

**NEUROLINGUISTICS AND COGNITIVE NEUROSCIENCE
(PSYCH 637 - SECTION 2)**

Instructor: Karin Stromswold

Time: Spring 1996, Mondays 4 pm - 6:40 pm

Place: Psychology Building (Busch), Room 301

Ways of reaching me: email to karin@rucss.rutgers.edu, phone (445-2448)

Content: This seminar will cover the neural bases of language. Topics will include:

- * the relationship between language development and neural development, including evidence from normal language acquisition
- * acquired and developmental language disorders
- * language acquisition outside the critical period.
- * the genetics of language disorders such as dyslexia, stuttering and developmental aphasia
- * recent research using functional brain imaging techniques (PET, ERP, MEG, and fMRI)

Open to: Graduate students with backgrounds in psychology, linguistics, philosophy, cognitive science or neuroscience. Others may enroll with special permission.

Requirements for everyone (including auditors):

¥ Attend class regularly and participate in class discussions

¥ Do each week's assigned readings (approx. 50- 100 pp/wk)

¥ To help focus and foster class discussion, prior to each class, students must submit at least one question about each of the week's assigned readings. I will try to incorporate students' questions into the class discussions.

Additional written requirement for people taking the course for credit:

Write one long paper (15-20 pp) **OR**

Write two medium-length papers (8-10 pp) **OR**

Write short (1-2 pp) commentaries on **each** week's readings

SCHEDULE

Unit 1: Neuroanatomy, Neurodevelopment & Neural Plasticity	
1/22	Introduction/Overview
1/29	Basic neuroanatomy and neurodevelopment
2/5	Normal development of language areas of the brain
2/12	Development of language abilities in the absence of experience
Unit 2: Language Disorders	
2/19	Acquired language disorders of childhood
2/26	Acquired language disorders of adulthood: Cognitive & linguistic studies of aphasia
3/4	Acquired language disorders of adulthood: Neural studies of aphasia
3/18	Specific Language Impairment, dyslexia and hyperlexia
3/25	Genetics of language and language disorders
Unit 3: Functional Neuroimaging Studies	
4/1	Cortical stimulation and recording studies
4/8	ERP studies
4/15	MEG studies
4/22	PET studies
4/29	fMRI studies

READING LIST

UNIT 1: NEUROANATOMY, NEURODEVELOPMENT & NEURAL PLASTICITY

Week 1 Introduction/Overview

Kandel, E. R. (1991). Brain and Behavior. In E. R. Kandel, J. H. Schwartz, & T. M. Jessell (Eds.), Principles of Neural Science, (3rd ed., pp. 5-17). New York: Elsevier Science Publishing Co., Inc.

Kandel, E. R. (1991). Nerve Cells and Behavior. In E. R. Kandel, J. H. Schwartz, & T. M. Jessell (Eds.), Principles of Neural Science, (3rd ed., pp. 18-32). New York: Elsevier Science Publishing Co., Inc.

Kertesz, A. (1994). Localization and Function: Old Issues Revisted and New Developments. In A. Kertesz (Ed.), Localization and Neuroimaging in Neuropsychology, (pp. 1-33). New York: Academic Press.

Week 2 Basic neuroanatomy & neurodevelopment

Jessell, T. M. (1991). Neuronal survival and synapse formation. In E. R. Kandel, J. H. Schwartz, & T. M. Jessell (Eds.), Principles of Neural Science, (3rd ed., ch 59, pp. 929-943). New York: Elsevier Science Publishing Co., Inc.

Kandel, E. R., & Jessell, T. (1991). Early experience and the fine tuning of synaptic connections. In E. R. Kandel, J. H. Schwartz, & T. M. Jessell (Eds.), Principles of Neural Science, (3rd ed., ch 60, pp. 945-958). New York: Elsevier Science Publishing Co., Inc.

Mayeux, R., & Kandel, E. R. (1991). Disorders of language: The aphasias. In E. R. Kandel, J. H. Schwartz, & T. M. Jessell (Eds.), Principles of Neural Science, (3rd ed., ch 54, pp. 839-851). New York: Elsevier Science Publishing Co., Inc.

[Optional -- Kandel, Schwartz and Jessel, chapters 57 & 58, pp. 887-929]

Week 3 Normal development of cortical language areas

Chi, J. G., Dooling, E. C., & Gilles, F. H. (1977). Left-right asymmetries of the temporal speech areas of the human brain. Archives of Neurology, *34*, 346-348.

Dehaene-Lambertz, G., & Dehaene, S. (1994). Speed and cerebral correlates of syllable discrimination in infants. Nature, *370*, 292-295.

Molfese, D. L., Wetzel, W. F., & Gill, L. A. (1993). Known versus Unknown Word Discrimination in 12-month Human Infants. Developmental Neuropsychology, *9*, 241-258.

Schmauder, A. R., & Bell, M. A. (1995). EEG, brain and language development: A case study. In D. MacLaughlin & S. McEwen (Eds.), Proceedings of the 19th Boston University Conference on Language Development, (Vol. 2, pp. 533-542). Somerville, MA: Cascadilla Press.

Simonds, R. J. & Scheibel, A. B. (1989). The postnatal development of the motor speech area: A preliminary study. Brain and Language, *37*, 42-58.

[Optional: Scheibel, A. B. (1984). A dendritic correlate of human speech. In N. Geschwind & A. M. Galaburda (Eds.), Cerebral Dominance: The Biological Foundations. (pp. 43-52). Cambridge, MA: Harvard University Press.]

Week 4: Language development in the absence of experience

Kilbourn, K. 1994. Learning a second language late: Second language acquisition in adults. In M.A. Gernsbacher (ed), Psycholinguistics. New York: Academic Press. p. 917-944.

Curtiss, S. (1988). Abnormal language acquisition and the modularity of language. In F. J. Newmeyer (Ed.), Linguistics: The Cambridge Survey Vol 2: Linguistic Theory, Extensions and Implications, (pp. 96-116). Cambridge: Cambridge University Press.

Newport, E. (1990). Maturation constraints on language learning. Cognitive Science, 14, 11-28.

Skuse, D. H. (1984b). Extreme deprivation in early childhood-II: Theoretical issues and a comparative review. Journal of Child Psychology and Psychiatry, 25, 543-572.

Week 5: Childhood brain injuries

Lenneberg, E. H. (1967). Biological Foundations of Language. chapter 4 New York: John Wiley & Sons.

Dennis, M. (1980). Capacity and strategy for syntactic comprehension after left or right hemidecortication. Brain and Language, 10, 287-317.

Feldman, H., Holland, A. L., Kemp, S. S., & Janosky, J. E. (1992). Language development after unilateral brain injury. Brain and Language, 42, 89-102.

Landau, W., Goldstein, R., & Kleffner, F. (1960). Congenital aphasia: A clinicopathologic study. Neurology, 10, 915-921.

Papanicolaou, A. C., DiScenna, A., Gillespie, L., & Aram, D. (1990). Probe-evoked potential finding following unilateral left-hemisphere lesions in children. Archives of Neurology, 47, 562-566.

Week 6 Adulthood aphasia Cognitive studies

Dronkers, N., & Pinker, S. (199x). Language and the Aphasias. In E. R. Kandel, T. M. Jessel, & J. H. Schwartz (Eds.), Principles of Neuroscience, (Fourth ed.,). New York: Elsevier.

Zurif, E. B. (1995). Brain regions of relevance to syntactic processing. In L. R. Gleitman & M. Liberman (Eds.), An Invitation to Cognitive Science, 2nd Edition: Language, (Vol. 1, pp. 381-397). Cambridge, MA: MIT Press.

Caplan, D. (1994). Language and the brain. In M. A. Gernsbacher (Ed.), Handbook of Psycholinguistics, (pp. 1023-1053). New York: Academic Press.

Week 7 Adulthood aphasia: Functional & neuroanatomic studies

Metter, E. J., & Hanson, W. R. (1994). Use of Positron Emission Tomography to Study Aphasia. In A. Kertesz (Ed.), Localization and Neuroimaging in Neuropsychology, (pp. 123-149). New York: Academic Press.

Metter, E. J., Kempler, D., Jackson, C., Hanson, W. R., Mazziotta, J. C., & Phelps, M. E. (1989). Cerebral glucose metabolism in Wernicke's, Broca's, and Conduction Aphasia. Archives of Neurology, 46, 27-34.

Mohr, J. P., Pessin, M. S., Finkelstein, S., Funkenstein, H. H., Duncan, G. W., & Davis, K. R. (1978). Broca aphasia: Pathologic and clinical. Neurology, 28, 311-324.

Poizner, H., & Kegl, J. (1992) Neural basis of language and motor behavior: Perspectives from American Sign Language. Aphasiology, 6, 219-256

Selnes, O. A., Knopman, D. S., Niccum, N., Rubens, A. B., & Larson, D. (1983). Computed Tomographic scan correlates of auditory comprehension deficits in aphasia: a prospective recovery study. Annals of Neurology, 13, 558-566.

Week 8 Specific language impairment, dyslexia, & hyperlexia

Everyone will read the following 2 articles:

Stromswold, K. in press. Specific language impairments. T. Feinberg and M. Farah, (eds.), *Behavioral neurology and neuropsychology*. New York: McGraw Hill.

Bellugi, U., Birchle, A., Neville, H., Jernigan, T., & Doherty, S. (1992). Language, cognition, and brain organization in a neurodevelopmental disorder. In M. Gunnar & C. Nelson (Eds.), Developmental Behavioral Neuroscience Hillsdale, NJ: Erlbaum Press.

Each student will be assigned 2 of the following articles

Hagman, J. O., Wood, F., Buchsbaum, M. S., Tallal, P., Flowers, L., & Katz, W. (1992). Cerebral brain metabolism in adult dyslexic subjects assessed with positron emission tomography during performance of an auditory task. Archives of Neurology, 49, 734-739.

Cohen, H., Gelinias, C., Lassonde, M., & Geoffroy, G. (1991). Auditory lateralization for speech in language-impaired children. Brain and Language, 41, 395-401.

Cohen, M., Campbell, R., & Yaghai, F. (1989). Neuropathological abnormalities in developmental dysphasia. Annals of Neurology, 25, 567-570.

Jernigan, T. L., Bellugi, U., Sowell, E., Doherty, S., & Hesselink, J. (1993). Cerebral morphological distinctions between Williams and Down Syndromes. Archives of Neurology, 50, 186-191.

Denays, R., Tondeur, M., Foulon, M., Verstraeten, F., Ham, H., Piepsz, A., & Noel, P. (1989). Regional brain blood flow in congenital dysphasia studies with technetium-99M HM-PAO SPECT. Journal of Nuclear Medicine, 30, 1825-1829.

Jernigan, T. L., Hesselink, J. R., Sowell, E., & Tallal, P. A. (1991). Cerebral structure on Magnetic Resonance Imaging in language impaired and learning-impaired children. Archives of Neurology, 48, 539-545.

Lou, H. D., Henriksen, L., & Bruhn, P. (1990). Focal cerebral dysfunction in developmental learning disabilities. Lancet, 335, 8-11.

Plante, E., Swisher, L., Vance, R., & Rapsak, S. (1991). MRI findings in boys with Specifically Language Impairment. Brain and Language, 41, 52-66.

Week 9: Genetics of language and language disorders

Stromswold, K. (1995,). The genetic basis of language acquisition. Paper presented at the The 20th Annual Boston University Conference on Language Development, Boston, MA.

Pinker, S., & Bloom, P. (1990). Natural language and natural selection. Behavioral and Brain Sciences, 13, 707-784.

Gopnik, M. (1990a). Feature-blind grammar and dysphasia. Nature, 344, 715.

Hurst, J. A., Baraitser, M., Auger, E., Graham, F., & Norell, S. (1990). An extended family with a dominantly inherited speech disorder. Developmental Medicine and Child Neurology, 32, 347-355.

Week 10: Cortical stimulation & recording

Lesser, R. P., Arroyo, S., Hart, J., & Gordon, B. (1994). Use of Subdural Electrodes for the Study of Language Functions. In A. Kertesz (Ed.), Localization and Neuroimaging in Neuropsychology, (pp. 57-72). New York: Academic Press.

Ojemann, G. A. (1994). Cortical Stimulation and Recording in Language. In A. Kertesz (Ed.), Localization and Neuroimaging in Neuropsychology, (pp. 35-55). New York: Academic Press.

Optional: Jacobs, B., Batal, H. A., Lynch, B., Ojemann, G., Ojemann, L. M., & Scheibel, A. B. (1993). Quantitative dendritic and spine analyses of speech cortices: A case study. Brain and Language, 44, 239-253.

Optional: Blair, R. C., & Karniski, W. (1994). Distribution-Free Statisticall Analyses of Surface and Volumetric Maps. In R. W. e. a. Thatcher (Ed.), Functional Neuroimaging: Technical Foundations, (pp. 19-28). New York: Academic Press.

Optional: Bookstein, F. L. (1994). Distribution-Free Statisticall Analyses of Surface and Volumetric Maps. In R. W. e. a. Thatcher (Ed.), Functional Neuroimaging: Technical Foundations, (pp. 107-119). New York: Academic Press.

Week 11: ERP

Gevins, A., Cutillo, B., DuRousseau, D., Le, J., Leong, H., & Smith, M. (1994). High-Resolution Evoked Potential Technology for Imaging Neural Networks of Cognition. In R. W. e. a. Thatcher (Ed.), Functional Neuroimaging: Technical Foundations, (pp. 223-231). New York: Academic Press.

Swick, D., Kutas, M., & Neville, H. J. (1994). Localizing the Neural Generators of Event-Related Brain Potentials. In A. Kertesz (Ed.), Localization and Neuroimaging in Neuropsychology, (pp. 73-121). New York: Academic Press.

Kutas, M., & Van Petten, C. K. (1994). Psycholinguistics Electrified: Event-Related Brain Potential Investigations. In M. A. Gernsbacher (Ed.), Handbook of Psycholinguistics, (pp. 83-143). New York: Academic Press.

Week 11: MEG

Rogers, R. L. (1994). Magnetoencephalographic Imaging of Cognitive Processes. In R. W. e. a. Thatcher (Ed.), Functional Neuroimaging: Technical Foundations, (pp. 289-297). New York: Academic Press.

Williamson, S. J., Lu, Z. L., Karron, D., & Kaufman, L. (1991). Advantages and limitations of magnetic source imaging. Brain Topography, 4 (2), 169-179.

Lu, Z. L., Williamson, S. J., & Kaufman, L. (1991). Human auditory primary and association cortex have differing lifetimes for activation traces. Brain Research, in press.

Phillips, C., Marantz, A., McGinnis, M., Pesetsky, D., Wexler, K., Yellin, E., Poeppel, D., Roberts, T., & Rowley, H. (1995). Brain mechanisms of speech perception: A preliminary report. MIT Working Papers in Linguistics, 26(153-191).

Week 13: PET

Chertkow, H., & Bub, D. (1994). Functional Activation and Cognition: The ^{15}O PET Subtraction Method. In A. Kertesz (Ed.), Localization and Neuroimaging in Neuropsychology, (pp. 151-184). New York: Academic Press.

Mazoyer, B. M., Dehaene, S., Tzourio, N., Murayama, N., Cohen, L., Levrier, O., Salamon, G., Syrota, A., & Mehler, J. (1993). The cortical representation of speech. Journal of Cognitive Neuroscience, *5*(4), 467-479.

Stromswold, K., Alpert, N., Rauch, S., & Caplan, D. (in press) Localization of Syntactic Processing Using Positron Emission Tomography. Brain and Language. (22 pages)

McGuire, P. K., Shah, G. M. S., & Murray, R. M. (1993). Increased blood flow in Broca's area during auditory hallucinations in schizophrenia. Lancet, *342*, 703-706.

Optional: Daghighian, F., Sumida, R., & Phelps, M. E. (1990). PET imaging: an overview and instrumentation. Journal of Nuclear Medicine Technology, *18* (1), 5-13.

Week 14 fMRI

Edelman, R. R., & Warach, S. (1993). Magnetic Resonance Imaging (Part 1). New England Journal of Medicine, *328*, 708-716.

Binder, J. R., & Rao, S. M. (1994). Human brain Mapping with Functional Magnetic Resonance Imaging. In A. Kertesz (Ed.), Localization and Neuroimaging in Neuropsychology, (pp. 185-212). New York: Academic Press.

McCarthy, G., Blamire, A. M., Rothman, D. L., Gruetter, R., & Shulman, R. G. (1993). Echo-planar magnetic resonance imaging studies of frontal cortex activation during word generation in humans. Proceedings of the National Academy of Sciences, *90*, 4952-4956.

Binder, J. R., Rao, S. M., Hammeke, T. A., Yetkin, F. Z., Jesmanowicz, A., Bandettini, P. A., Wong, E. C., Estkowski, L. D., Goldstein, M. D., Houghton, V. M., & Hyde, J. S. (1994). Functional magnetic resonance imaging of human auditory cortex. Source Annals of Neurology, *35*(6), 662-672.

Belliveau, J. W., Kennedy, D. N., McKinsty, R. C., Buchbinder, B. R., Weisskoff, R. M., Cohen, M. S., Vevea, J. M., Brady, T. J., & Rosen, B. R. (1991). Functional mapping of the human visual cortex by magnetic resonance imaging. Science, *254*, 716-720.