

## **METALEARNING, NEUROMODULATION AND EMOTION**



### **Papers and Presentations**

#### **【Basic Concepts】**

Doya, K. (2002). Metalearning and Neuromodulation. *Neural Networks*, 15(4).

Doya, K. (2000). Metalearning, neuromodulation, and emotion. In G. Hatano, N. Okada and H. Tanabe (Eds.), *Affective Minds*, pp. 101-104. Elsevier Science B. V.

Doya, K. (2000). Possible roles of neuromodulators in the regulation of learning processes. 30th Annual Meeting, Society for Neuroscience.

#### **【System Integration Group】**

##### **1999**

Doya, K. (1999). Metalearning, neuromodulation and emotion. The 13th Toyota Conference on Affective Minds, 46-47.

##### **2000**

Bapi, R. S., Graydon, F. X., Doya, K. (2000). Time course of learning of motor sequence representation. 30th Annual Meeting, Society for Neuroscience, 26, 707.

Doya, K. (2000). Metalearning, Neuromodulation and Emotion. Humanoid Challenge, JST Inter-field Exchange Forum, 87-88.

Doya, K. (2000). Possible roles of neuromodulators in the regulation of learning processes. 30th Annual Meeting, Society for Neuroscience, 26, 2103.

Doya, K. (2000). A possible role of serotonin in regulating the time scale of reward prediction. *Serotonin: From the Molecule to the Clinic*, 89.

Doya, K. (2000). Metalearning, neuromodulation, and emotion. G. Hatanao, et al. (eds) *Affective Minds*, Elsevier Science, B.V., 101-104.

Doya, K. (2000). Complementary roles of basal ganglia and cerebellum in learning and motor control. *Current Opinion in Neurobiology*, 10(6), 732-739.

Doya, K., Katagiri, K., Wolpert, D. M., Kawato, M. (2000). Recognition and imitation of movement patterns by a multiple predictor-controller architecture. Technical Report of IEICE, TL2000(11), 33-40.

Doya, K., Samejima, K., Katagiri, K., Kawato, M. (2000). Multiple model-based reinforcement learning. Kawato Dynamic Brain Project Technical Report, KDB-TR-08, 1-20.

Kimura, H., Doya, K. (2000). Motor control: Neural models and system theory. 14th

International Symposium on Mathematical Theory and Networks and Systems, 232.

Morimoto, J., Doya, K. (2000). Acquisition of stand-up behavior by a real robot using hierarchical reinforcement learning. 17th International Conference on Machine Learning, 1(1), 623-630.

Morimoto, J., Doya, K. (2000). Robust reinforcement learning. Neural Information Processing Systems 2000, 77.

Morimoto, J., Doya, K. (2000). Robust reinforcement learning. IEICE Neuro-Computing Workshop, NC2000-49, 59-66.

Ohba, S., Ishii, S., Sato, M. (2000). Variational Bayes method for Mixture of Principal Component Analyzers. 7th International Conference on Neural Information Processing (ICONIP-2000), 2, 1416-1421.

Samejima, K., Ueda, Y., Kimura, M., Doya, K., Schweighofer, N. (2000). Information coding of the striatal neurons during sequential movement. 30th Annual Meeting, Society for Neuroscience, 26, 681.

Sato, M. (2000). On-line Bayesian Learning and Model Selection. 7th International Conference on Neural Information Processing, 1, 470-475.

Sato, M. (2000). Convergence of On-line EM Algorithm. 7th International Conference on Neural Information Processing, 1, 476-481.

## **2001**

Bapi, R. S., Doya, K. (2001). Multiple forward model architecture for sequence Processing. R. Sun and C. L. Giles (eds) Sequence Learning, Springer, 309-320.

Doya, K. (2001). Robotic neuroscience: A synthetic approach to the brain. Neuroscience Research Supplement, 24(1), S16.

Doya, K. (2001). Regulatory roles of serotonin and norepinephrine in reinforcement learning. 9th International Catecholamine Symposium, 36, S19-4.

Doya, K. (2001). Specialization of cerebellum, basal ganglia, and cerebral cortex in supervised, reinforcement, and unsupervised learning. Stockholm Workshop on Computational Neuroscience, 13.

Doya, K., Kimura, H., Kawato, M. (2001). Neural mechanisms of learning and control. IEEE Control Systems Magazine, 21(4), 42-54.

Doya, K., Kimura, H., Miyamura, A. (2001). Motor control: Neural models and system theory. *International Journal of Applied Mathematics and Computer Science*, 11(1), 77-104.

Kuroda, S., Yamamoto, K., Miyamoto, H., Doya, K., Kawato, M. (2001). Statistical characteristics of climbing fiber spikes necessary for efficient cerebellar learning. *Biological Cybernetics*, 84(3), 183-192.

Matsumoto, N., Okada, M., Doya, K., Sugase, Y., Yamane, S., Kawano, K (2001). Dynamics of the face-responsive neurons in the temporal cortex. *Neuroscience Research Supplement*, 24(1), S73.

Morimoto, J., Doya, K. (2001). Acquisition of stand-up behavior by a real robot using hierarchical reinforcement learning. *Robotics and Autonomous Systems*, 36, 37-51.

Morimoto, J., Doya, K. (2001). Robust reinforcement learning. V.Tresp et al.(eds.) *Advances in Neural Information Processing Systems 13*. MIT Press, 1061-1067.

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

Sato, M. (2001). On-line model selection based on the variational Bayes. *Neural Computation*, 13(7), 1649-1681.

Yoshimoto, J., Ishii, S., Sato, M. (2001). Application of reinforcement learning based on on-line EM algorithm to balancing of acrobat  
. *Systems and Computers in Japan*, 32(5), 12-20.

## **2002**

Asahi, S., Okamoto, Y., Okada, G., Morinobu, S., Yamawaki, S., Doya, K. (2002). Relationship between brain activation during GO/NOGO task and impulsiveness: A fMRI study. *32nd Annual Meeting, Society for Neuroscience*, 78.5.

Capi, G., Uchibe, E., Doya, K. (2002). Selection of neural architecture and the environment complexity. *The 3rd International Symposium on Human and Artificial Intelligence Systems: Dynamic Systems Approach for Embodiment and Sociality*, 231-237.

Doya, K. (2002). Metalearning and neuromodulation. *Neural Networks*, 15, 495-506.

Doya, K., Dayan, P., Hasselmo M. E. (2002). Computational models of neuromodulation. *Neural Networks*, 15, 475-477.

Doya, K., Samejima, K., Katagiri, K., Kawato, M. (2002). Multiple model-based reinforcement learning. *Neural Computation*, 14(6), 1347-1369.

Okada, G., Okamoto, Y., Ueda, K., Morinobu, S., Yamawaki, S., Doya, K. (2002). Selection between small, immediate rewards and large, delayed rewards in prediction of future reward: A functional magnetic resonance imaging study. 8th International Conference on Functional Mapping of the Human Brain, 968.

Oba, S., Sato, M., Takemasa, I., Monden, M., Matsubara, K., Ishii, S. (2002). Missing value estimation using mixture of PCAs. *ICANN 2002*, 492-497.

Sato, M., Nakamura, Y., Ishii, S. (2002). Reinforcement Learning for Biped Locomotion. *ICANN 2002*, 777-782.

Sato, M., Oba, S. (2002). Incremental Sparse Kernel Machine. *ICANN 2002*, 700-706.

Schweighofer, N., Doya, K. (2002). A biologically plausible computational model of meta-learning in reinforcement learning. 32nd Annual Meeting, Society for Neuroscience, 283.20.

Ueda, Y., Samejima, K., Doya, K., Kimura, M. (2002). Reward value-dependent striate neuron activity of monkey performing trial-and-error behavioral decision task. Society for Neuroscience 32nd Annual Meeting, 765.13.

### **2003**

Capi, G., Uchibe, E., Doya, K. (2003). Selection of Neural Architecture and the Environment Complexity. *Dynamic Systems Approach for Embodiment and Sociality from Ecological Psychology to Robotics*, 6, 311-317.

Capi, G., Doya, K. (2003). Evolving Recurrent Neural Controllers for Sequential Tasks - A Parallel Implementation. *Congress on Evolutionary Computation*.

Daniel M Wolpert, D. M., Doya, K., Kawato, M. (2003). A unifying computational framework for motor control and social interaction.. *Philosophical Transactions of the Royal Society*, 358, 593-602.

Doya, K. (2003). Enjoy now or strive for future: Neural mechanisms of reward prediction at different time scales. *RIKEN BSI Summer Program 2003*, 36.

Doya, K. (2003). A Computational Theory of Neuromodulation. *International Symposium "New Horizons in Molecular Sciences and Systems: An Integrated Approach"*.

Doya, K., Sugimoto, N., Daniel M Wolpert, Kawato, M. (2003). Selecting optimal behaviors based on contexts. International Symposium on Emergent Mechanisms of Communication (IEMC 2003).

Elfwing, S., Uchibe, E., Doya, K. (2003). An Evolutionary Approach to Automatic Construction of the Structure in Hierarchical Reinforcement Learning. Genetic and Evolutionary Computation Conference (GECCO 2003), LNCS2723, 507-509.

Eriksson, A., Capi, G. , Doya, K. (2003). Evolution of Meta-parameters in Reinforcement Learning Algorithm. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2003), 412-417.

Nakamura, Y., Sato, M., Ishii, S. (2003). Reinforcement Learning for Biped Robot. 2nd International Symposium on Adaptive Motion of Animals and Machines (AMAM2003), 36.

Oba, S., Sato, M., Ishii, S. (2003). Prior hyperparameters in Bayesian PCA. Joint 13th International Conference on Artificial Neural Networks and 10th International Conference on Neural Information Processing (ICANN/ICONIP2003), 271-279.

Samejima, K., Ueda, Y., Doya, K., Kimura, M. (2003). ACTIVITY OF STRIATE PROJECTION NEURONS ENCODES ACTION-SELECTIVE REWARD EXPECTATIONS . Society for Neuroscience 33rd Annual Meeting .

Samejima, K., Doya, K., Kawato, M. (2003). Inter-module credit assignment in modular reinforcement learning. Neural Networks, 16(7), 985-994.

Tanaka, S., Doya, K., Okada, G., Ueda, K., Okamoto, Y., Yamawaki, S. (2003). Prediction of Immediate and Future Rewards Differentially Recruits Cortico-Basal Ganglia Loops. Society for Neuroscience 33rd Annual Meeting.

Tanaka, S. , Doya, K., Okada, G. , Ueda, K. , Okamoto, Y., Yamawaki, S. (2003). Different Cortico-Basal Ganglia Loops Specialize in Reward Prediction on Different Time Scales. Seventeenth Annual Conference on Neural Information Processing Systems (NIPS 2003).

## **2004**

Bando, T., Shibata, T., Doya, K., Ishii, S. (2004). Switching particle filters for efficient real-time visual tracking. International Conference on Pattern Recognition 2005.

Doya, K. (2004). How the basal ganglia realize reinforcement learning. Tamagawa—COE International Symposium on Attention and Decision, 70.

Doya K. (2004). Molecular and network mechanisms of reinforcement learning. Annual Meeting of Japanese Physiology Society. Sapporo, Japan.

Doya, K. (2004). Prediction of rewards at different time scales in the basal ganglia. Computational and Neural Systems, California Institute of Technology.

Doya, K. (2004). Cyber rodents: Exploration of adaptive mechanisms for self-preservation and self-reproduction. Neurobotic models in Neuroscience and Neuroinformatics.

Doya, K. (2004). Metalearning and neuromodulation. 2004 Telluride Workshop on Neuromorphic Engineering.

Doya, K. (2004). Metalearning, neuromodulation and emotion. Laboratory talk (Salk institute).

Doya, K. (2004). Metalearning, neuromodulation and emotion. Laboratory talk (Sony CSL Paris).

Doya K. (2004). Parallel networks for reward prediction at different time scales. The Mechanism of Brain and Mind Workshop. Yuzawa, Japan.

Doya K. (2004). Designing the reward system. 14th Annual Meeting, Japanese Neural Network Society. Kyoto, Japan.

Doya K. (2004). Reward prediction in the striatum and its modulation by serotonin. NIPS 2004 Workshop on Reinforcement Learning and the Brain: Beyond the Dopamine System. Whistler, Canada.

Elfving S., Uchibe E., Doya K., Christensen H. I. (2004). Multi-Agent Reinforcement Learning: Using Macro Actions to Learn a Mating Task. IEEE/RSJ International Conference on Intelligent Robots and Systems, Sendai, Japan.

Haruno, M., Kuroda, T., Doya, K., Toyama, K., Kimura, M., Samejima, K., Imamizu, H., Kawato, M. (2004). A neural correlate of reward-based behavioral learning in caudate nucleus: a functional magnetic resonance imaging study of a stochastic decision task. Journal of Neuroscience, 24(7), 1660-1665.

Kawawaki, D., Shibata, T., Goda, N., Doya, K., Kawato, M. (2004). Anterior and superior lateral occipito-temporal cortex responsible for target motion prediction during overt and covert visual pursuit. Society for Neuroscience 34th Annual Meeting, 64.

Klein, M., Kamp, H., Palm, G., Doya, K. (2004). Expressing and understanding desires in language games. Ninth International Conference on the Simulation and Synthesis of Living

Systems (ALIFE9).

Morimura T., Matsuyama K., Hayashi T., Samejima K., Doya K. (2004). Validation of decision making models by sequential Monte Carlo method applied to human decision data. The Mechanism of Brain and Mind Workshop, Yuzawa, Japan.

Samejima K., Doya K., Ueda K., Kimura M. (2004). Estimating internal variables and parameters of a learning agent by a particle filter. *Advances in Neural Information Processing Systems* 16, 1335-1342, MIT Press. [PDF]

Sato, M., Yoshioka, T., Kajiwara, S., Toyama, K., Goda, N., Doya, K., Kawato, M. (2004). Hierarchical bayesian estimation for MEG inverse problem. *NeuroImage*, 23, 806-826.

Sato, M., Yoshioka, T., Kajiwara, S., Toyama, K., Goda, N., Doya, K., Kawato, M. (2004). Hierarchical variational Bayesian method for MEG. *BIOMAG2004*, 609.

Schweighofer, N., Doya, K., Kuroda, S. (2004). Cerebellar aminergic neuromodulation: towards a functional understanding. *Brain Research Reviews*, 44, 103-116.

Schweighofer, N., Doya, K., Fukai, H., Chiron, Jean V., Furukawa, T., Kawato, M. (2004). Chaos may enhance information transmission in the inferior olive. *Proceedings of the National Academy of Sciences, USA*, 101(13), 4655-4660.

Schweighofer, N., Tanaka, S., Asahi, S., Okamoto, Y., Doya, K., Yamawaki, S. (2004). An fMRI study of the delay discounting of reward after tryptophan depletion and loading. 1: decision-making. *Society for Neuroscience 34th Annual Meeting*, 97.

Sugimoto, N, Doya, K., Kawato, M. (2004). Cooperation by estimating other's internal state. *Ninth Neural Computation and Psychology Workshop, modelling language, cognition and action*.

Tanaka, S., Doya, K., Okada, G., Ueda, K., Okamoto, Y., Yamawaki, S. (2004). Prediction of immediate and future rewards differentially recruits cortico-basal ganglia loops. *Nature Neuroscience*, 7(8), 887-893.

Tanaka, S., Doya, K., Okada, G., Ueda, K., Okamoto, Y., Yamawaki, S. (2004). Parallel mechanisms of cortico-basal ganglia loops for decision-making by reward prediction at different time scales. *2nd International Symposium on Emergent Mechanisms of Communication in the Brain*, 71.

Tanaka, S., Schweighofer, N., Asahi, S., Okamoto, Y., Yamawaki, S., Doya, K. (2004). An fMRI study of the delay discounting of reward after tryptophan depletion and loading. 2:

reward expectation. Society for Neuroscience 34th Annual Meeting, 98.

Yoshioka, T., Sato, M., Kajiwara, S., Toyama, K., Goda, N., Doya, K., Kawato, M. (2004). An analysis of MEG data by hierarchical variational Bayesian method. BIOMAG2004, 611.

Uchibe, E., Doya, K. (2004). Competitive-cooperative-concurrent reinforcement learning with importance sampling. The Eighth International Conference on the Simulation of Adaptive Behavior, 287-296.

Uchibe, E., Capi, G., Elfving, S., Eriksson, A., Suzuyama, H, Doya, K. (2004). Cyber rodent project. Symposium: Towards Artificial Rodents.

Uchibe E., Doya K. (2004). Selection from multiple reward functions for cooperative-competitive-concurrent reinforcement learning. Towards Artificial Rodents. Laboratoire d'Informatique de Paris 6. Paris, France.

## **2005**

Bando, T., Shibata, T., Doya, K., Ishii, S. (2005). Hard / soft switching particle filters for efficient real-time visual tracking. International Symposium on Artificial Life and Robotics 2005.

Bissmarck, F., Nakahara, H., Doya, K., Hikosaka, O. (2005). Responding to modalities with different latencies. Advances in Neural Information Processing Systems, MIT Press.

Capi, G., Doya, K. (2005). Evolution of neural architecture fitting environmental dynamics. Adaptive Behavior, 13,53-66.[pdf]

Doya K. (2005). Encoding of future rewards in the striatum. Cold Spring Harbor Workshop on Neural Information and Coding, Mangalore, India.

Doya K. (2005). Reward prediction in the striatum and its modulation by serotonin. Seminar at Sloan-Swartz Center for Theoretical Neurobiology, Brandeis University. Waltham, USA.

Morimoto, J., Doya, K. (2005). Robust reinforcement learning. Neural Computation, 17, 335-359.

## **【Learning Theory Group】**

### **2000**

Nakada, Y., Matsumoto, T. (2000). Nonlinear time series predictions via hierarchical Bayesian MCMC: Predictive mean and error bar. 7th International Conference on Neural



Information Processing, 1, 199-204.

Nakajima, Y., Nakada Y., Satoh, Y., Matsumoto, T., Asano, M. (2000). Quadratic approximation vs. MCMC predictive mean computations and model comparisons for hierarchical Bayes approach with neural nets . 2000 IEEE International Symposium on Intelligent Signal Processing and Communication Systems, 2(A8-4-3), 765-770.

Sato, M., Asano, M, Matsumoto, T. (2000). A hierarchical bayesian nonlinear time series prediction weighted by marginal likelihoods. 2000 IEEE International Workshop on Neural Networks for Signal Processing, 1, 115-124.

### **2001**

Kurihara.T, Yosui.K, Matsumoto, T. (2001). A Sequential Monte Carlo Bayesian On-Line Learning. The 9th International Symposium on Intelligent Signal Processing and Communications Systems(ISPACS2001), 381-385.

Matsumoto, T., Nakajima, Y., Sato, M., Sugi, J. , Hamagishi, H. (2001). Reconstructions and predictions of nonlinear dynamical systems: A hierarchical Bayesian approach. IEEE Transactions on Signal Processing, 49(9), .

Nakada, Y., Kurihara.T., Matsumoto, T. (2001). Bayesian MCMC Nonlinear Time Series Prediction. IEEE Signal Processing Society International Conference on Acoustics, Speech, and Signal Processing 2001.

Yosui.K, Kurihara.T, Nakada, Y., Matsumoto, T. (2001). Bayesian Nonlinear Time Series Prediction Via MCMC. 2001 IEEE-EURASIP Workshop on Nonlinear Signal and Image Processing. Yosui.K, Kurihara.T, Matsumoto, T. (2001). Automatic Learning of Hyperparameters via Sequential Monte Carlo. New Trends in Optimization and Computational Algorithms(NTOC2001), 121-122.

### **2003**

Souma T., Yosui, K., Kurihara, T., Matsumoto T. (2003). Reconstructions and predictions of nonlinear dynamical systems by Rao-Blackwellised sequential Monte Carlo. IEEE ICASSP2003(2003 International Conference on Acoustics, Speech, and Signal Processing), , 777-780.

Souma T., Yosui, K., Matsumoto T. (2003). Bayesian reconstructions and predictions of

nonlinear dynamical systems by Rao-Blackwellised sequential Monte Carlo. *Practical Bayesian Statistics 5*, Milton Keynes.

### **2005**

Nakada, Y., Matsumoto, T., Kurihara, T., Yosui, K. (2005). Bayesian reconstructions and predictions of nonlinear dynamical systems via the hybrid Monte Carlo scheme. *Signal Processing*, 85(1), 129-145.

### **【Adaptive Systems Group】**

### **2000**

Amemori, K., Ishii, S. (2000). Effect of the synaptic time constant on stochastic spiking neurons. *7th International Conference on Neural Information Processing*, 1, 6-11.

Amemori, K., Ishii, S. (2000). Gaussian process approach to spiking neurons for inhomogeneous Poisson inputs. *Neural Computation*, 13(12), 2763-2777.

Nagayuki, Y., Ishii, S., Doya, K. (2000). Multi-agent reinforcement learning: An approach based on the other agent's internal model. *Fourth International Conference on Multi-Agent Systems*, 215-221.

Nagayuki, Y., Ishii, S., Ito, M., Shimohara, K., Doya, K. (2000). A multi-agent reinforcement learning method with the estimation of the other agent's actions. *Fifth International Symposium on Artificial Life and Robotics*, 1, 255-259.

Niitsuma, H., Ishii, S. (2000). Learning minimax strategy by support vector machines. *7th International Conference on Neural Information Processing (ICONIP-2000)*, 2, 1432-1437.

Yoshimoto, J., Ishii, S., Sato, M. (2000). On-line EM reinforcement learning. *International Joint Conference on Neural Networks*, 3, 163-168.

### **2001**

Amemori, K., Ishii, S. (2001). Gaussian process approach to spiking neurons for inhomogeneous Poisson inputs. *Neural Computation*, 13(12), 2763-2797.

Amemori, K., Ishii, S. (2001). A link between behavioral and physiological modelings of noradrenergic modulation. *CREST Workshop on Metalearning and Neuromodulation*, 32.

Amemori, K., Ishii, S. (2001). Gaussian process approach to stochastic spiking neurons

with reset. International Conference on Artificial Neural Networks, 1, 358-365.

Amemori, K., Ishii, S. (2001). Resonance of a stochastic spiking neuron that mimics the Hodgkin-Huxley model. International Conference on Artificial Neural Networks, 1, 1069-1076.

Ishii, S. (2001). Control of exploration-exploitation balance in reinforcement learning. CREST Workshop on Metalearning and Neuromodulation , 16.

Ohba, S., Sato, M., Ishii, S. (2001). On-line learning methods for Gaussian processes. International Conference on Artificial Neural Networks, 1, 292-299.

Tamakoshi, H., Ishii, S., Yoshida, W., Sato, M. (2001). Vowel synthesis by on-line EM algorithm with IIR filter. International Joint Conference on Neural Networks, 1, 2821-2825.

Yoshimoto, J., Ishii, S., Sato, M. (2001). Application of Reinforcement Learning Based on On-Line EM Algorithm to Balancing of Acrobot . Systems and Computers in Japan , 32(5), 12-20.

Yoshioka, T., Ishii, S. (2001). Fast Gaussian process regression using representative data. International Joint Conference on Neural Networks, 1, 132-137.

## **2002**

Ishii, S., Yoshida, W., Yoshimoto, J. (2002). Control of exploitation-exploration meta-parameter in reinforcement learning. Neural Networks, 15(4/5), .

Sakumura, Y, Ishii, S. (2002). The Differential Operation by Neural Assembly . "2002 International Symposium on Nonlinear Theory and its Applications (NOLTA 2002)".

Yoshimoto, J., Ishii, S., Sato, M. (2002). Hierarchical Model Selection for NGnet Based on Variational Bayes Method. International Conference on Artificial Neural Networks 2002 (ICANN 2002), 661-666.

## **2003**

Fujita, H., Matsuno, Y., Ishii, S. (2003). A reinforcement learning scheme for a multi-agent card game. IEEE International Conference System Man & Cybernetics 2003.

Kanemoto, K., Yoshimoto, J., Ishii, S. (2004). A probabilistic approach to identify environmental models of mobile robots. The Ninth International Symposium on Artificial Life and Robotics (AROB 9th '04).

Nishimura, M., Yoshimoto, J., Ishii, S. (2004). Acrobot control by learning the switching of multiple controllers. The Ninth International Symposium on Artificial Life and Robotics (AROB 9th '04).

Nakamura, Y., Sato, M., Ishii, S. (2003). Reinforcement Learning for Biped Robot. 2nd International Symposium on Adaptive Motion of Animals and Machines (AMAM2003), 36.

Oba, S., Sato, M., Ishii, S. (2003). Prior hyperparameters in Bayesian PCA. Joint 13th International Conference on Artificial Neural Networks and 10th International Conference On Neural Information Processing (ICANN/ICONIP2003), 271-279.

Oba, S., Sato, M., Ishii, S. (2003). Variational Bayes method for mixture of principal component analyzers. Systems and Computers in Japan, 34(11), 55-56.

Oba, S., Sato, M., Takemasa, I., Monden, M., Matsubara, K., Ishii, S. (2003). A Bayesian missing value estimation method for gene expression profile data. Bioinformatics, 19, 2088-2096.

Oba, S., Sato, M., Ishii, S. (2003). Prior hyperparameters in Bayesian PCA. International Conference of Artificial Neural Networks (ICANN2003; Istanbul), 34(11), 55-56.

Yoshida, W., Ishii, S. (2003). A possible function of anterior prefrontal cortex in a model-based reinforcement learning: a computational model and an fMRI study. Twelfth Annual Computational Neuroscience Meeting (CNS).

Yoshida, W., Ishii, S. (2003). A model-based reinforcement learning: a computational model and an fMRI study. 11th European Symposium on Artificial Neural Networks (ESANN2003).

Yoshimoto, J., Ishii, S., Sato, M. (2003). System Identification Based on On-line Variational Bayes Method and Its Application to Reinforcement Learning. Joint 13th International Conference on Artificial Neural Networks and 10th International Conference On Neural Information Processing (ICANN/ICONIP2003), 123-131.

## **2004**

Kanemoto, K., Yoshimoto, J., Ishii, S. (2004). A probabilistic approach to identify

environmental models of mobile robots.. The Ninth International Symposium on Artificial Life and Robotics (AROB 9th '04).

Mori T., Nakamura, Y., Sato, M., Ishii, S. (2004). Reinforcement learning for CPG-driven biped robot. The Nineteenth National Conference on Artificial Intelligence (AAAI2004) .

Nishimura, M., Yoshimoto, J., Ishii, S. (2004). Acrobot Control by Learning the Switching of Multiple Controllers.. The Ninth International Symposium on Artificial Life and Robotics (AROB 9th '04).

Shibata, T., Suhara, Y., Oga, T., Ueki, Y., Mima, T., Ishii, S. (2004). Application of multivariate autoregressive modeling for analyzing the interaction between EEG and EMG in humans. ISBET2004.

Yoshida, W., Ishii, S. (2004). A model of reinforcement learning and effects of neuromodulation. NAIST-COE Symposium.

Yoshimoto, J., Ishii, S. (2004). A Solving Method for MDPs by Minimizing Variational Free Energy. 2004 International Joint Conference on Neural Networks (IJCNN 2004).

### **【Emotional Memory Group】**

#### **2000**

Shirao, T., Sekino, Y. (2000). Clustering and anchoring mechanisms of molecular constituents of postsynaptic scaffolds in the spine. *Neuroscience Research*, 40, 1-7.

Zhang J., Shirao T., Sekino Y. (2000). Regulation of the synaptic transmission through adenosine A1 receptors and adenylyl cyclase in the CA2 region of rat hippocampus. 30th Annual Meeting, Society for Neuroscience, 26, 404

#### **2001**

Ikeda, M., Sagara, M., Sekino, Y., Shirao, T., Honda, K., Yoshioka, T., Allen, C.N., Inoue, S. (2001). The sulphhydryl reagent, N-ethylmaleimide, disrupts sleep and blocks A1 adenosine receptor-mediated inhibition of intracellular calcium signaling in the in vitro ventromedial preoptic nucleus. *Neuroscience*, 106(4), 733-743.

Ito, M., Miyake, S., Sawada, Y. (2001). Rat Navigation problems and Internal Coding. CREST Workshop on Metalearning and Neuromodulation.

Ito, M., Samejima, K., Miyake, S., Sawada, Y. (2001). Reinforcement Learning Models Of

Rat Navigation Tasks. 31st Society for Neuroscience.

Kobayashi S., Shirao, T., Sasaki, T. (2001). Drebrin expression is increased in spinal motoneurons after axotomy. *Neuroscience Letters*, 311, 165-168.

Sekino, Y., Zhang J., Shirao, T. (2001). Synergistic effect of forskolin and adenosine A1receptor antagonist on synaptic transmission in the rat hippocampal slices. 74th Annual Meeting of The Japanese Pharmacological Society, 814.

Sekino, Y. (2001). Adenosine A1 receptors regulate information acquisition in the hippocampus. CREST Workshop on Metalearning and Neuromodulation.

Shirao, T., Sekino, Y. (2001). Metaplasticity and regulation of the spine-neck length in dendritic. CREST Workshop on Metalearning and Neuromodulation.

Takahashi, H., Sekino, Y., Shirao, T. (2001). Reversible translocation of actin-binding protein drebrin by glutamate receptor activity in cultured hippocampal neurons. 31st Annual Meeting of Society for Neuroscience .

Takahashi, H., Sekino, Y., Shirao, T. (2001). Activity-dependent redistribution of actin-binding protein drebrin in synaptic plasticity in cultured hippocampal neurons. The 11th Neuro-pharmacology Conference .

Tanaka, T., Sekino, Y., Shirao, T. (2001). Change of dendritic spine length induced by drebrin A knockdown using antisense oligonucleotide in vitro. 31st Annual Meeting of Society for Neuroscience .

Tanaka, T., Sekino, Y., Shirao, T. (2001). Morphological analysis of the dendritic spines induced by drebrin A knockdown using antisense oligonucleotides in the cultured cortical neurons. The 11th Neuro-pharmacology Conference .

Yamazaki H., Takahashi, H., Aoki, T., Shirao, T. (2001). Molecular Cloning and Dendritic Localization of rat SH3P7. *European Journal of Neuroscience*, 14(6), 998-1008.2002

## **2002**

Shirao, T. (2002). Inhibition of drebrin-A expression blocked the postsynaptic actin specialization in the dendritic filopodia. INMED Conference 2002.

Shirao, T. (2002). Changes of Actin-Drebrin Complex in Spine Formation and Synaptic Plasticity. 第 25 回日本神経科学大会, (S13-2)111.

Shirao, T., Takahashi, H., Sekino, Y. (2002). Inhibition of Drebrin-A Expression Blocked the

Postsynaptic Actin Specialization in the Dendritic Filopodia. INMED conference Nature and Nurture in Brain Development.

Sekino, Y., Shirao, T. (2002). Tonic activity of adenosine A1 receptors regulates the signal flow at the CA2 region in rat hippocampus: Optical recording analysis. The 28th NIPS International Symposium .

Satoshi, T., Sekino, Y., Shirao, T. (2002). Suppression of drebrin A expression blocks a-actinin disappearance induced by glutamate in cortical neuronal cultures. 32nd Annual Meeting, Society for Neuroscience.

### **2003**

Beraudi, A., Traversa, U., Villani, L., Sekino, Y., Nagy, J.I., Poli, A. (2003). Distribution and expression of A1 adenosine receptors, adenosine deaminase and adenosine deaminase-binding protein (CD26) in goldfish brain. *Neurochemistry International.*, 42(6), 455-464.

Ferhat, L., Esclapez, M., Represa, A., Fattoum, A., Shirao, T., Ben-Ari, Y. (2003). Upregulation of acidic calponin during dendritic spine plasticity following pilocarpine-induced seizures. *Hippocampus*, 13(7), 845-858.

Ito, M., Doya, K., Shirao, T., Sekino, Y. (2003). Spatial distribution of fos-positive neurons in the supramammillary nucleus and the hippocampus of rats placed in a novel environment.. Society for Neuroscience 33rd Annual Meeting .

Ito, M., Doya, K., Shirao, T., Sekino, Y. (2003). The supramammillary nucleus modulates the neuronal activity in the amygdala of rats placed in a novel environment. Japanese Neural Network Society.

Kobayashi, C., Shirao, T. (2003). Establishment of drebrin A transgenic mice lines and their transgene expression analysis. First COE International Symposium.

Kobayashi, C., Ito, M., Kobayashi S., Saji, M., Shirao, T., Sekino, Y. (2003). Abnormal shape of dendritic filopodia and spines induced by overexpression of drebrin A in cultured hippocampal neurons. *Neuro2003*.

Mizui, T., Takahashi, H., Koyama, H., Shirao, T. (2003). Abnormal shape of dendritic filopodia and spines induced by overexpression of drebrin A in cultured hippocampal neurons. *Neuro2003*.

Mizui, T., Shirao, T., Sekino, Y. (2003). Activation of glutamate receptors translocates drebrin from dendritic spines to the parent dendrite in hippocamal neurons. First COE International Symposium.

Mizui, T., Hanayama, k., Sekino, Y. (2003). Redistribution of drebrin, an actin-binding protein in dendritic spines, induced by activation of glutamate receptors in hippocamal neurons. Annual Meeting of the Japanese Society for Neurochemistry.

Sekino, Y., Tanaka, S., Shirao, T. (2003). Drebrin is redistributed to the dendritic shafts with actin filaments by glutamate receptor activation . Neuro2003.

Sekino, Y., Shirao, T., Obata, K. (2003). Adenosine A1 Receptor Activity Regulates Signal Processing in the Hippocampus. IBRO.

Shirao, T., Takahashi, H., Sekino, Y., Obata, K. (2003). Drebrin Clustering in Dendritic Filopodia is a First Essential Step of Dendritic Spine Morphogenesis. IBRO.

Shirao, T., Takahashi, H., Sekino, Y. (2003). Drebrin Clustering with Actin Filaments is an Essential Step of Dendritic Spine Morphogenesis. IBRO Presymposium.

Shirao, N., Okamoto, Y., Okada, G., Okamoto, Yu., Yamawaki, S. (2003). Temporomesial activation in young females associated with unpleasant words concerning body image. *Neuropsychobiology*, 48, 136-142.

Takahashi, H., Sekino, Y., Tanaka, S., Mizui, T., Kishi, S., Shirao, T. (2003). Drebrin-dependent actin clustering in dendritic filopodia governs synaptic targeting of postsynaptic density-95 and dendritic spine morphogenesis. *Journal of Neuroscience*, 23(16), 6586-6595.

Takahashi, H., Shirao, T. (2003). Functional roles of actin cytoskeleton in dendritic spine morphogenesis during development. Neuro2003.

Takahashi, H., Shirao, T. (2003). Cluster formation of drebrin in dendritic filopodia is an essential step for dendritic spine morphogenesis. COE International Symposium.

Yamazaki H., Kobayashi, C., Mizui, T., Shirao, T. (2003). Subcellular localization of Drap1, drebrin associated protein 1, in cultured hippocampal neurons. The 26th Annual Meeting of the Japan Neuroscience Society.

Yamazaki, H., Mizui, T., Shirao, T. (2003). Domain analysis of Drebrin-associated protein 1, Drap1. Annual Meeting of the Japanese Society for Neurochemistry.



## **2004**

Ito M., Doya K., Shirao T., Sekino Y. (2004). Ibotenic acid lesions of the supramammillary nucleus decreased c-Fos expression in the hippocampus of rats exploring in an open field. Annual Meeting of Japanese Physiology Society, Sapporo, Japan.

Ito, M., Doya, K., Shirao, T., Sekino, Y. (2004). Fos imaging reveals that the supramammillary nucleus enhances hippocampal activity of rats placed in a novel open field. Society for Neuroscience 34th Annual Meeting, 96.

Tezuka, M, Oda, O., Shirao, T., Inoue, HK. (2004). Microglia/macrophage reactions and cell proliferation during the repair of spinal cord injuries in infant rats. *Neurotrauma Res*, 15.

## **【Learninig Modulation Group】**

## **2000**

Iba, M., Sawaguchi, T. (2000). Local Injections of an alfa-2 noradrenergic antagonist into the dorsal prefrontal cortex induce specific deficits in visuospatial selective attention. 30th Annual Meeting, Society for Neuroscience, 26, 657.22.

Kikuchi-Yorioka, Y., Sawaguchi, T. (2000). Parallel visuospatial and audiospatial working memory processes in the monkey dorsolateral prefrontal cortex. *Nature Neuroscience*, 3(11), 1075-1076.

Kikuchi-Yorioka, Y., Sawaguchi, T. (2000). The effect of local inactivation in the dorsolateral prefrontal cortex on visual and auditory working memory tasks. *Society of Neuroscience*, 26, 365.8.

Sawaguchi, T. (2000). The role of D1-dopamine receptors in working memory-guided movements mediated by frontal cortical areas. *Parkinsonism & Related Disorders*, 7, 9-19.

## **2001**

Iba, M., Sawaguchi, T. (2001). Pop-out independent target selection in the monkey dorsolateral prefrontal cortex. *Neuroscience Research Supplement*, 24(1), S135.

Kikuchi-Yorioka, Y., Sawaguchi, T., Miyauchi, S. (2001). Prefrontal and temporal activation during an associative learning task as revealed by fMRI. *Neuroscience Research Supplement*, 24(1), S299.

Sawaguchi, T., Iba, M. (2001). Prefrontal cortical representation of visuospatial working

memory in monkeys examined by local inactivation with muscimol. *Journal of Neurophysiology*, 86(4), 2041-2053.

Sawaguchi, T. (2001). The effects of dopamine and its antagonists on directional delay-period activity of prefrontal neurons in monkeys during an oculomotor delayed-response task. *Neuroscience Research*, 41(2), 115-128.

Sawaguchi, T. (2001). Unmasking of silent "task-related" neuronal activity in the monkey prefrontal cortex by a GABA $\alpha$  antagonist. *Neuroscience Research*, 39(1), 123-131.

## **2002**

Hirata, Y., Sawaguchi, T. (2002). Enhancement of columnar activity induced by activation of D1-dopamine receptors in the monkey prefrontal cortex. 32nd Annual Meeting, Society for Neuroscience.

Tsujimoto, S., Sawaguchi, T. (2002). Neuronal activity representing directional response-outcome in the primate prefrontal cortex . 32nd Annual Meeting, Society for Neuroscience.

## **2003**

Tsujimoto, S., Sawaguchi, T. (2004). Properties of delay-period neuronal activity in the primate prefrontal cortex during memory- and sensory-guided saccade tasks. *European Journal of Neuroscience*, 19, 447-457.

Tsujimoto, S., Sawaguchi, T. (2004). Neuronal representation of response-outcome in the primate prefrontal cortex. *Cerebral Cortex*, 14, 47-55.

Tsujimoto, S., Yamamoto, T, Kawaguchi, H., Koizumi, H., Sawaguchi, T. (2003). Functional maturation of the prefrontal cortex in preschool children measured by optical topography. Society for Neuroscience 33rd Annual Meeting.

## **【Mental Pharmacology Group】**

### **2001**

Fukumoto,T., Morinobu, S., Okamoto,Y., Kagaya,A., Yamawaki,S. (2001). Chronic lithium treatment increases the expression of brain-derived neurotrophic factor in the rat brain.. *Psychopharmacology*, 158, 100-106.

Katagiri,H., Kagaya, A., Nakae, S., Morinobu,S.,Yamawaki, S. (2001). Modulation of serotonin-2A receptor function in rats after repeated treatment with dexamethasone and L-type calcium channel antagonist nimodipine.. Prog. Neuro-Psychopharmacol. & Biol. Psychiat., 25, 1269-1281.

Kurata, K., Takebayashi,M., Kagaya, A., Morinobu, S., Yamawaki, S. (2001). Effect of  $\beta$ -estradiol on voltage-gated Ca<sup>2+</sup> channels in rat hippocampal neurons: A comparison with dehydroepiandrosterone. European Journal of Pharmacology, 416(3), 203-212.

Miyoshi, I., Kagaya, A., Kohchi, C., Morinobu, s., Yamawaki, S. (2001). Characterization of 5-HT<sub>2A</sub> receptor desensitization and the effect of cycloheximide on it in C6 cells. Journal of Neural Transmission, 108(3), 249-260.

Yamashita,H., Fujikawa, T., Yanai,I., Morinobu,S., Yamawaki,S. (2001). Clinical features and treatment response of patients with major depression and silent cerebral infarction.. Neuropsychobiology, 176-182.

Yamawaki, S., Kagaya, A., Okamoto, Y., Takebayashi, M., Saeki, T. (2001). Effects of antidepressants and lithium on intracellular calcium signaling.. Contemporary Neuropsychiatry , 257-262.

## **2002**

Asahi, S., Okamoto, Y., Okada, G., Morinobu, S., Yamawaki, S., Doya, K. (2002). Relationship between brain activation during GO/NOGO task and impulsiveness: A fMRI study. 32nd Annual Meeting, Society for Neuroscience , 78.5.

G. Okada, Y. Okamoto, K. Ueda, S. Morinobu, S. Yamawaki, K. Doya (2002). Selection between small, immediate rewards and large, delayed rewards in prediction of future reward: A functional magnetic resonance imaging study. 8th International Conference on Functional Mapping of the Human Brain.

Tamura, T., Morinobu, S., Okamoto, Y., Kagaya, A., Yamawaki, S. (2002). The effects of antidepressant drug treatments on activator protein-1 binding activity in the rat brain.. Progress in Neuro-Psychopharmacology & Biological Psychiatry, 26, 375-381.

Yamashita,H., Fujikawa, T., Yanai, I., Yamawaki, S. (2002). Cognitive dysfunction in recovered depressive patients with silent cerebral infarction.. Neuropsychobiology, 45, 12-18.

**2003**

Shirao, N., Okamoto, Y., Okada, G., Okamoto, Yu., Yamawaki, S. (2003). Temporomesial activation in young females associated with unpleasant words concerning body image. *Neuropsychobiology*, 48, 136-142.

Ueda, K., Okamoto, Y., Okada, G., Yamashita, H., Hori, T., Yamawaki, S. (2003). Brain activity during expectancy of emotional stimuli: An fMRI study. *Neuroreport*, 14(1), 51-55.