

Curriculum Vitae

Apkar Vania Apkarian, Ph.D.
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Email: A-Apkarian@northwestern.edu
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Personal

Citizenship: U.S.A
Health: Excellent
Marital Status: Married, Dr. Seema Khan
two children: Salpi and Charents

Education

Physiologische Institut, Universitat Wurzburg *1988 - 1989*
Wurzburg, Federal Republic of Germany
Humboldt Post-doctoral Fellow

SUNY Health Science Center at Syracuse *1988*
Syracuse, New York
Ph.D. in Neuroscience

University of Southern California *1979*
Los Angeles, California
Master of Science, biomedical Engineering

University of Southern California *1974*
Los Angeles, California
Bachelor of Science, Electrical Engineering

Professional experience

Northwestern University Medical School
Chicago, Illinois
Associate professor of Physiology, Surgery,
Cognitive Brain Mapping Group,
& Neuroscience Institute *2000-present*

SUNY Upstate Medical University *1997-2000*
Syracuse, New York
Associate Professor of Neurosurgery & Physiology
Department of Neurosurgery

SUNY Upstate Medical University *1993-2000*
Syracuse, New York

Director, Neurosurgery Research Laboratories

Syracuse University *1992-2000*
Syracuse, New York
Assistant Adjunct Professor
Institute for Sensory Research

SUNY Health Science Center at Syracuse *1991-1998*
Syracuse, New York
Director, Computational Neuroscience Program

SUNY Health Science Center at Syracuse *1989-1996*
Syracuse, New York
Assistant Professor of Neurosurgery & Physiology
Department of Neurosurgery

SUNY Health Science Center at Syracuse *1979-1988*
Syracuse, New York
Research Associate
Department of Neurosurgery

Additional professional activities

NIH Peer Review Panels *1999-*
Site visit to NIH *1997*
Site visit to NIH *1996*
Site Visit to Chapel Hill *1992*
NSF Grant Review(s) *1989 & 1993*
Journal Review(s): Journal of Neurophysiology
Journal of Neuroscience Methods
Pain
Pain Forum
Cerebral Cortex
Journal of Comparative Neurology
Journal of Neuroscience
Somatosensory and Motor Research
Journal of Anesthesiology
Neuroscience Letters
NeuroImage
Journal of Pain
European Journal of Pain

Professional memberships

Society for Neuroscience
American Pain Society

International Association for the Study of Pain
North American Cervicogenic Headache Society
International Brain Research Organization
American Physiological Society

Languages: English, French, Arabic, Armenian

Honors and Awards

Alexander Von Humboldt-Stiftung Fellowship
Eta Kappa Nu, Electrical Engineering Honor Society
Armenian General Benevolent Union Scholarship (twice)
Armenian Educational Foundation Scholarship

Grants

Pending. Principal Investigator, NIH R01 Grant, renewal for 2003-2008
Cortical Pathophysiology of Pain - \$1,250,000

Pending. Principal Investigator, NIH R01 Grant
Cortical Dynamics for Pain Perception in Behaving Rats - \$ 1,125,000

2002-2003 Principal Investigator, Endo Pharmaceuticals
Brain Imaging of Lidoderm therapy for Post Herpetic Neuropathy - \$52,416

1999-2003 Principal Investigator, NINDS 2R01 Grant
Cortical Pathophysiology of Pain - \$575,803

2002-2003 Principal Investigator. Private Donation for Cancer Pain Research - \$15,000.

1996-1999 Principal Investigator, NINDS 1R01 Grant
Cortical Pathophysiology of Pain - \$547,107

1999-2000 Coordinator, PRAXIS/P/SAU/10179/1998, Porto, Portugal.
Nociceptive coding by neuronal ensembles in the spinal cord - \$47,000

1998. Principal Investigator, T32MH19736 Grant
1993-1998 NIMH Training Grant in Computational Neuroscience - \$906,094

1993-1996 Co-Principal Investigator NIMH 1R01 Grant
Noise and Encoding of Sensory Information - \$196,790

1993-1995 Principal Investigator Fogarty NIH Fellowship
Central Processing of Somatic and Visceral Pain - \$28,600

1993-1995 Research Grant from Headache Clinic in Toronto, Canada

The Role of the Upper Cervical Spinal Cord in Pain Reception and its Relation to Headaches - \$20,000

1989-1990 Principal Investigator Hendricks Grant 2S07RR0540229 - \$25,000

1986-1989 Co-Principal Investigator NINCDS Grant NS22891
The Dorsolateral Spinothalamic Tract - \$359,146

Advisees

Scott I. Gingold	7/89-6/91	Residency Research Training	Neurosurgeon
Mark W. Jones	7/88-6/90	Residency Research Training	Neurosurgeon
Mark V. Smith	7/89-6/91	Residency Research Training	Neurosurgeon
Robert J. Martin	7/89-6/91	Residency Research Training	Neurosurgeon
R. Anthony Stea	7/92/6/94	Residency Research Training	Neurosurgeon
Johannes Brüggemann	6/91-12/95	Post-doctoral Training	Faculty HSC
Ting Shi	9/90-10/96	Graduate Student	Ph.D.
Michael Fonte	9/96- 8/98	Graduate Student	M.D. Ph.D.
Vasco Galhardo	9/97-10/01	Graduate Student	Ph.D., Faculty Porto Med Sch
Chandra Ivey	6/95-7/97	Graduate Student	M.S.
Patricia Gelnar	7/92-7/97	Graduate Student	M.D. Ph.D.
Reshma Kumar	7/99-10/00	Graduate Student	
John Yu	7/99-10/00	Graduate Student	
Tara Ramachandran	7/99-8/00	Graduate Student	M.D.
Youngsoo Kim	1/00-present	Graduate Student	
Grachev Igor	7/98-7/00	Post-doctoral Training	Industry

High School Students:

Riddhi Patel, Tom Souhlas 10/00-6/01

Publications

1. Apkarian, A.V., Sosa Y., Krauss B., Thomas, P.S., Frederickson, B.E., Levy R.E., Harden R.N., Chialvo D.R., Chronic pain impairs decision-making. PNAS (2002) submitted.
2. Galhardo, V., Apkarian, A.V., Lima, D., Peripheral inflammation increases functional coherency of spinal responses to tactile but not nociceptive stimulation. J. Neurophysiol. (2002) 88: 2096-2103.
3. Saade, N.E., Baliki, M., El-Khoury, C., Hawwa, N., Atweh, S.F., Apkarian, A.V., Jabbur, S.J., The role of the dorsal column in neuropathic behavior: evidence for plasticity and non specificity. J. Neuroscience (2001) submitted.
4. Khan, S.A., Apkarian A.V., Mastalgia and breast cancer: A protective association? Cancer Detec. Prev. (2002) 26(3): 192-196.

5. Khan, S.A., Apkarian, A.V., The characteristics of cyclical and non-cyclical mastalgia: a prospective study using a modified McGill Pain Questionnaire. *Breast Cancer Res. Treat.* (2002) 75(2): 147-157.
6. Grachev, I.D., Fredericksen B.E., and Apkarian, A.V. Brain chemistry reflects dual states of pain and anxiety in chronic low back pain. *J. Neural Transmission* (2002) 109: 15-33.
7. Apkarian, A.V., Thomas, S., Krauss, B.R. and Szeverenyi, N.M., Prefrontal hyperactivity in sympathetically mediated chronic pain. *Neuroscience Letters* (2001) 311:193-197.
8. Grachev, I.D. and Apkarian, A.V., Chemical network of the living human brain. Evidence of reorganization with aging. *Cognitive Brain Research* (2001) 11:185-197.
9. Apkarian, A.V., Krauss, B.R., Frederickson, B.E. and Szeverenyi, N.M., Imaging the pain of low back pain: Functional MRI in combination with monitoring subjective pain perception allows the study of clinical pain-states. *Neurosci. Letters* (2001) 299:57-60.
10. Grachev, I.D., Swarnkar A., Szeverenyi, N.M, Ramachandran, T.S., and Apkarian, A.V., Aging alters the multichemical networking profile of the human brain: an *in vivo* ¹H-MRS study of young versus middle-aged subjects. *J. of Neurochemistry* (2001) 77:292-303.
11. Brüggemann, J., Galhardo, V. and Apkarian, A.V., Immediate reorganization of the rat somatosensory thalamus following peripheral partial nerve ligation. *J. of Pain* (2001) 2:220-228.
12. Grachev, I.D., Fredrickson, B.E., Apkarian, A.V., Dissociating anxiety from pain. Mapping neuronal marker N-acetyl-aspartate to perception distinguishes closely interrelated characteristics of chronic pain. *Molecular Psychol.* (2001) 6:256-260.
13. Grachev, I.D. and Apkarian, A.V., Aging alters regional multichemical profile of the human brain: an *in vivo* ¹H MRS study of young versus middle-aged subjects. *J. of Neurochemistry* (2001) 76:582-593.
14. Grachev, I.D. and Apkarian, A.V., Chemical heterogeneity of the living human brain: a proton MR spectroscopy study on the effects of sex, age, and brain region, *NeuroImage* (2000) 11:554-563.
15. Grachev, I.D. and Apkarian, A.V., Chemical mapping of anxiety in the brain of healthy humans: an *in vivo* ¹H MRS study on the effects of sex, age and brain region. *Human Brain Mapping* (2000) 11:261-272.
16. Grachev, I.D. and Apkarian, A.V., Anxiety in healthy humans is associated with orbital frontal chemistry. *Molecular Psychiatry* (2000) 5:482-488.
17. Apkarian, A.V., Grachev I.D., Krauss, B.R. and Szeverenyi, N.M., New directions for studying human brain pathophysiology of chronic pain states. *Disability* (2000) 9:17-23.
18. Treede, R.-D., Apkarian, A.V., Bromm, B., Greenspan, J.D., and Lenz, F.A., Cortical representation of pain: functional characterization of nociceptive areas near the lateral sulcus. *Pain* (2000) 87: 113-119.

19. Apkarian, A.V., Gelnar, P.A., Krauss, B.R. and Szeverenyi, N.M., Cortical responses to thermal pain depend upon stimulus size: an fMRI study. *J. Neurophysiology* (2000) 83: 3113-22.
20. Bolanowski, S.J., Maxfield, L.M., Gescheider, G.A. and Apkarian, A.V., The effects of stimulus location on the gating of touch by heat- and cold-induced pain, *Somatosens. And Motor Res.* (2000) 17:195-204.
21. Apkarian A.V., Shi T., Brüggemann J., and L.R. Airapetian, Segregation of nociceptive and non-nociceptive networks in the squirrel monkey somatosensory thalamus, *J. Neurophysiology* (2000) 84: 484-494.
22. Grachev, I.D., Fredericksen B.E., and Apkarian, A.V. Abnormal brain chemistry in chronic back pain: an *in vivo* proton magnetic resonance spectroscopy study. *Pain* (2000) 89:7-18.
23. Apkarian, A.V., Functional magnetic resonance of pain consciousness: cortical networks of pain critically depend on what is implied by "pain". *Current Review of Pain* (1999) 3:308-315.
24. Apkarian, A.V., In search of pain consciousness or pain and the metaphysics of a Porsche 911. In: Saadé, N.E., Apkarian, A.V. and Jabbur, S.J. (Eds.), "Pain and Neuroimmune Interactions", Kluwer Academic/Plenum Publishers, New York, 2000, pp. 193-208.
25. Brüggemann, J., Vahle-Hinz, C., Apkarian, A.V. and Kniffki, K-D., Somato- visceral convergence in thalamic regions of the cat, *J. Neurophysiol.* (1999) submitted.
26. Shahverdian, A. Yu. and Apkarian, A.V., On irregular behavior of neuron spike trains, *Fractals* (1999) 7(1): 93-103.
27. Gelnar, P.A., Krauss, B.R., Sheehe, P.R., Szeverenyi, N.M. And Apkarian, A.V., Comparative fmri study of cortical representation for thermal painful, vibrotactile and motor performance tasks, *NeuroImage* (1999) 10: 460-482.
28. Apkarian, A.V., Darbar, A., Krauss, B.R., Gelnar, P.A. and Szeverenyi, N.M., Differentiating cortical areas related to pain perception from stimulus identification: temporal analysis of fMRI activity, *J. Neurophysiol.* (1999) 81:2956-2963.
29. Apkarian, A.V., Functional magnetic resonance imaging of pain consciousness: cortical networks of pain critically depend on what is implied by "pain", *Curr. Rev. Pain* (1999) 308-315.
30. Krauss, B. and Apkarian, A.V., Group average activation maps of functional MRI: methodology of identifying group brain areas activated during painful thermal stimuli, motor and vibrotactile tasks in humans, *Rivista di Neuroradiologia*, (1998) 11(suppl.2): 135-138.
31. Apkarian, A.V. and Brüggemann, J., Visceral and somatic pain: the gift that nobody wants and everybody needs, *Pain Forum*, (1998) 7(3): 126-128.
32. Ivey, C., Apkarian, A.V. and Chialvo, D.R., Noise-induced tuning curve changes in mechanoreceptors, *J. Neurophysiol.*, (1998) 79: 1879-1890.

33. Brüggemann, J., Shi, T. and Apkarian, A.V., Viscerosomatic interactions in the thalamic ventral posterolateral nucleus (VPL) of the squirrel monkey, *Brain Res.*, (1998) 787: 269-276.
34. Gelnar, P.A., Krauss, B.R., Szeverenyi, N.M. and Apkarian, A.V., Fingertip representation in the human somatosensory cortex: an fMRI study, *NeuroImage* (1998) 7:261-283.
35. Brüggemann, J., Shi, T. and Apkarian, A.V., Viscero-somatic neurons in the primary somatosensory cortex (SI) of the squirrel monkey, *Brain Res.* 756 (1997) 297-300.
36. Newman, H.M., Stevens, R.T. and Apkarian, A.V., Direct spinal projections to limbic and striatal areas: anterograde transport studies from the upper cervical spinal cord and the cervical enlargement in squirrel monkey and rat, *J.Comp.Neurol.* 365 (1996) 640-658.
37. Apkarian, A.V., Primary somatosensory cortex and pain, *Pain Forum* 5 (1996) 188-191.
38. Shi, T. and Apkarian, A.V., Morphology of thalamocortical neurons projecting to the primary somatosensory cortex and their relationship to spinothalamic terminals in the squirrel monkey, *J.Comp.Neurol.* 361 (1995) 1-24.
39. Apkarian, A.V., Functional imaging of pain: new insights regarding the role of the cerebral cortex in human pain perception, *Sem.Neurosci.* 7 (1995) 279-293.
40. Apkarian, A.V. and Shi, T., Squirrel monkey lateral thalamus: I. Somatic nociceptive neurons and their relation to spinothalamic terminals, *J.Neurosci.*(1994) 14:6779-6795.
41. Brüggemann, J., Shi, T. and Apkarian, A.V., Squirrel monkey lateral thalamus: II. Viscero-somatic convergent representation of urinary bladder, colon, and esophagus, *J.Neurosci.* (1994) 14:6796-6814.
42. Apkarian, A.V., Stea, R.A. and Bolanowski, S.J., Heat-induced pain diminishes vibrotactile perception: a touch gate, *Somatosen.Motor Res.*(1994)11:259-267.
43. Stevens, R.T., London, S.M. and Apkarian, A.V., Spinothalamocortical projections to the secondary somatosensory cortex (SII) in squirrel monkey, *Brain Res.* 631 (1993) 241-246.
44. Shi,T., Stevens, R.T., Tessier, J. and Apkarian, A.V., Spinothalamocortical inputs nonpreferentially innervate the superficial and deep cortical layers of SI, *Neurosci.Lett.* 160 (1993) 209-213.
45. Chialvo, D.R. and Apkarian, A.V., Modulated noisy biological dynamics: three examples, *J.Stat.Physics* 70 (1993) 375-391.
46. Krauss, B.R., Serog, B.J., Chialvo, D.R. and Apkarian, A.V., Dendritic complexity and the evolution of cerebellar Purkinje cells, *Fractals*, (1993) 95-102.
47. Stea, R.A. and Apkarian, A.V., Letter to the Editor, *TINS*, 15 (1992) 250-251.

48. Brandt, H.M. and Apkarian, A.V., Biotin-dextran: a sensitive anterograde tracer for neuroanatomic studies in rat and monkey, *J.Neurosci.Meth.* 45 (1992) 35-40.
49. Apkarian, A.V., Stea, R.A., Manglos, S.H., Szeverenyi, N.M., King, R.B. and Thomas, F.D., Persistent pain inhibits contralateral somatosensory cortical activity in humans, *Neurosci.Lett.* 140 (1992) 141-147.
50. Gingold, S.I., Greenspan, J.D. and Apkarian, A.V., Anatomic evidence of nociceptive inputs to primary somatosensory cortex: relationship between spinothalamic terminals and thalamocortical cells in squirrel monkeys, *J.Comp.Neurol.* 308 (1991) 467-490.
51. Smith, M.V., Apkarian, A.V. and Hodge, C.J., Jr., Somatosensory response properties of contralaterally projecting spinothalamic and non-spinothalamic neurons in the second cervical segment of the cat, *J.Neurophysiol.* 66 (1991) 83-102.
52. Smith, M.V. and Apkarian, A.V., Thalamically projecting cells of the lateral cervical nucleus in monkey, *Brain Res.* 555 (1991) 10-18.
53. Stevens, R.T., Apkarian, A.V. and Hodge, C.J., Jr., The location of spinothalamic axons within spinal cord white matter in cat and squirrel monkey, *Somatosen.Motor Res.* 8 (1991) 97-102.
54. Martin, R.J., Apkarian, A.V. and Hodge, C.J., Jr., Ventrolateral and dorsolateral ascending spinal cord pathway influence on thalamic nociception in cat, *J.Neurophysiol.* 64 (1990) 1400-1412.
55. Hodge, C.J., Jr. and Apkarian, A.V., The spinothalamic tract, *Crit.Rev Neurobiol.* 5 (1990) 363-397.
56. Apkarian, A.V. and Hodge, C.J., The primate spinothalamic pathways: I. A quantitative study of the cells of origin of the spinothalamic pathway, *J.Comp.Neurol.* 288 (1989) 447-473.
57. Apkarian, A.V. and Hodge, C.J., Primate spinothalamic pathways: II. The cells of origin of the dorsolateral and ventral spinothalamic pathways, *J.Comp.Neurol.* 288 (1989) 474-492.
58. Apkarian, A.V. and Hodge, C.J., Primate spinothalamic pathways: III. Thalamic terminations of the dorsolateral and ventral spinothalamic pathways, *J.Comp.Neurol.* 288 (1989) 493-511.
59. Apkarian, A.V., Jyväsjärvi, E., Kniffki, K-D., Mengel, M.K.C. and Stieffenhofer, A., Activation of carotid sinus baroreceptors reduces pain sensations evoked by electrical and cold stimulation of human teeth, *Proc.Finn.Dent.Soc.* 85 (1989) 409-413.
60. Apkarian, A.V., Hodge, C.J., Jr., Martin, R.J. and Stevens, R.T., A cryogenic device for reversibly blocking transmission through small regions of the spinal cord white matter, *J.Neurosci.Meth.* 29 (1989) 93-106.
61. Apkarian, A.V. and Hodge, C.J., A dorsolateral spinothalamic tract in macaque monkey, *Pain* 37 (1989) 323-333.
62. Stevens, R.T., Hodge, C.J., Jr. and Apkarian, A.V., Medial, intralaminar and lateral terminations of lumbar spinothalamic tract neurons: a fluorescent double-label study, *Somatosen.Motor Res.* 6 (1989) 285-308.

63. Apkarian, A.V., The primate spinothalamic pathways: cells of origin and terminations of the dorsolateral and ventral spinothalamic pathways in New World and Old World monkeys, (1988) Ph.D. Dissertation.
64. Jones, M.W., Apkarian, A.V., Stevens, R.T. and Hodge, C.J., Jr., The spinothalamic tract: an examination of the cells of origin of the dorsolateral and ventral spinothalamic pathways in cat and squirrel monkey, *J.Comp.Neurol.* 260 (1987) 349-361.
65. Hodge, C.J., Jr., Apkarian, A.V. and Stevens, R.T., Inhibition of dorsal horn cells by stimulation of Kölliker-Fuse nucleus, *J.Neurosurg.* 65 (1986) 825-833.
66. Stevens, R.T., Apkarian, A.V. and Hodge, C.J., Jr., Sources of catecholaminergic innervation of the trigeminal nucleus caudalis in cat, *Exp.Neurol.* 90 (1985) 215-223.
67. Stevens, R.T., Apkarian, A.V. and Hodge, C.J., Funicular course of catecholamine fibers innervating the lumbar spinal cord of the cat, *Brain Res.* 336 (1985) 243-251.
68. Jones, M.W., Hodge, C.J., Jr., Apkarian, A.V. and Stevens, R.T., A dorsolateral spinothalamic pathway in cat, *Brain Res.* 335 (1985) 188-193.
69. Apkarian, A.V., Stevens, R.T. and Hodge, C.J., Funicular location of ascending axons of lamina I cells, *Brain Res.* 334 (1985) 160-164.
70. Apkarian, A.V., Hodge, C.J., Stevens, R.T. and Franck, J.I., Lumbar dorsal root potentials elicited by stimulation of nucleus locus coeruleus, *Exp.Neurol.* 85 (1984) 202-208.
71. Hodge, C.J., Jr., Apkarian, A.V., Owen, M.P. and Hanson, B.S., Changes in the effects of stimulation of locus coeruleus and nucleus raphe magnus following dorsal rhizotomy, *Brain Res.* 288 (1983) 325-329.
72. Hodge, C.J., Apkarian, A.V., Stevens, R.T., Vogelsang, G.D., Brown, O.M. and Franck, J.I., Dorsolateral pontine inhibition of dorsal horn cell responses to cutaneous stimulation: lack of dependence on catecholaminergic systems in cat, *J.Neurophysiol.* 50 (1983) 1220-1235.
73. Stevens, R.T., Hodge, C.J., Jr. and Apkarian, A.V., Catecholamine varicosities in cat dorsal root ganglia and spinal ventral roots, *Brain Res.* 261 (1983) 151-154.
74. Apkarian, A.V., Hodge, C.J., Wisnicki, H.J. and Delatizky, J., A simple computerized neuroanatomical data collection system, *IEEE Trans.Biomed.Eng.* 30 (1983) 126-130.
75. Stevens, R.T., Hodge, C.J., Jr. and Apkarian, A.V., Kölliker-Fuse nucleus: the principal source of pontine catecholaminergic cells projecting to the lumbar spinal cord of cat, *Brain Res.* 239 (1982) 589-594.
76. Hodge, C.J., Jr., Apkarian, A.V., Stevens, R.T., Vogelsang, G.D. and Wisnicki, H.J., Locus coeruleus modulation of dorsal horn unit responses to cutaneous stimulation, *Brain Res.* 204 (1981) 415-420.

77. McNeal, D.R. and Apkarian, A.V., Analytical design of a cuff electrode, International Rehabilitation Conference, Dubrovnik, Yugoslavia, 1978.
78. Apkarian, A.V., A mathematical model to determine threshold in implantable electrodes, Master's Thesis, University of Southern California, 1978.

Journal Covers

1. The Journal of Comparative Neurology, October 9, 1995. Volume 361, Number 1.
2. Pain, May/June 1996. Volume 65, Numbers 1-2,3
3. NeuroImage, May 1998. Volume 7, Number 4

Books

1. Pain Mechanisms and Management, S.N. Ayrapetyan and A.V. Apkarian (Eds.), IOS Press, Amsterdam, The Netherlands, 1998, ISBN: 90 5199 306 4.
2. Pain and NeuroImmune Interactions, N.E. Saadé, A.V. Apkarian and S.J. Jabbur (Eds.), Kluwer Academic/Plenum Publishers, New York, 1999.

Book Chapters

1. Apkarian A.V., Grachev, I.D., Krauss B.R., and Szeverenyi N.M., Methods in imaging human brain pathophysiology of chronic pain. In: Methods in Pain Research, ed. L. Kruger, CRC press, 241-262, 2001.
2. Apkarian A.V., Grachev, I.D., Krauss B.R., and Szeverenyi N.M. Imaging brain pathophysiology of chronic CRPS pain. In: Complex Regional Pain Syndrome, ed. Harden, Janig, Baron, IASP Press 2001, in press.
3. Apkarian, A.V. Cortical pathophysiology of neuropathic pain: Human brain imaging studies and theories of neuropathic pain. In: Spinal Cord Injury Pain, ed. R. Yezierski, IASP Press 2001, in press.
4. Apkarian, A.V. and Shi, T., Thalamocortical connections of the cingulate and insula in relation to nociceptive inputs to the cortex. In: S.N. Ayrapetyan and A.V. Apkarian (Eds.) Pain Mechanisms and Management, IOS Press, Amsterdam, The Netherlands, 1998, pp. 212-220.
5. Apkarian, A.V., Pain perception and the role of thalamocortical inhibitory networks across organizational scales. In: S.N. Ayrapetyan and A.V. Apkarian (Eds.) Pain Mechanisms and Management, IOS Press, Amsterdam, The Netherlands, 1998, pp. 228-236.
6. Apkarian, A.V., Thalamic anatomy and physiology of pain perception: connectivity, somato-visceral convergence and spatio-temporal dynamics of nociceptive information coding. In: J.M. Besson, G. Guilbaud and H. Ollat (Eds.), Forebrain Areas Involved in Pain Processing, John Libbey Eurotext, Paris, France, 1995, Chap. 7, pp. 93-118.
7. Apkarian, A.V., Brüggemann, J., Shi, T. and Airapetian, L.R., A Thalamic model for true and referred visceral pain. In: G.F. Gebhart (Ed.), Visceral Pain, IASP Press, 1995, Seattle, Chap. 10, pp. 217-259.
8. Hodge, C.J., Jr., Apkarian, A.V., Martini, S. and Martin, R.J., Lateral thalamic nociception: the effects of interruption of transmission through the ventrolateral and the dorsolateral spinothalamic tracts. In: L. Pubols

and B.J. Sessle (Eds.), Effects of Injury on Trigeminal and Spinal Somatosensory Systems, Alan R. Liss, Inc., New York, 1987, pp. 313-320.

Patents

"Interface for sound processing for cochlear implants in humans", by D.R. Chialvo and A.V. Apkarian. On file at the SUNY office of Technology Transfer, Albany, New York.

"Objective Measure of Chronic Pain State Using fMRI", By A.V. Apkarian and N.M. Szeverenyi. Patent awarded in July 1999.

"Objective Measure of Chronic Pain State Using MR Spectroscopy", By A.V. Apkarian and I. Grachev. Patent pending, applied August 1999.

"Objective Measure of Anxiety Using MR Spectroscopy", By A.V. Apkarian and I. Grachev. Patent pending, applied December 1999.

"A method for identifying breast cancer", By A.V. Apkarian and N.M.. Szeverenyi. Patent pending applied May 2000.

Organized Symposia

Computational Neuroscience Symposium with D. Pelli, November, 1992.

"Power Laws, Noise & Neural Code", Syracuse, New York

Neurofest '93, April 1993.

"Functional Neuroimaging of the Human Brain", Syracuse, New York

Computational Neuroscience Symposium with D. Pelli, April, 1994.

"Object Recognition", Syracuse, New York

Neurofest '94, Poster Session, April 1994. Syracuse, New York

Computational Neuroscience Symposium with D. Pelli, August, 1994.

"Computing with Noisy Neurons", Syracuse, New York

Computational Neuroscience Symposium with D. Pelli, February, 1995.

"Multineuronal Dynamics" Syracuse, New York

Computational Neuroscience Symposium with S. Bolanowski, March 1996.

"Imaging Pain: Science & Technology" Syracuse, New York

Neurofest '96, Poster Session, April 1996.

"Implantation or Ablation? New Surgical Treatments for Parkinson's Disease", Syracuse, New York.

Society for Promotion of Science and Technology in Karabagh, September, 1996.

"International Symposium on the Application of the Theory of Metabolic Regulation to Pain", Karabagh, Armenia

Computational Neuroscience Symposium with S. Bolanowski, April 1997.
"What Does the Brain Compute?", Syracuse, New York.

Neurofest '98 with R. Barlow, June 13, 1998.
"Imaging the Brain", Syracuse, New York.

Invited Talks

1. A cortical theory for chronic pain. University of western Ontario, London, Ontario, Canada, March 2002.
2. Non-Invasive brain imaging of chronic pain. Chicago Neuroscience Society, March 2001.
3. Brain imaging of chronic pain. Rehabilitation Institute of Chicago, September 2001.
4. Chronic neuropathic pain and brain imaging. Dor 200, Porto, Portugal, September 2000.
5. Brain imaging of chronic pain. BioMedical Engineering, Northwestern University June 2001.
6. Brain imaging of chronic pain, Cognitive Neurology and Alzheimer's Disease Center, Northwestern University, October 2001.
7. Brain imaging of chronic neuropathic pain conditions. International Association for the Study of Pain Symposium on Spinal Cord Injury, Phoenix, Arizona, March 2001.
8. Chronic pain and cortical dysfunction. German Pain Society Meeting, Hamburg, Germany, October 2000.

9. Prefrontal abnormalities in CRPS patients. International Association for the Study of Pain Symposium on CRPS, Cardiff Wales, October, 2000.

10. Prefrontal abnormalities in chronic pain. Symposium on Cortex and Pain. Second Spring Conference on Pain. Grand Cayman, BWI, May 2000.

11. Thalamocortical dynamics of interactions between the senses of touch and pain. Winter Conference on Brain Research, January 2000.

12. Current advances in diagnostic brain imaging tools for pain. The World Foundation for Pain Relief and Research, Inc. Current Concepts in Acute, Chronic, and Cancer Pain Management, New York, New York, December 1999.

13. Imaging pain consciousness. Neurology/Neurosurgery Grand Rounds, SUNY Health Science Center at Syracuse, September 1999.

14. The role of secondary somatosensory cortex in pain. 9th World Congress on Pain, Vienna, Austria, August, 1999.

15. Psychophysical, electrophysiological, and human brain imaging techniques exploring central representation for pain. Orbeli Institute of Physiology, Yerevan, Armenia, June 1999.

16. Functional imaging of clinical pains. Yerevan State University, Yerevan, Armenia, June 1999.

17. Stochastic Resonance and Touch Perception. Physics Institute of Yerevan, Armenia, June 1999.
18. Imaging Pain Consciousness. First International Neuroscience Meeting in Beirut, Lebanon, May 1999.
19. Dynamics of thalamic coding of noxious inputs. Pain Symposium, NIH, November, 1998.
20. Imaging the Brain in Pain with fMRI. Funktionelle Bildgebung bei Schmerz, Munich, Germany, September, 1998.
21. Technical issued regarding fMRI studies of pain. Johannes Gutenberg University, Mainz, Germany, September 1998.
22. Imaging the Brain in Pain. University of Minnesota, Minneapolis, Minnesota, July, 1998.
23. Stochastic Resonance and Mechanoreceptor Tuning Curves. First International Conference on Stochastic Resonance in Biological Systems, Arcidosso, Italy, May, 1998.
24. Cortical Pathophysiology of Pain: Functional Brain Imaging Studies. Chinese Association for the Study of Pain, Taipei, Taiwan, March 1997.
25. Dynamics of Nociceptive Information Transmission in the Thalamus. Neurology/Neurosurgery Grand Rounds, SUNY Health Science Center at Syracuse, February 1997.
26. Thalamocortical neural networks involved in pain perception: fMRI and electrophysiology. Neuroscience Seminar to College of Graduate Studies, SUNY Health Science Center at Syracuse, January 1997.
27. Representation of noxious stimuli and Pain in Thalamocortical Circuits: Electrophysiologic and Functional Imaging Studies. 3rd Meeting of the Portuguese Neuroscience Society, Porto, Portugal, December, 1996.
28. Symposium: Imaging Pain: Science & Technology, March, 1996. Syracuse, New York.
29. Symposium: Brain imaging of chronic pain, November, 1995. American Pain Society 14th Annual Scientific Meeting, Los Angeles, California.
30. Physiology and anatomy of cervicotrigenial relay, September, 1995. North American Cervicogenic Headache Conference, Toronto, Canada.
31. Thalamic and cortical mechanisms of pain, human brain imaging and multielectrode studies, August, 1995. Department of Psychology & Beckman Institute, University of Illinois, Urbana, Illinois.
32. Brain imaging of pain, July, 1995. Biophysics Center of the Armenian National Academy of Science, Yerevan, Armenia.

33. Reciprocal reversal of frontal and parietal cortical pain activations by blocking chronic RSD pain: an fMRI study, June, 1995. 1st International Conference on Functional Mapping of the Human Brain, Paris, France.
34. Dynamics of somatovisceral coding in thalamus, June, 1995. Physiologisches Institut der Universitat Wurzburg, Wurzburg, Germany.
35. Thalamocortical circuits involved in pain perception: physiologic and functional MRI studies, May, 1995. Dinard, France.
36. Thalamocortical circuits of pain, January, 1993. Hammersmith Hospital Cyclotron Unit, London, England.
37. Thalamocortical pain circuits and computational models of information processing in the brain, January, 1993. Armenian Academy of Science, Yerevan, Armenia.
38. Workshop: Physiologic and psychophysical measures of noise modulated signal, May, 1992. First Experimental CHAOS Conference, sponsored by the Office of Naval Research, West Palm Beach, Florida.
39. Symposium: Role of the upper cervical spinal cord in nociception, October, 1992. American Pain Society Meeting, San Diego, California.
40. Symposium: Thalamic mechanisms of nociception, October, 1992. Society for Neuroscience Meeting in Anaheim, California.
41. Workshop: The primate posterior somatosensory thalamus in relation to pain, February, 1992. Winter Conference on Brain Research (WCBR), Steamboat Springs, Colorado.
42. Thalamocortical pain pathways, April 1991. Institute for Sensory Research, Syracuse University, Syracuse, New York.
43. Changes in cortical regional blood flow following painful stimulation using SPECT and MRI, January, 1991. Radiology Research Seminar, SUNY Health Science Center, Syracuse, New York.
44. Function of ascending DLF fibers, March, 1990. International Association for the Study of Pain (IASP), Adelaide, Australia.
45. Primate spinothalamic tracts: cells of origin, thalamic terminations and cortical connectivity, October, 1989. The American Pain Society, Phoenix, Arizona.
46. Primate spinothalamic pathways, February, 1989. University of Erlangen, Erlangen, Federal Republic of Germany.
47. The dorsolateral spinothalamic pathway in cat and monkey, February, 1989. Physiologische Institut, University of Wurzburg, Wurzburg, Federal Republic of Germany.

48. Symposium on anatomical and functional characteristics of the spinothalamic tract, January, 1989. Winter Conference on Brain Research, Utah.
49. Workshop: Is the notion of specific pathways conveying specific functions moribund in the field of nociception? or, how to squeeze five functions into a dozen pathways, January, 1989. Winter conference on Brain Research, Utah.
50. Contemplating pain, February, 1988. Neurosurgery Department, SUNY Health Science Center, Syracuse, New York.
51. The primate spinothalamic pathway, December, 1988. INSERM, Paris, France.
52. Spinothalamic pathways in the primate, November, 1987. Neuroscience Meeting, New Orleans, Louisiana.
53. The dorsolateral spinothalamic tract: a new model for nociception, May, 1987. Neurobiology and Anesthesiology Branch of National Institutes of Health, Bethesda, Maryland.
54. The dorsolateral spinothalamic tract: a new model for nociception, May, 1987. Marine Biomedical Institute, University of Texas, Medical Branch, Galveston, Texas.
55. Symposium on nociceptive pathways, January, 1987. Winter Conference on Brain Research, Colorado.

Teaching

For 2001-2002:

1. "Biological Imaging: Principles and Applications" Course Director: Philip Hockberger (IGP-415 or BME 495).
2. "Topics in Cognitive Neuroscience" Course Director: Jim Houk (NUIN 499).
3. "Cognitive Neurology Seminar" Course Director: Dana Small.
4. "Neuroscience for Medical Students" Course Director: Jim Baker.

Abstracts

1. Apkarian A.V., Sonty S., Sosa Y., Harden N., Levy R.M., and Gitelman D.R. Decreased thalamic Gray Matter Density in Chronic Pain: Voxel-Based Brain Morphometry Comparison Between Chronic Low Back Pain Patients and Matched Normal Subjects. Proc. 8th Ann. Mtg. Organization for Human Brain Mapping, Sendai, Japan.

2. Apkarian A.V. and Grachev, I.D. Brain chemistry reflects dual states of pain and anxiety in chronic low back pain. Proc. 7th Ann. Mtg. Organization for Human Brain Mapping, Brighthon, England.
3. Grachev, I.D. and Apkarian, A.V. Chemical network of the human brain: evidence of reorganization with aging. Proc. 6th Ann. Mtg. Organization for Human Brain Mapping. San Antonio, TX, 2000.
4. Kumar, R., Grachev, I.D., and Apkarian, A.V., Relationship between cognitive performance and brain chemistry in chronic back pain. Soc. Neurosci. Abst. 26: (2000).
5. Apkarian, A.V. and Grachev, I.D., Chemical mapping of anxiety in the brain of healthy humans: an *in vivo* ¹H-MRS study on the effects of sex, age and brain region. Soc. Neurosci. Abst. 26: (2000).
6. Grachev, I.D., Fredrickson, B.E., and Apkarian, A.V., Dissociating pain from anxiety: an *in vivo* proton magnetic resonance spectroscopy study of chronic back pain. Soc. Neuroscience Abst. 26: (2000).
7. Apkarian, A.V., Lamarre, Y., Krauss, B.R. and Szeverenyi, N., Moving fingers without activating motor cortex: a fMRI study of motor performance in a functionally deafferented patient, Soc.Neurosci. Abst. 25: (1999).
8. Darbar, A., Szeverenyi, N.M. and Apkarian, A.V., Somatotopy of thermal pain: dependence on dominance and body part stimulated, Soc.Neurosci. Abst. 25: (1999).
9. Grachev, I.D., Fredrickson, B.E. and Apkarian, A.V., Chronic back pain is associated with abnormal brain chemistry: an *in vivo* proton magnetic resonance spectroscopy study of patients vs. normal subjects, Soc. Neurosci.Abst. 25: (1999).
10. Krauss, B.R., Grachev, I., Szeverenyi, N.M. and Apkarian, A.V., Imaging the pain of back pain, Soc.Neurosci.Abst. 25: (1999).
11. Apkarian, A.V., Darbar, A., Krauss, B.R., Gelnar, P., and Szeverenyi, N.M., In search of cortical areas related to conscious, subjective pain perception: temporal analysis of fMRI activations in a painful thermal task. Proc. 9th World Congress on Pain. Austria, Vienna, 1999.
12. Krauss, B.R., Darbar, A., Thomas, P.S., and Apkarian, A.V., Performance on a decision-making task in sympathetically mediated chronic pain (RSD CRPS I): evidence for cognitive impairment. Proc. 9th World Congress on Pain. Austria, Vienna, 1999.
13. Khan, S.A., Zych, L., and Apkarian, A.V., Breast Pain: Character, relation to diet and the presence of breast cancer. Proc. 9th World Congress on Pain. Austria, Vienna, 1999.
14. Grachev, I.D., Zych, L., Huckins, S., Fredrickson, B.E., Hodge, C.J., and Apkarian, A.V., Brain biochemical abnormalities in chronic back pain: an *in vivo* hydrogen magnetic resonance spectroscopy study. Proc. 9th World Congress on Pain. Austria, Vienna, 1999. P. 185.
15. Galhardo, V., Brüggemann, J., and Apkarian, A.V., Population dynamics in the somatosensory thalamus after partial ligation of the sciatic nerve in the rat, Soc.Neurosci.Abst. 24: (1998).

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21. Gelnar, P.A., Krauss, B., Szeverenyi, N.M. and Apkarian, A.V., Group average activation maps of brain areas activated during painful thermal stimuli, motor and vibrotactile tasks in humans, using multi-slice functional MRI, Amer.Soc.Neuro.Radiol., (1998).
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