

R. Allen Waggoner

Position

Research Specialist
Laboratory for Cognitive Brain Mapping
RIKEN Brain Science Institute
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Research Interests

High-resolution fMRI
Diffusion weighted fMRI
Physiological noise correction
Parallel imaging
Safety issues related to parallel transmission MRI

Education

B.S. Department of Chemistry, Missouri Southern State College, Joplin, Missouri, 1986
(now Missouri Southern State University)

Ph.D. Department of Chemistry, University of Missouri-Rolla, Rolla, Missouri, 1993
(now Missouri University of Science & Technology)

Dissertation Title: *Self-Diffusion Studies in Polymer-Solvent Systems by Pulsed-Gradient Spin-Echo Nuclear Magnetic Resonance*

Experience

1987-1988 Teaching Assistant, University of Missouri-Rolla, Rolla, Missouri
1988-1993 Research Assistant, University of Missouri-Rolla, Rolla, Missouri
1993-1996 Postdoctoral Fellow, The Lovelace Institutes, Albuquerque, New Mexico
1996-2006 Research Scientist - *MRI Physics*, Brain Science Institute, RIKEN
2006-present Research Specialist - *MRI Physics*, Brain Science Institute, RIKEN

Professional Activities

- Reviewer for the journal *Science*
- Reviewer for *Journal of Magnetic Resonance*
- Reviewer for *Journal of Magnetic Resonance Imaging*
- Reviewer for the journal *NeuroImage*
- Abstract Reviewer for International Society for Magnetic Resonance in Medicine
- Abstract Reviewer for Organization for Human Brain Mapping
- Co-organized of the first RIKEN-BSI fMRI mini-school in 2008
- Member of program committee for ISMRM Workshop on *Ultra High Field Systems & Applications: 7T & Beyond: Progress, Pitfalls & Potential* Lake Louise, Alberta, Canada, February 21-23, 2011
- Member of the *Japan Society for Magnetic Resonance in Medicine - Safety Committee*
- Chairman of the *7 Tesla Safety Sub-Committee* of the *Japan Society for Magnetic Resonance in Medicine*

Professional Organizations

- International Society for Magnetic Resonance in Medicine
- Organization for Human Brain Mapping
- Japanese Society for Magnetic Resonance in Medicine

Publications

33. P. Sun, J.L. Gardner, M. Costagli, K. Ueno, R.A. Waggoner, K. Tanaka, and K. Cheng, **Demonstration of tuning to stimulus orientation in human visual cortex: a high-resolution fMRI study with a novel continuous and periodic stimulation paradigm**, *Cerebral Cortex*, in press, 2013.
32. Y. Matsuda, K. Ueno, R.A. Waggoner, D. Erickson, Y. Shimura, K. Tanaka, K. Cheng, and R. Mazuka, **Processing of infant-directed speech by adults**, *NeuroImage*, **54(1)**, 611-621, 2011.
31. R.A. Waggoner, K. Tanaka, and K. Cheng, **Exploring the Origins of the DfMRI Signal at 4 Tesla**, *NeuroImage*, **47(S1)**, S186, 2009.
30. M. Costagli, R.A. Waggoner, K. Ueno, K. Tanaka, and K. Cheng, **Correction of 3D rigid body motion in fMRI time series by independent estimation of rotational and translational effects in k-space**, *NeuroImage*, **45(3)**, 749-757, 2009.
29. P. Sun, K. Ueno, R.A. Waggoner, J.L. Gardner, K. Tanaka, and K. Cheng, **A temporal frequency-dependent functional architecture in human V1 revealed by high-resolution fMRI**, *Nature Neuroscience*, **10(11)**, 1404-1406, 2007.
28. Y. Matsuda, K. Ueno, R.A. Waggoner, D. Erickson, Y. Shimura, K. Tanaka, K. Cheng, and R. Mazuka, **Processing of infant-directed speech in adults**, *NeuroImage*, **36(S1)**, S38, 2007.
27. R.A. Waggoner, M. Costagli, K. Ueno, K. Tanaka, K. Cheng, **SENSE or TSENSE for fMRI, Which is Better?** *NeuroImage*, **31(S1)**, S173, 2006.
26. M. Costagli, R.A. Waggoner, K. Ueno, K. Tanaka, K. Cheng, **3D Motion Correction in the Fourier Domain for fMRI Time Series**, *NeuroImage*, **31(S1)**, S152, 2006.
25. Y. Tanaka, R.A. Waggoner, K. Ueno, K. Tanaka, K. Cheng, **The left parieto-occipital cortex is critically involved in the object completion with degraded image information**, *NeuroImage*, **31(S1)**, S119, 2006.
24. P. Sun, J.L. Gardner, M. Costagli, K. Ueno, R.A. Waggoner, K. Tanaka, K. Cheng, **Direct demonstration of tuning to stimulus orientation in human V1: a high-resolution fMRI study with a continuous stimulation paradigm and a differential mapping method**, *NeuroImage*, **31(S1)**, S112, 2006.
23. R.A. Waggoner, K. Ueno, K. Tanaka, K. Cheng, **The Significance of Physiological Noise with increasing R in SENSE-EPI**, *NeuroImage*, **26(S1)**, S43, 2005.
22. K. Ueno, R.A. Waggoner, K. Tanaka, K. Cheng, **Spatial precision of BOLD-fMRI in human V1: point spread function measured at 4T with spatially localized and size-varied stimuli**, *NeuroImage*, **26(S1)**, S23, 2005.
21. R. Horie, C. Hirata, R.A. Waggoner, K. Ueno, K. Tanaka, K. Cheng, J. Tani, **Functional Mapping of State-dependent Activity in a Learned Artificial Grammar**, *NeuroImage*, **26(S1)**, S30, 2005.
20. J.L. Gardner, P. Sun, R.A. Waggoner, K. Ueno, K. Tanaka, and K. Cheng, **Contrast Adaptation and Representation in Human Early Visual Cortex**, *Neuron*, **47(4)**, 607-620, 2005.
19. C. Hirata, R. Horie, R.A. Waggoner, K. Ueno, K. Cheng, K. Tanaka, J. Tani, **Neural substrates of learned abstract motor sequence: a high-field fMRI study**, *NeuroImage*, **22(S1)**, e1238, 2004.

18. P. Sun, K. Ueno, R. Waggoner, K. Tanaka, K. Cheng, **Temporal frequency dominance domains in human primary visual cortex: a high resolution fMRI study**, *NeuroImage*, **22(S1)**, e1104, 2004.
17. J. L. Gardner, P. Sun, R.A. Waggoner, K. Ueno, K. Tanaka, K. Cheng, **Adaptation causes horizontal shifts of contrast response curves in early human visual cortex: an event-related fMRI study**, *NeuroImage*, **22(S1)**, e969, 2004.
16. F. Moradi, L.C. Liu, K. Cheng, R.A. Waggoner, K. Tanaka, and A.A. Ioannides, **Consistent and precise localization of brain activity in human primary visual cortex by MEG and fMRI**, *NeuroImage*, **18(3)**, 595-609, 2003.
15. K. Tanaka, K. Ueno, K. Cheng and R.A. Waggoner, **Recent development in noninvasive brain activity measurement by functional magnetic resonance imaging (fMRI)**, *Oyo Buturi*, **72(8)**, 1033-1038, 2003.
14. 上野賢一, 程康, R.A. Waggoner, 田中啓治, **4テスラfMRIによる大脳コラムのイメージング**, *脳21*, **5(4)** : 363-367, 2002.
13. K. Cheng, R.A. Waggoner, and K. Tanaka, **Human Ocular Dominance Columns as Revealed by High-Field Functional Magnetic Resonance Imaging**, *Neuron*, **32(2)**, 359-374, 2001.
12. R.A. Waggoner, K. Cheng, and K. Tanaka, **A Comparison of the BOLD Response in V1, MT, and M1**, *NeuroImage*, **11(5)**, S782, 2000.
11. K. Cheng, R.A. Waggoner, and K. Tanaka, **Mapping Human Ocular Dominance Columns with High-Field (4T) fMRI**, *NeuroImage*, **11(5)**, S705, 2000.
10. K. Tanaka, K. Cheng, H. Takeichi, T. Ong, R.A. Waggoner, E. Yoshitome, S. Mizuta, and K. Ueno, **Using functional Magnetic Resonance Imaging to study Human Brain Functions**. *RIKEN Review*, **24**, 64-66, 1999.
9. M. Nakagawa, R.A. Waggoner, and E. Fukushima, **Non-Invasive measurement of Fabric Particle Packing by NMR in Introduction to Mechanics of Granular Flow**, M. Oda, ed., A.A.Balkema Publishers, Rotterdam, Netherlands, 240-247, 1999.
8. R.A. Waggoner, M. Nakagawa, J. Glass, M. Reece and E. Fukushima, **Particle Compaction as Observed by MRI in Spatially Resolved Magnetic Resonance: Methods and Applications in Materials Science, Agriculture and Biomedicine**, B. Blümich, P. Blümmler, R. Botto, and E. Fukushima ed., M. Bauschulte, Quirinusstr Publishers, Roetgen Germany, 299-304, 1998.
7. E. Yoshitome, R.A. Waggoner, and K. Tanaka, **Contrast Decrease in EPI with Centric Order Phase Encoding**, *NeuroImage*, **7(4)**, S539, 1998.
6. D.O. Kuethe, A. Caprihan, E. Fukushima, and R.A. Waggoner, **Imaging Lungs Using Inert Fluorinated Gases**, *Magnetic Resonance in Medicine*, **39(1)**, 85-88, 1998.
5. R.A. Waggoner and E. Fukushima, **Velocity Distribution of Slow Fluid Flows in Bentheimer Sandstone: An NMRI and Propagator Study**, *Magnetic Resonance Imaging*, **14(9)**, 1085-1092 (1996).
4. R.A. Waggoner, F.D. Blum, and John Lang, **Diffusion in Aqueous Solutions of Poly(ethylene glycol)**, *Macromolecules*, **28(8)**, 2658-2664 (1995).
3. R.A. Waggoner, F.D. Blum, and J.M.D. MacElroy, **Dependence of the Solvent Diffusion Coefficient on Concentration in Polymer Solutions**, *Macromolecules*, **26(25)**, 6841-6848 (1993).

2. F. D. Blum, S. Pickup, R. A. Waggoner, **NMR Measurements of Solvent Self-Diffusion Coefficients in Polymer Solutions**, *Polymer Preprints*, **31(1)**, 125-126 (1990).
1. R.A. Waggoner and F.D. Blum, **Solvent-Diffusion and Drying of Coatings**, *J. Coat. Tech.*, **61(768)**, 51-56 (1989). (Finalist in the Roon Award Competition of the Federation of Coatings Societies).

Presentations

39. R. Allen Waggoner, S. Gupta, K. Tanaka, and K. Cheng. **Assessment of T_2^* Blurring in SIR Accelerated EPI**, 40th Annual Meeting of the Japanese Society for Magnetic Resonance in Medicine, Kyoto, Japan, September 6-8, 2012.
38. R. Allen Waggoner, **An Overview of High Resolution fMRI Studies in the Laboratory for Cognitive Brain Mapping**, Institute of Biophysics of Chinese Academy of Sciences, Beijing China, June 15, 2012. (Invited Talk)
37. R. Allen Waggoner, **An Overview of fMRI Studies in the Laboratory for Cognitive Brain Mapping**, Neuroscience Research Institute, Gachon University of Medicine and Science, Incheon South Korea, November 29, 2011. (Invited Talk)
36. R.A. Waggoner, K. Tanaka, and K. Cheng, **Impact of Increasing Field Strength on the Diffusion Weighted fMRI Response**, ISMRM Workshop on Ultra-High Field Systems & Applications: 7T & Beyond: Progress, Pitfalls & Potential, Lake Louise, Alberta, Canada, February 20-23, 2011.
35. R.A. Waggoner, K. Tanaka, and K. Cheng, **Investigating the Origins of the DfMRI Signal Using 4 Tesla**, 18th Scientific Meeting and Exhibition of the *ISMRM*, Stockholm, Sweden, May 1-7, 2010.
34. R.A. Waggoner, K. Tanaka, K. Cheng, **Exploring the Origins of the DfMRI Signal at 4 Tesla**. 15th Annual Meeting of the Organization for Human Brain Mapping, San Francisco, CA. USA, June 18-23 2009.
33. R.A. Waggoner, T. Oda, R. Kinugasa, K. Ueno, K. Cheng, H. Yokota, and R. Himeno, **DTI Based Muscle Fiber Tractography in Humans at 4 Tesla Using Stimulated-Echos**, 17th Scientific Meeting and Exhibition of the *ISMRM*, Honolulu, HI, April 18-24, 2009.
32. R.A. Waggoner, M. Costagli, K. Tanaka, and K. Cheng, **Inherent Smoothing in Accelerated Parallel Imaging Reconstruction Techniques**, 15th Scientific Meeting and Exhibition of the *ISMRM*, Berlin, Germany, May 19-25, 2007.
31. R.A. Waggoner, M. Costagli, K. Tanaka, and K. Cheng, **Spatial Smoothing Resulting from Accelerated Parallel Imaging Reconstruction**, ISMRM Workshop on Advances in High Field MR, Pacific Grove, CA. USA, March 25-28, 2007.
30. R.A. Waggoner, M. Costagli, Y. Matsuda, K. Ueno, K. Tanaka, K. Cheng, **SENSE or TSENSE, Which Makes Sense for fMRI?** 34th Annual Meeting of the Japanese Society for Magnetic Resonance in Medicine, Tsukuba, Ibaraki, Japan, September 14-16, 2006.
29. R.A. Waggoner, M. Costagli, K. Ueno, K. Tanaka, K. Cheng, **SENSE or TSENSE for fMRI, Which is Better?** 12th Annual Meeting of the Organization for Human Brain Mapping, Florence, Italy, June 11-15 2006.

28. R.A. Waggoner, M. Costagli, K. Ueno, K. Tanaka, K. Cheng, **Which is the Optimum Reconstruction Technique for Partially Parallel Imaging fMRI?** 48th NMR² Meeting, Albuquerque, NM. May 13-14, 2006.
27. R.A. Waggoner, M. Costagli, K. Ueno, K. Tanaka, K. Cheng, **Physiological Noise Correction with Increasing Acceleration in SENSE-EPI**, 14th Scientific Meeting and Exhibition of the *ISMRM*, Seattle, WA May 6-12, 2006.
26. R.A. Waggoner and M. Costagli, **SENSE or TSENSE, Which is Best for fMRI?** National Institute for Physiological Studies' 4th Annual fMRI Workshop, Okazaki, Japan, November 24-25, 2005.
25. R.A. Waggoner, M. Costagli, K. Ueno, K. Tanaka, K. Cheng, **Physiological Noise Correction with Increasing R in SENSE-EPI**, 5th Bi-Annual Minnesota Workshop On High Field MR Imaging And Spectroscopy And MR Imaging Of Brain Function, University of Minnesota, October 13-16, 2005.
24. R.A. Waggoner, M. Costagli, K. Ueno, K. Tanaka, K. Cheng, **Physiological Noise in SENSE-EPI**, 8th International Conference on Magnetic Resonance Microscopy, Utsunomiya, Japan, August 22-26, 2005.
23. R.A. Waggoner, K. Ueno, K. Tanaka, K. Cheng, **The Significance of Physiological Noise with increasing R in SENSE-EPI**, 11th Annual Meeting of the Organization for Human Brain Mapping, Toronto, Canada, June 13-16 2005.
22. R.A. Waggoner, Y. Kobayashi, G. Matsumura, N. Shiraishi, K. Tanaka, K. Cheng, **T1 in Postmortem Brains at 4T**, 11th Scientific Meeting and Exhibition of the *ISMRM*, Toronto, Canada July 10-16, 2003.
21. R. Allen Waggoner, **An Introduction to the Use of MRI to Study Brain Function**, Waseda University Department of Electrical, Electronics and Computer Engineering, January 30th, 2003. (Invited Talk)
20. R.A. Waggoner, K. Cheng,, and K. Tanaka, **A Comparison of the Temporal Characteristics of the BOLD Responses in V1, MT and the Primary Motor Cortex (M1) to a Variety of Stimuli**, National Institute for Physiological Studies' 1st Annual fMRI Workshop, Okazaki, Japan, November, 28-29 2002.
19. R. Allen Waggoner, **An Introduction to MRI**, American School in Japan, May 9, 2001. (Invited Talk)
18. R.A. Waggoner, K. Cheng, and K. Tanaka, **What do similarities and differences of the BOLD response in different cortical areas tell us? A comparison study of V1, MT and M1**, Japan Science and Technology Corporation Symposium, "Trends in Neuroscience at the Millennium", Tokyo, Japan, January 22-24, 2001.
17. R.A. Waggoner, K. Cheng, and K. Tanaka, **A Comparison of the BOLD Response in V1, MT, and M1**, 28th Meeting of the Japanese Society for Magnetic Resonance in Medicine, Kyoto, Japan, October 2-4, 2000.
16. R.A. Waggoner, K. Cheng, and K. Tanaka, **A Comparison of the BOLD Response in V1, MT, and M1**, 6th Annual Meeting of the Organization for Human Brain Mapping, San Antonio, TX, June 12-16 2000.
15. R.A. Waggoner, K. Cheng, and K. Tanaka, **Stimulus-Dependence and Independence of the BOLD Response in Human V1 and MT**, Eighth Scientific Meeting and Exhibition of the *ISMRM*, Denver CO, April 1-7, 2000

14. R.A. Waggoner, **Functional Magnetic Resonance Imaging of the Human Visual Cortex at 4 Tesla**, RIKEN Symposium "Nuclear Magnetic Resonance – Crosstalk between Research and Technology", Wako-shi Japan, December 10, 1999. (Invited Talk)
13. R.A. Waggoner, M. Nakagawa, J. Glass, M. Reece and E. Fukushima, **Particle Compaction as Observed by MRI**, 4th International Conference on Magnetic Resonance Microscopy and Macroscopy, Albuquerque, NM, September 21-25, 1997
12. R.A. Waggoner, M. Nakagawa, and E. Fukushima, **Magnetic Resonance Imaging and Particle Mechanics**, Avalanche and Particle Mechanics Meeting, Golden CO. May 13-14, 1996. (Invited Talk)
11. R.A. Waggoner and E. Fukushima, **k-Space and q-Space Velocity Imaging in Porous Media**, 37th ENC, Asilomar, March 17-22, 1996.
10. R. A. Waggoner and E. Fukushima, **Velocity Imaging in Porous Media**, Third International Meeting, Recent Advances in MR Applications to Porous Media, Louvain-la-Neuve, Belgium, September 3-6, 1995.
9. R.A. Waggoner and E. Fukushima, **MRI of Flow in Porous Media**, Magnetic Resonance Gordon Research Conference, Wolfeboro, NH, June, 25-30, 1995.
8. R.A. Waggoner and E. Fukushima, **Studies of flow and Porous Media via Magnetic Resonance**, 36th ENC, Boston, MA, March, 26-30, 1995.
7. R.A. Waggoner, **Magnetic Resonance Imaging of Flows**, Albuquerque Society for Applied Spectroscopy Meeting, Albuquerque, NM, November 16, 1994. (Invited Talk)
6. R.A. Waggoner, P.D. Majors, E. Fukushima, **^1H and ^{19}F NMRI Studies of Immiscible Fluid Displacements in Porous Media**, 35th ENC, Asilomar, April 10-15, 1994.
5. R. Allen Waggoner, **Diffusion Studies in Polymer Solutions by NMR**, Chemistry Department, New Mexico Tech., Socorro, NM, December 1, 1993. (Invited Talk)
4. R.A. Waggoner and F.D. Blum, **Modeling of the Drying of Coatings**, Spring 1991 American Chemical Meeting, Atlanta, GA, April 14-19, 1991.
3. R.A. Waggoner and F.D. Blum, **Solvent Self-Diffusion and Free Volume in Concentrated Polymer Solutions**, FACSS XVI, Chicago, IL, Oct. 1-6, 1989.
2. R.A. Waggoner and F.D. Blum, **Self-Diffusion Coefficients in Polystyrene Solutions**, Midwest Regional American Chemical Society Meeting, St. Louis, MO, Nov. 1-3, 1989.
1. R.A. Waggoner and F.D. Blum, **Role of Diffusion in the Drying of Coatings**, Midwest Regional American Chemical Meeting, Iowa City, IA, Nov. 16-18, 1988.