

Pasko Rakic

Degrees: MD (1960); PhD (1969) University of Belgrade, Former Yugoslavia

Position: Professor of Neuroscience and Neurology, Yale University School of Medicine

Research Interests: Developmental Neurobiology; Cellular and Molecular Mechanisms of Neuronal Proliferation, Migration, Axonal Navigation and Synaptogenesis; Genetic and Epigenetic Regulation of Neuronal Interactions during Development in Spontaneous and Induced Mutations; Neuropathology of Congenital Disorders; Brain Evolution.

Professional Experience:

1961-62 Resident in Neurosurgery, University Hospital, Belgrade

1962-66 Clinical and Research Fellow in Neurosurgery, Harvard Medical School, Boston

1967-69 Assistant Professor of Dev. Biology & Genetics, Biological Institute, Belgrade

1969-72 Assistant Professor of Neuropathology, Harvard Medical School, Boston

1972-78 Associate Professor of Neuropathology, Harvard Medical School

1978-01 Chairman, Section of Neurobiology, Yale University School of Medicine

2001-2015 Chairman, Department of Neurobiology, Yale University School of Medicine

2004-2015 Director, Kavli Institute for Neuroscience, Yale University

1978 - Dorys McConnell Duberg Chair in Neuroscience, Yale University

Honors and Awards:

Member: National Academy of Sciences (USA), 1985; American Academy of Arts and Sciences, 1994; National Institute of Medicine (USA), 1999; President, Cajal Club, 1992; Selby Fellow, Australian Academy of Science, 1983; President, Society for Neuroscience, 1996. **Foreign member:** Croatian Academy of Arts and Sciences, 1990; Serbian Academy of Arts and Sciences, 1985; Norwegian Academy of Science and Letters, 2008; Academia Europea, 2014; Royal Society London, 2016.

Awards: Inaugural (2008) Kavli Neuroscience Prize; Bristol-Myers Squibb Neuroscience Award, 2002; Gerard Prize, SFN, 2002; Pasarow Foundation Award, 2001; Marta Philipson Award, Stockholm 2000; Karl Spencer Lashley Award, Amer. Philosophical Society, 1986; Grass Foundation Award, 1985; Francois I Medal, College de France, 1986; Kreig Cortical Discoverer Award, 1989; F.O. Schmitt Medal, 1992; Fyssen International Science Prize, 1992; Weinstein-Goldenson Scientific Award (United Cerebral Palsy Foundation) 1994; Henry Gray Award, AAA, 1996; Javits Award, 1984-91, 1991-97; Krieg Lifetime Achievement Award shared with Paul Allen, 2010; Max Cowan Award, 2013; Sandy Palay Award, 2014; Child Mind Institute Award, NYC, 2014; Becker Award "Gesellschaft fuer Neuropaediatric" 2014.

Honorary degrees: MS, Yale University, 1978; Doctor Honoris Causa, Albert Sent-Georgyi University, Szeged (Hungary); Doctor Honoris Causa Universitatis Studiorum Zagrebiensis, 1997 (Croatia); Doctor Honoris Causa, University of Buenos Aires, 2011 (Argentina).

Eponymous Lectures: Jenkins Memorial (Oxford, UK); Ariens Kappers (Royal Netherlands Academy of Sciences); Gordon Holmes (London); Pickney Harmon (Cajal Club), Bernard Sacks (AAPN), Grass Foundtion (SFN); Yesup (Columbia Univ), Philip Bard (Johns Hopkins), Key Note Speaker (IBRO); Sally Harrington Goldwater; C.N.Woolsey (Madison); Ramon y Cajal lecture, Cajal Institute, Madrid; R.J. Terry (UWSL St. Louis); D.O. Hebb (Montreal); Cotzias (Am. Academy of Neurology);

Mountcastle (Johns Hopkins); Talarich Lecture (Toronto); Hunt-Wilson (AANS); Special Presidential Lecture (SFN); Storer Lecture UC Davis; Key Note Speaker (Soc. Genetic Psychiatry); Sherington Centennial (Oxford, UK); Key Note Speaker (Soc. Biological Psychiatry); James Arthur (Am. Museum of Natural History); Nobel Forum, Stockholm (Sweden); Sherington Centennial (Oxford, UK); Key-note at Soc. Biological Psychiatry; Janelia Farm (HHMI); E.G. Jones Memorial, UC Davis; Zach Hall, USC, Los Angeles, CA; Key-note, Swedish Society of Human Genetics, Uppsala, Sweden; Laureate Lecture, Pittsburgh, PA; Key-note, British Genetic Society, London, UK; Darwin's Centennial (Cambridge, UK); Numerous additional plenary and eponymous lectures in over 35 countries.

Professional Societies: American Association of Advancement of Science (Fellow); American Association of Anatomists; Association of Research in Vision and Ophthalmology, Cajal Club; International Brain Research Organization (IBRO); International Society for Developmental Neuroscience, International Society of Psychiatric Genetics, Neuroscience Research Program; Society for Neuroscience, American College of Neuropsychopharmacology (ACNP).

Editorial Boards: Advances in Neurology (1988-); Brain Research (1977-); Exp. Brain Res. (1977-); Glia (1988-2003); J. Cognitive Science (1988-2008); J. Comp. Neurology (1979-); J. Neurocytology (1975-98); J. Neuroscience (1981-90 and 1999-2004); Neuroscience (1973-); Neuroscience Research (1996-2001); Cerebral Cortex, Co-founder and Editor-in-Chief (1991-).

Advisory Activities: *Board Member:* Kuratorium, Max-Planck Institute, Germany, 1982-96; Councilor, Society for Neuroscience, 1980-84; United Nations Commission on Radiological Protection (ICRP), 1983; U.S. National Committee for IBRO, 1982-88, Chairman, 1988-92; British Neurological Research Trust, 1988-93; Board of Trustees, Neuroscience Institute, Rockefeller University (1988-91); Frontier Research Program, RIKEN, Tokyo, Japan, 1992-95; External Evaluation Committee, Max-Delbruck Center for Molecular Medicine, Berlin, Chairman, 1998; Advisory Board, National Alliance for Autism Research, 1994- ; March of Dimes Basil O'Connor Award Committee, 1994-1999; AAAS Biological Sciences Committee, 1997-2000; Hyseq Inc., Sunnyvale, 1988-2001; Wright Foundation, Geneva, Paterson Medical Foundation, 2006-; 1996-99; Board, Mutagenesis Center, Jackson Laboratory Bar Harbor, 1999-2004;; Wolfson Neurology Initiative, 2011; Allan Institute for Brain Science, Seattle, WA 2013-2015; Reseach Council, Brain and Behavior Research Foundation, 2006-present National Institute of Biological Sciences, Beijing, China. 2007-; Croatian Brain Institute, 1995-present

NIH Study Sections: Neurology A, 1978-82; Visual Sciences B, 1984-88; NIH Special Foreign Currency Grants, 1972-78; Special Consultant NIH Program Project Review Section, 1977; Advisor to NIDA, Grant Review Panel, 1975-77; Technical Review Panel on Neuroscience, NIDA-ADAMHA, 1979; NIMH Panel on Neural Development, 1993; NIH/SCR/DBD, 2014.

Consultant for: National Science Foundation; Atomic Energy Control Board (Canada); Canadian Medical Research Council; The March of Dimes Foundation; J.S. Guggenheim Memorial Foundation; Huntington Chorea Foundation; Human Frontier Foundation; Brain & Behavior Research Foundation-NARSAD; Allen Institute for Brain Science, Seattle WA

Grants: Principal Investigator: Regeneration of the CNS (1974-77); Neuropathology of Congenital Disorders; Human Frontier Research Grant (1990-93); Director, Javits Center of Excellence in Neuroscience (1985-90); Program Project on Developmental Neurobiology of Neocortex (1982-2003); Stress Activated Protein Kinase in Neuronal Apoptosis (1999-2009); Notch Signaling in the Brain (2001-2011); Neurogenetic Processes in Fetal Brain (1970-2016); Prenatal Development of the Visual System (1977-present); Origin of Species-specific Cortical Distinctions (2008-present).

Organizer of international symposia: Local Circuit Neurons (1975); Development and Modifiability of the Neocortex (1981); Determinants of Neuronal Connections (1983); Principles of Neuronal Migration (1984); Brain Beyond Genes (1986); Developmental Determinants of Pattern Formation (1987); Dahlem

Conference on Neurobiology of Neocortex (1987); Functions of Glia (1989); Specification of Cerebral Cortex (1991); Domains of Vision (1996); Genetic Factors Controlling Forebrain Development (2000); Prefrontal Cortex, Working Memory, Flexible Behavior', in memoriam of Patricia S. Goldman-Rakic (2006); FENS-Development and Plasticity of Cortical Representation (2011).

Teaching Experience: Core Neuroscience Course, Harvard (1970-77); Development of the CNS, Harvard (1970-77); Advanced Human Neuroscience, Harvard (1970-77); Neuroscience Course, Stanford (1976); Principles of Development, Belgrade Univ. (1971-73). Principles of Neurobiology (Cold Spring Harbor, 1977); Development of the Nervous System (Cold Spring Harbor, 1978-86); Molecular Neurobiology of Human Diseases (Cold Spring Harbor, 1988, 1989); Neurobiology (MBL, Woods Hole, 1978); Immunogenetics (Cold Spring Harbor, 1976); Advanced Study Institute Summer Schools, Crete (Greece, 1978, 1997), Varenna (Italy, 1981, 1991), Porto (Portugal, 1982); International School of Biophysics, Erice (Italy, 1985), Trieste (Italy, 1986, 1988, 1990, 2001); Review and Update in Neurobiology (MBL, Woods Hole, 1984-94); IBRO Summer School, Zadar (Croatia, 2005); Development of the CNS, Yale (1979-1994); Basic Neurosciences, Yale (1985, 1987); Brain and Mind, Yale (2003-) Director of the Neuroscience Core Curriculum Course, Yale (1978-2010); Mentor for Ph.D. Neurobiology and Neuroscience students at Harvard and Yale Universities.

Graduate Students (GS) and Postdoctoral Fellows (PF) selected from over 50, seven of which became Chairs of Departments or Directors of Institutes:

Richard Nowakowski, GS, Professor & Chairman, Dept. Neurobiology. UF Tallahassee, FL
Carla Shatz, PF, Professor and Director Bio-X Stanford University, Palo Alto, CA
Ivica Kostovic, PF, Director, Croatian Brain Institute, University of Zagreb, Croatia
Pat Levitt, PF, Professor, University of Southern California, Los Angeles, CA
Anthony La Mantia, GS, Professor & Chairman Neuroscience Inst., GWU, Washington, DC
Nada Zecevic, GS, Professor, University of Connecticut, Farmington, CT
Jean-Pierre Bourgeois, PF, Researcher CNRS, Pasteur Institute, Paris, France
Rodrigo Kuljis, PF, Professor and Chair of Neurology, University of Miami, Miami, FL
Robert Williams, PF, Chair, Computational Genomics, UT-Oak Ridge National Laboratory
Douglas Meinecke, PF, Chief, Developmental Neuroscience Program, NIMH, Bethesda, MD
Richard Cameron, PF, Associate Professor, Medical College of Georgia, Augusta, GA
Hitoshi Komuro, PF, Associate Professor, Cleveland Clinic Foundation, Cleveland, OH
Eva Anton, PF, Professor, Univ North Carolina Chapel Hill, NC
Maria Donoghue, PF, Associate Professor, Georgetown Univ. Washington, DC
Chia-Yi (Alex) Kuan, GS; PF, Professor, Emory University, Atlanta GA
Tarik Hydar, PF, Professor, Boston University, Boston, MA
Nenad Sestan, GS: PF, Professor, Yale University, New Haven, CT
Skirmantas Janusonis, PF, Associate Professor, UC Santa Barbara, CA
Matthew Sarkisian, PF, Assistant Professor, University of Florida, Gainesville, FL
Alvaro Duque PF, Research Scientist, Yale University, New Haven, CT
Albert Ayoub, PF, Research Scientist, Yale University, New Haven, CT
Jon Arrelano, PF, Research Scientist, Yale University, New Haven, CT
Yury Morozov, PF, Research Scientist, Yale University, New Haven, CT
Masaaki Torri, PF, Assistant Professor, George Washington University, Washington, DC
Joshua Breunig, GS, PF, Assistant Professor, Cedars-Sinai MC, Los Angeles, CA
Kazue Hashimoto-Torii, PF, Assistant Professor GWU, Washington, DC
Brian, Rash, PF, Associate Research Scientist, Yale University, New Haven, CT
Martin Dominguez, MD, PhD, Resident, Columbia Univeristy, New York, NY
Jamie Benoit, GS, Research Fellow. MIT. Boston, MA

SCIENTIFIC PUBLICATIONS

Biometrics (as of March, 2016): Citations: 59,856; h-index 123; i10 index 336

From Google Scholar: <https://scholar.google.com/citations?user=WNEBDpQAAAAJ&hl=en>

List of all original works (chronologically):

- Divac I, Rakic P, Mihailovic LJ. 1965 Inhibition and caudate nucleus. *Yugoslav Physiol. Pharmacol. Acta* 1: 79-86
- Hamlin H, Rakic P, Yakovlev PI. 1965 Stereotactic imprecision. *Confin. Neurol.* 26: 426-436
- Rakic P. 1965 Mesocoelic recess in the human brain. *Neurol.* 15: 708-7157
- Rakic P. 1968 Studies on the proliferation, migration, and differentiation of neuroblasts during neurohistogenesis in mammals, particularly man. Thesis for Sc.D. degree (in Serbo-Croatian), Belgrade, 191 pages
- Rakic P, Yakovlev PI. 1968 Development of the corpus callosum and cavum septi in man. *J. Comp. Neurol.* 132: 45-72
- Rakic P, Sidman RL. 1968 Supravital DNA synthesis in the developing human and mouse brain. *J. Neuropath. Exp. Neurol.* 27: 246-276
- Rakic P, Sidman RL. 1968 Subcommissural organ and adjacent ependyma: autoradiographic study of their origin in the mouse brain. *Am. J. Anat.* 122: 317-335
- Rakic P, Sidman, RL. 1969 Telencephalic origin of pulvinar neurons in the fetal human brain. *Z. Anat. Entwickl.-Gesch.* 129: 53-82
- Rakic P, Sidman RL. 1970 Histogenesis of cortical layers in human cerebellum, particularly the lamina dissecans. *J. Comp. Neurol.* 139: 473-500
- Rakic P. 1971 Neuron-glia relationship during granule cell migration in developing cerebellar cortex. A Golgi and electronmicroscopic study in Macacus rhesus. *J. Comp. Neurol.* 141: 283-312
- Rakic P. 1971 Guidance of neurons migrating to the fetal monkey neocortex. *Brain Res.* 33:471-476
- Rakic P. 1972 Mode of cell migration to the superficial layers of fetal monkey neocortex. *J. Comp. Neurol.* 145: 61-84
- Rakic P. 1972 Extrinsic cytological determinants of basket and stellate cell dendritic pattern in cerebellar molecular layer. *J. Comp. Neurol.* 146: 335-354
- Rakic P, Sidman RL. 1973 Weaver mutant mouse cerebellum; defective neuronal migration secondary to specific abnormality of Bergmann glia. *Proc. Natl. Acad. Sci. (USA)* 70: 240-244
- Rakic P. 1973 Kinetics of proliferation and latency between final cell division and onset of differentiation of cerebellar stellate and basket neurons. *J. Comp. Neurol.* 147: 523-546
- Sidman RL, Rakic P. 1973 Neuronal migration with special reference to developing human brain: a review. *Brain Res.* 62: 1-35
- Rakic P, Sidman, RL. 1973 Sequence of developmental abnormalities leading to granule cell deficit in cerebellar cortex of weaver mutant mice. *J. Comp. Neurol.* 152: 103-132
- Rakic P, Sidman RL. 1973 Organization of cerebellar cortex secondary to deficit of granular cells in weaver mutant mice. *J. Comp. Neurol.* 152: 133-162

- Rakic P. 1974 Embryonic development of the LP-pulvinar complex in man. In: LP-pulvinar Complex. (Cooper IS, Riklan M, Rakic P. eds.) Charles C. Thomas, Springfield, pp. 3-25
- Nowakowski RS, Rakic P. 1974 Clearance rate of exogenous ^3H -thymidine from the plasma of pregnant rhesus monkeys. *Cell and Tissue Kinetics* 7: 189-194
- Rakic P. 1974 Neurons in the monkey visual cortex: Systematic relation between time of origin and eventual disposition. *Science* 183: 425-427
- Rakic P, Stensaas LJ, Sayre EP, Sidman RL. 1974 Computer-aided three-dimensional reconstruction and quantitative analysis of cells from serial electronmicroscopic montages of fetal monkey brain. *Nature* 250: 31-34
- Rakic P. 1974 Intrinsic and extrinsic factors influencing the shape of neurons and their assembly into neuronal circuits. In: Frontiers in Neurology and Neuroscience Research. (Seeman P. Brown GM. eds.) Toronto Univ. Press, pp. 112-132
- Sidman RL, Rakic P. 1974 Neuronal migrations in human brain development. In: Pre- and Post-Natal Development of the Human Brain. (Berenberg S, Caniaris M, Masse NP. eds.) *Modern Problems in Pediatrics* 13: 13-43
- Rakic P. 1975 Timing of major ontogenetic events in the visual cortex of the rhesus monkey. In: Brain Mechanisms in Mental Retardation. (Buchwald NA, Brazier M. eds.) Academic Press, New York, pp. 3-40
- Rakic P. 1975 Local circuit neurons. *Neuroscience Research Program Bulletin* 13: 1-399. Published as a book in 1976 by MIT Press, Cambridge, 161 pages
- Nowakowski RS, LaVail JH, Rakic P. 1975 The correlation of the time of origin of neurons with their axonal projection: The combined use of ^3H -thymidine autoradiography and horseradish peroxidase histochemistry. *Brain Res.* 99: 363-368
- Rakic P. 1975 Role of cell interaction in development of dendritic patterns. In: Physiology and Pathology of Dendrites. (Kreutzberg G. ed.) Raven Press, New York, Advances in Neurology 12: 117-134
- Rakic P. 1975 Cell migration and neuronal ectopias in the brain. In: Morphogenesis and Malformation of the Brain and Face. (Bergsma D. ed.) Birth Defects: Original Series. Vol. 9. Liss, New York, pp. 95-129
- Rakic P. 1975 Effects of local cellular environments on the differentiation of local circuit neurons. *Neuroscience Research Program Bulletin*. 13: 400-407
- Rakic P. 1976 Synaptic specificity in the cerebellar cortex: Study of anomalous circuits induced by a single gene mutation in mice. In: The Synapse. *Cold Spring Harbor Symposia on Quantitative Biology* 40: 333-346
- Zecevic N, Rakic P. 1976 Differentiation of Purkinje cells and their relationship to other components of developing cerebellar cortex in man. *J. Comp. Neurol.* 167: 27-48
- Rakic P. 1976 Prenatal genesis of connections subserving ocular dominance in the rhesus monkey. *Nature* 261: 467-471
- Rakic P. 1976 Differences in the time of origin and in eventual distribution of neurons in areas 17 and 18 of the visual cortex in the rhesus monkey. *Exp. Brain Res.* Suppl. 1: 244-248
- Divac I, LaVail JH, Rakic P, Winston K. 1977 Heterogeneous afferents to the inferior parietal lobule of the rhesus monkey revealed by retrograde transport method. *Brain Res.* 123: 197-207

- Rakic P. 1977 Genesis of the dorsal lateral geniculate nucleus in the rhesus monkey: site and time of origin, kinetics of proliferation, routes of migration and pattern of distribution of neurons. *J. Comp. Neurol.* 176: 23-52
- Rakic P. 1977 Prenatal development of the visual system in the rhesus monkey. *Phil. Trans. Roy. Soc. Lond. B.* 278: 245-260
- Rakic P. 1978 Neuronal migration and contact guidance in primate telencephalon. *Postgraduate Medical Journal* 54: 25-40
- Caviness VS, Jr, Rakic P. 1978 Mechanisms of cortical development: a view from mutations in mice. *Ann. Rev. Neurosci.* 1: 297-326.
- Lenn JN, Halfon N, Rakic P. 1978 Development of the interpeduncular nucleus in the midbrain of rhesus monkey and human. *Anat. Embryol.* 152: 273- 289
- Knyihar E, Csillik B, Rakic P. 1978 Transient synaptic contacts in the embryonic primate spinal cord. *Science* 202: 1206-1209
- Goldman PS, Rakic P. 1979 Impact of the outside world upon the developing primate brain. Perspective from neurobiology. *Bulletin of the Menninger Foundation* 43: 20-28
- Brand S, Rakic P. 1979 Genesis of the primate neostriatum: ³H-thymidine autoradiographic analysis of the time of neuron origin in the rhesus monkey. *Neuroscience* 4: 767-778
- Schmechel DE, Rakic P. 1979 A Golgi study of radial glial cells in developing monkey telencephalon. *Anat. Embryol.* 156: 115-152
- Rakic P. 1979 Genesis of visual connections in the rhesus monkey. In: Developmental Neurobiology of Vision. (Freeman R. ed.) Plenum, New York, pp. 249-260
- Nowakowski RS, Rakic P. 1979 Mode of migration of neurons to the hippocampus: A Golgi and electron microscopic analysis in fetal rhesus monkey. *J. Neurocytol.* 8: 697-71
- Rakic P. 1980 Genetic and epigenetic determinants of local neuronal circuits in the mammalian central nervous system. In: Neurosciences Fourth Study Program (Schmitt FO, Worden FG. eds.) MIT Press Cambridge, pp. 109-127
- Schmechel DE, Rakic, P 1979 Arrested proliferation of radial glial cells during midgestation in rhesus monkey. *Nature* 227: 303-305
- Levitt P, Rakic P. 1980 Immunoperoxidase localization of glial fibrillary acid protein in radial glial cells and astrocytes of the developing rhesus monkey brain. *J. Comp. Neurol.* 193: 815-840
- Kostovic I, Rakic P. 1980 Cytology and time of origin of interstitial neurons in the white matter in infant and adult human and monkey telencephalon. *J. Neurocytol.* 9: 219-242
- Brand S, Rakic P. 1980 Neurogenesis of the nucleus accumbens septi and neighboring septal nuclei in the rhesus monkey: a combined ³H-thymidine and electron microscopic study. *Neurosci.* 5: 2125-2138
- Rakic P. 1981 Developmental events leading to laminar and areal organization of the neocortex. In: The Organization of Cerebral Cortex (Schmitt FO, Worden FG, Adelman G, Dennis SG. eds.) MIT Press, Cambridge, pp. 7-28
- Rakic P, Nowakowski RS. 1981 Time of origin of neurons in the hippocampal region of the rhesus monkey. *J. Comp. Neurol.* 196: 99-124
- Nowakowski RS, Rakic P. 1981 Site of origin and route of migration in the hippocampal region of the rhesus monkey. *J. Comp. Neurol.* 196: 125-154

- Cooper J, Rakic P. 1981 Neurogenetic gradients in the superior and inferior colliculi of the rhesus monkey. *J. Comp. Neurol.* 202: 309-334
- Shatz CJ, Rakic P. 1981 The genesis of efferent connections from the visual cortex of the fetal rhesus monkey. *J. Comp. Neurol.* 196: 287-307
- Rakic P. 1981 Development of visual centers in the primate brain depends on binocular competition before birth. *Science* 214: 928-931
- Levitt P, Cooper ML, Rakic P. 1981 Coexistence of neuronal and glial precursor cells in the cerebral ventricular zone of the fetal monkey: An ultrastructural immunoperoxidase analysis. *J. Neurosci.* 1: 27-39
- Rakic P. 1981 Neuron-glial interaction during brain development. *Trends in Neuroscience* 4: 184-187
- Gould BB, Rakic P. 1981 The total number, time of origin and kinetics of proliferation of neurons comprising the deep cerebellar nuclei in the rhesus monkey. *Exp. Brain Res.* 44: 195-206
- Ogren MP, Rakic P. 1981 The prenatal development of the pulvinar in the monkey: ³H-thymidine autoradiographic and morphometric analyses. *Anat. Embryol.* 162: 1-20
- Rakic P. 1982 The role of neuronal-glial interaction during brain development. In: Neuronal-glial Cell Interrelationships. (Sears TA. ed.) Dahlem Konferenzen, Springer, Berlin, pp. 25-38
- Levitt P, Rakic P. 1982 The time of genesis, embryonic origin and differentiation of the brainstem monoamine neurons in the rhesus monkey. *Dev. Brain Res.* 4: 35-57
- Rakic P, Goldman-Rakic PS. 1982 Development and Modifiability of the Cerebral Cortex. (Edited volume for MIT Press, Cambridge, MA). *Neurosciences Res. Prog. Bull.* 20: 429-611
- Csillik B, Knyihar E, Rakic P. 1982 Transganglionic degenerative proliferation in the Rolando substance of the primate spinal cord: decoupling and restoration of synaptic connectivity in the central nervous system after peripheral nerve lesions. *Folia Morphologica (Csr)* 30: 189-194
- Strichartz GR, Aguayo AJ, Cowan WM, Distel H, Lim L, McKhann GM, Mugnaini E, Rakic P, Rickmann MJ, Spitzer NC, Webster H deF. 1982 Ontogeny. State of the art report. In: Neuron-glial Cell Interrelationships. (Sears TA, ed.) Springer, Berlin, pp. 93-114
- Sidman RL, Rakic P. 1982 Development of the human central nervous system. In: Histology and Histopathology of the Nervous System. (Haymaker W, Adams RD. eds.) CC. Thomas, pp. 3-145
- Knyihar-Csillik E, Csillik B, Rakic P. 1982 Ultrastructure of normal and degenerating glomerular terminals of dorsal root axons in the substantia gelatinosa of the rhesus monkey. *J. Comp. Neurol.* 210: 357-375
- Knyihar-Csillik E, Csillik B, Rakic, P. 1982 Preterminal synaptology of dorsal root glomerular terminals in the substantia gelatinosa of the spinal cord in the rhesus monkey. *J. Comp. Neurol.* 210: 376-399
- Rakic P. 1982 La migration neurale. In: Naissance du Cerveau. *Compte Rendi- Monaco* 4. Corps Medical Imp. Lafayette, pp. 13-18
- Rakic P. 1982 Early developmental events: cell lineages, acquisitions of neuronal positions, and areal and laminar development. *Neurosciences Res. Prog. Bull.* 20: 439-451
- Duffy CJ, Rakic P. 1983 Differentiation of granule cells in the dentate gyrus of the rhesus monkey: a quantitative Golgi study. *J. Comp. Neurol.* 214: 224-337
- Levitt P, Cooper ML, Rakic P. 1983 Early divergence and changing proportions of neuronal and glial precursor cells in the primate cerebral ventricular zone. *Dev. Biology* 96: 472-484

- Rakic P, Riley KP. 1983 Overproduction and elimination of retinal axons in the fetal rhesus monkey. *Science* 209: 1441-1444
- Rakic P, Riley KP. 1983 Regulation of axon numbers in the primate optic nerve by prenatal binocular competition. *Nature* 305: 135-137
- Rakic P. 1983 Geniculo-cortical connections in primates: Normal and experimentally altered development. *Progress in Brain Res.* 58: 393-404
- Cooper ML, Rakic P. 1983 Gradients of cellular maturation and synaptogenesis in the superior colliculus of the fetal rhesus monkey. *J. Comp. Neurol.* 215: 165-186
- Kostovic I, Rakic P. 1984 Development of prestriate visual projections in the monkey and human fetal cerebrum revealed by transient cholinesterase staining. *J. Neurosci.* 4: 25-42
- Rakic P. 1984 Emergence of neuronal and glial cell lineages in primate brain. In: Cellular and Molecular Biology of Neural Development. (Black IB. ed.) Plenum, New York, pp. 29-50
- Rakic P. 1984 Organizing principles for development of primate cerebral cortex. In: Organizing Principles for Brain Development. (Sharma S. ed.) Plenum, New York, pp. 21-48
- Goldman-Rakic PS, Rakic P. 1984 Experimental modification of gyral patterns. In: Cerebral Dominance: The Biological Foundation. (Geschwind N, Galaburda AM. eds.) Harvard University Press, Cambridge, MA, pp. 179-192
- Brand S, Rakic P. 1984 Cytodifferentiation and synaptogenesis in the neostriatum of the fetal and neonatal rhesus monkeys. *Anat. Embryol.* 169: 21-34
- Levitt PR, Rakic P, Goldman-Rakic PS. 1984 Region-specific distribution of catecholamine afferents in primate cerebral cortex: A fluorescence histochemical analysis. *J. Comp. Neurol.* 225: 1-14
- Eckenhoff MF, Rakic P. 1984 Radial organization of the hippocampal dentate gyrus: A Golgi, ultrastructural and immunohistochemical analysis in the developing rhesus monkey. *J. Comp. Neurol.* 223: 1-21
- Levitt P, Rakic P, de Camilli P, Greengard, P. 1984 Emergence of cyclic guanosine 3':5'-monophosphate-dependent protein kinase immunoreactivity in developing rhesus monkey cerebellum: Correlative immunocytochemical and electron microscopic analysis. *J. Neurosci.* 4: 2553-2564
- Rakic P. 1984 Defective cell-to-cell interactions as causations of brain malformations. In: Malformations of Development. Biological and Psychological Sources and Consequences. (Gollin ES, ed.) Academic Press, New York, pp. 239-285
- Rakic P. 1984 Neurogenesis in Primates. In: Nervous System Development and Repair. *Discussions in Neurosciences* 1: 43-48
- Levitt PR, Rakic P, Goldman-Rakic PS. 1984 Comparative assessment of monoamine afferents in mammalian cerebral cortex. In: Monoamine Innervation of Cerebral Cortex. (Descarries L, Reader P, Jasper H, eds.) Liss, New York, pp. 41-59
- Rakic P, Goldman-Rakic PS. 1985 Use of fetal neurosurgery for experimental studies of structural and functional brain development in nonhuman primates. In: Perinatal Neurology and Neurosurgery. (Thompson RA, Green JR, Johnsen SD, eds.) Spectrum, New York, pp. 1-15
- Rakic P. 1985 Mechanisms of neuronal migration in developing cerebellar cortex. In: Molecular Basis of Neural Development. (Edelman GE, Cowan WM, Gall E. eds.) Wiley and Sons, New York, pp. 139-160
- Rakic P. 1985 Limits of neurogenesis in primates. *Science* 227: 1054-1056

- Easter SS, Jr, Purves D, Rakic P, Spitzer NC. 1985 The changing view of neural specificity. *Science* 230: 507-511
- Williams RW, Rakic P. 1985 Dispersion of growing axons within the optic nerve of the embryonic monkey. *Proc. Natl. Acad. Sci. (USA)* 82: 3906-3910
- Rakic P. 1985 DNA synthesis and cell division in the adult primate brain. *Ann. N.Y. Acad. Sci.* 457: 193-211
- Vinters HV, Gatti RA, Rakic P. 1985 Sequence of cellular events in cerebellar ontogeny relevant to expression of neuronal abnormalities in ataxia-telangiectasia. In: Ataxia-Telangiectasia: Genetics, Neuropathology and Immunology of a Degenerative Disease of Childhood. (Gatti RA, Swift M. eds.) Liss, New York, pp. 233-255
- Rakic P. 1985 Contact regulation of neuronal migration. In: The Cell in Contact: Adhesions and Junctions as Morphogenetic Determinants. (Edelman GM, Thiery J-P. eds.) Wiley & Sons, New York, pp. 67-91
- Rakic P. 1985 Timing of determination of neuronal and glial progenitor cells in the primate brain. In: Frontiers in Physiological Research. (Garlick DG, Korner PI. eds.) Australian Academy of Science, Canberra, pp. 63-68
- Nishimura Y, Rakic P. 1985 Development of the rhesus monkey retina: I. Emergence of the inner plexiform layer and its synapses. *J. Comp. Neurol.* 241: 420-434
- Garcia-Segura LM, Rakic P. 1985 Differential distribution of intermembranous particles in the plasmalemma of the migrating cerebellar granule cells. *Dev. Brain Res.* 23: 145-149.
- Knyihar-Csillik E, Rakic P, Csillik B. 1985 Fine structure of growth cones in the upper dorsal horn of the adult primate spinal cord in the course of reactive synaptogenesis. *Cell Tissue Re.* 239: 633 641
- Nishimura Y, Schwartz ML, Rakic P. 1985 Localization of aminobutyric acid and glutamic acid decarboxylase in rhesus monkey retina. *Brain Res.* 359: 351-355
- Rakic P. 1986 Mechanism of ocular dominance segregation in the lateral geniculate nucleus: competitive elimination hypothesis. *Trends in Neuroscience* 9: 11-15
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