p2178.

**Nakahara, H.**, Itoh, H., Hikosaka, O., Kawagoe, R., Takikawa, Y., & Aihara, K. (2001). Effects of caudate neural activity on memory-guided saccades. *7th Triennial Meeting of International Basal Ganglia Society*. Waitangi, New Zealand. p68.

**Nakahara, H.**, Wu, S., & Amari, S. (2000). Attention modulation of neural tuning through peak and base rate. *26th Seiriken International Symposium on Neural Mechanisms of Visual Perception and Cognition*. Aichi, Japan. p83.

Itoh, H., **Nakahara, H.**, Hikosaka, O., Kawagoe, R., Takikawa, K., & Aihara, K. (2000). Evidence for the caudate influences on memory-guided saccades. *Abstracts for Society for Neuroscience*. New Orleans, LA. 254.9 p682.

**Nakahara, H.**, Trappenberg, T., Hikosaka, O., Kawagoe, R., & Takikawa, Y. (1998). Computational analysis on reward-modulated activities of caudate neurons. *Abstracts for Society for Neuroscience*. Los Angeles, USA. 649.5.

**Nakahara, H.**, Doya, K., & Hikosaka, O. (1998). Benefit of multiple representations in parallel cortico-basal ganglia mechanisms for acquisition and execution of visuo-motor sequences. *6th Triennial Meeting of International Basal Ganglia Society Meeting*. Cape Cod, MA. 1. 29.

**Nakahara, H.**, Doya, K., Hikosaka, O., & Nagano, S. (1997). Multiple representations in the basal ganglia loops for acquisition and execution of sequential motor control. *Abstracts for Society for Neuroscience*. New Orleans, USA. 304.10.

Hori, G., **Nakahara, H.**, Inoue, M., & Nishimura, S.[inventor] (2001). Chemical substance classification apparatus, chemical substance classification method, and program. Patent No.3817161 (Japan Patent; Application No. 2001-339396; Application date, 2001.11.5; registration date, 2006.6.16).

### **Media, Non-academic publications, and Off-campus activities**

Interview (in Japanese), *Nikkei Business Associé October 21, 2008*. Tokyo, Japan. Nikkei BP.

Zweig, J. (2007). *Your Money & Your Brain*. Simon & Shuster Inc., New York. pp. 44-45, p.282. (mentioned).

Interview (in Japanese), in "*Mystery of Price*"(2006.4.18). Japan Broadcasting Corporation (NHK).

THE NIKKAN KOGYO SHIMBUN. (2004).

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THE CHEMICAL DAILY. (2004).

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### **Technical Reports**



**Nakahara, H.**, Amari, S., & Richmond, B. J. (2005). A comparison of single spike train descriptive models by information geometric measure. *RIKEN BSI BSIS Technical Report*. No.05-1.

Bissmarck, F., **Nakahara, H.**, Doya, K., & Hikosaka, O. (2004). Efficient learning of real-time motor skills by parallel policies. *IEICE NC2004-32*. pp.23-28.

Bissmarck, F., **Nakahara, H.**, Doya, K., & Hikosaka, O. (2003). Parallel network mechanisms for motor sequence acquisition in real time. *IEICE NC2002-222*. pp.23-28.

**Nakahara, H.**, Nishimura, S., Inoue, M., Hori, G., & Amari, S. (2002). Gene interaction in DNA microarray data is decomposed by information geometric measure. *RIKEN BSI BSIS Technical Report*. No.02-6.

Hori, G., Inoue, M., Nishimura, S., & **Nakahara, H.** (2002). Blind gene classification: An ICA-based gene classification/clustering method. *RIKEN BSI BSIS Technical Report*. No.02-5.

**Nakahara, H.**, Nishimura, S., Inoue, M., Hori, G., & Amari, S. (2002). Log linear model and gene interaction in DNA microarray data. *RIKEN BSI BSIS Technical Report*. No.02-1.

**Nakahara, H.**, Amari, S., Tatsuno, M., Kang, S., & Kobayashi, K. (2002). Examples of applications of information geometric measure to neural data. *RIKEN BSI BSIS Technical Report*. No.02-2.

Yamana, M., **Nakahara, H.**, Pontil, M., & Amari, S. (2002). Kernel machine ensembles by parallel boosting (in Japanese). *IEICE Technical report*. NC2002-52. pp.47-51.

**Nakahara, H.**, Doya, K., & Hikosaka, O. (1998). Benefit of multiple representations for motor sequence control in the basal ganglia loops. *RIKEN BSI BSIS Technical Report*. No.98-5.

**Nakahara, H.**, Doya, K., Hikosaka, O., & Nagano, S. (1997). Multiple representations in the basal ganglia loops for sequential decision making. *IEICE NC97-24*. vol.97 No.116. pp.97-104.

**Nakahara, H.** (1996). Finger counting as a calendar: A case of distributed cognition. In Y. Saeki (Ed.), *Reports of Cognitive Processing Studies*. No.4. pp.97-108.