

CURRICULUM VITAE

Helga Ellen Kolb Ph.D.
7070 Pinebrook Rd.
Park City, Utah 84098

Date of Birth: 10/20/40
Place of Birth: Kettering, England
U. S. Citizen
Married to Richard A. Normann
Children: Stuart William Stanbury

Education

1961 B.Sc. Zoology, University of Bristol, England
1964 M.Sc. Physiology, University of Bristol, England
1971 Ph.D. Medicine, University of Bristol, England

Chronology of Employment

1961-66 Research Assistant, Institute of Ophthalmology, University of London, England
1966-66 Research Technologist, Kennedy-Galton Centre, Herts, England.
1966-71 Research Associate, Wilmer Institute, Johns Hopkins School of Medicine, Baltimore, Maryland.
1971-74 Visiting Associate in the Clinical Branch of the National Eye Institute, NIH, Bethesda, Maryland.
1974-78 Senior Staff Fellow in the Laboratory of Neurophysiology, National Institute of Neurological Disorders and Stroke, NIH, Bethesda, Maryland.
1978-79 Career appointment as a Research Biologist, Laboratory of Neurophysiology, NINDS, NIH, Bethesda, Maryland.
1979-87 Research Associate Professor, Department of Physiology, University of Utah School of Medicine, Salt Lake City, Utah.
1979-84 Research Associate Professor, Ophthalmology Department, University of Utah School of Medicine, Salt Lake City, Utah.
1987- Research Professor, Department of Physiology, University of Utah School of Medicine, Salt Lake City, Utah.
1984-93 Research Professor, Ophthalmology Department, University of Utah School of Medicine, Salt Lake City, Utah
1993- Professor, Ophthalmology Department, University of Utah, School of Medicine, Moran Eye Center, Salt Lake City, Utah
2004- Professor Emeritus, Department of Ophthalmology and Visual Science, University of Utah, John Moran Eye Center, Salt Lake City, Utah

Societies

American Association for the Advancement of Science
Association for Research in Vision and Ophthalmology
Society for Neuroscience
International Society for Eye Research

Advisory Committees

Visual Disorders Study Section, 1980-84

Vis A2 Study Section, 1988-89

NRSA fellowships committee Neurosciences 1989, 1990

Site visit to Anatomy Department, University of Wisconsin, Madison, 1980

Chairman, Electrophysiology Section, ARVO meeting 1980-82

Member Special Study Section, NIH, meeting in Seattle, Washington, 1985

University of Utah School of Medicine Tenure and Promotion Committee, 1987-89

University of Utah School of Medicine, Medical Student Admissions Committee, 1990-93

Neuroscience Graduate Admissions Committee, 1994-1999

Research Standing Committee, Moran Eye Center 1995-present

ARVO Awards Committee, 1997-2000

Helen Keller Prize Committee, 1996-present

Von Sallmann Prize Committee, 2001-present

Honors

1) 1981 Invited participant in 4th Taniguchi Symposium, Lake Biwa, Japan

2) 1988 Research to Prevent Blindness Senior Investigator Award

3) 1991 Invited keynote speaker at the Scandinavian Visual Science Meeting, Oslo, Norway

4) 1993 Recipient of the Proctor Award and Medal at the annual meeting of the Association for Research in Vision and Ophthalmology

5) 1993 Recipient of the Governor's Medal for Science and Technology, State of Utah.

6) 1997 Keynote speaker, Deutches Oftalmologische Gesellschaft (DOG) meeting, Berlin, Germany

7) 2000 Von Sallmann Award at the ICER meeting, Santa Fe, New Mexico

8) NIH's Director's Lecture, Pittman Lecture, May, 2002

Invited speaker

1975 3rd Symposium on the Structure of the Eye, Lake Yamanaka, Japan

1976 Symposium on "Neural Circuitry", ARVO Meeting, Sarasota, Florida

1980 Information Processing in the Retina, Vienna, Austria

1982 Fifth International Congress of Eye Research, Veldhoven, Holland

1982 Seventh Symposium on Ocular and Visual Development, Philadelphia

1982 Sixth International 1984 Congress of Eye Research, Alicante, Spain

1990 "Brian Boycott Symposium" Harvard

1990 Ninth International Congress of Eye Research, Helsinki, Finland

1993 31st Intermountain Junior Sciences and Humanities Symposium

1993 Proctor awardee and speaker, ARVO meeting, Sarasota, Florida

1993 "Basic and clinical perspectives in Vision Research: a celebration of the career of Hisako Ikeda" Sherrington School of Physiology, St. Thomas's Hospital, London, UK

1995 Institute of Ophthalmology, Moorfields Eye Hospital, London "Festschrift for Dr. G.B. Arden's retirement"

1996 JERMOV meeting, Montpellier, France

1997 Keynote speaker, Deutches Oftalmologische Gesellschaft (DOG) meeting, Berlin, Germany
1997 Institute of Ophthalmology, Moorfields Eye Hospital, London
2000 Neurosciences Institute, UC Santa Barbara Annual Meeting
2002 Gunter Niemeyer festschrift, Zurich, Switzerland
2002 Washington College, Maryland
2002 Institute of Ophthalmology, Beijing University, Beijing, China
2002 South Central University, Changsha, China
2002 University of Chonquin, Chonquin, China
2003 Neurobiology and Anatomy, University of Texas, Houston

Symposium organizer

Electrophysiology Special Symposium, ARVO, 1982 and editor of the proceedings of the Symposium in Vision Research, 1983
Seventh International Congress of Eye Research, Nagoya, Japan, 1986
Eighth International Congress of Eye Research, San Francisco, 1988
Tenth International Congress of Eye Research, Stresa, Italy, 1992
Part organizer in "Brian Boycott Symposium" Harvard, 1990 and coeditor of the festschrift proceedings published in 1991
Part organizer of the 65th birthday Festschrift meeting for John E. Dowling "Concepts and Challenges in Retinal Biology: A tribute to John E. Dowling, Woods Hole, August, 2000
Fifteenth International Congress of Eye Research, Geneva, Switzerland, 2002

Editorial Boards

Editorial Board, Vision Research, 1979-91
Editorial Board, Journal of Comparative Neurology, 1985-95
Editorial Board, Visual Neuroscience, 1987-91
Guest Editor often, Investigative Ophthalmology and Visual Science

Graduate Students completed their degrees

Gloria Guiloff PhD June 1992

Thesis committee member

Jeff Ives MS 1983
Rachel Wong PhD (Melbourne, Australia) 1985
Jeffrey Schall PhD 1986
Sandy Lehman PhD not completed 1990
Gloria Guiloff PhD 1992
Kirk Thomas PhD 1992
Yuen Liu PhD 1995
Horst Von Reckum PhD, 1998
Raquel Climent-Martinez, in progress

Postdoctoral fellows

Peter Ahnelt, Vienna, Austria
HouHua Wang, Shanghai, China
Josef Ammermüller, Munich, Germany
Jay Muller, Houston, Texas
Nicolas Cuenca, Alicante, Spain
Eduardo Fernandez, Alicante, Spain
Jill Crooks, Glasgow, Scotland
Li Zhang, Shanghai, China
JiaHui Yang, Tianjin, China
Ester Netzer, Haifa, Israel
Esther Zemel, Haifa, Israel
Yan Xiaoxin, Hunan, China
Deng Ping, Changsha, China

Graduate level students

Magdalena Garcia, Alicante, Spain
James Schouten, 2 year medical student U of Utah
Dan Liu, Neuroscience, U of Utah
Terry Chun, Biology, U of Utah
Gregory Anastasopoulos, Biology. U. of Utah
Raquel Climente, Neurosciences, Alicante, Spain

Invited Outside Lectures

Invited lectures at the following Institutions: Walter Reed Armed Forces Medical School, Bethesda, Duke University, North Carolina; Columbia University School of Medicine, New York; Jules Stein Eye Institute, UCLA; Hershey School of Medicine, Pennsylvania; National Eye Institute, Bethesda; Dept. of Ophthalmology, Montefiore Hospital, New York; Johns Hopkins School of Medicine, Baltimore; Retina Foundation, Boston; Harvard University, Department of Biology; Eye Research Institute, University of Portland; Baylor School of Medicine, Houston; Max Planck Institute, Bad Neuheim, Germany; Keio University, Tokyo, Japan; Neurosciences, University of Oldenburg, Germany; Ophthalmology Department, St. Thomas' Hospital, London, UK; Neuroscience, University of California, Santa Barbara; Physiology Dept., Technion, Haifa, Israel; UMIST, Optometry, Manchester, UK; Physiology, University of Minnesota, Minneapolis; Biomedical Engineering, Northwestern University, Evanston; Neurosciences, University of Alicante, Spain; Computer Science and Technology, University of Bonn, Germany; Ophthalmology and Neurosciences, U. Texas, Houston; Institute of Ophthalmology, Moorfields, London. Neurosciences Institute, UC Santa Barbara Annual Meeting, Keynote speaker, 2000.

Gave the following **courses or lectures** at University of Utah:

1) Neuroanatomy course for medical students.

- 2) Proseminar course in Physiology.
- 3) Neurosciences lecture series 1 lecture a year on the organization of the retina.
- 4) Neuroscience Methods course.
- 5) Ophthalmology Department grand rounds and annual Residents Day course.
- 6) Several lectures to the Department of Physiology Seminar series.
- 7) Bioengineering Department, 1983.
- 8) Sigma Chi Lecture, 1985
- 9) Keynote lecture at Intermountain Neuroscience Meeting, October, 1993.
- 10) Recent advances in Neuroscience, 1996

Grant support

- 1) Grant EY03323 "Neural circuitry of the vertebrate retina" P.I. Helga E. Kolb. Funding from 3/31/80-present. Total over the years \$2,500,000.
- 2) Grant EY04855 "Synaptic organization of the turtle retina" P.I. Helga E. Kolb. Funding from 31/7/83-present. Total over the years \$1,500,000.
- 3) 2PO1 NS07938 Program Project Grant to Department of Physiology, Salvatore Fidone P.I. "Chemical and ionic mechanisms in sensory transduction", Project 1, E.M. Lasater and H. Kolb co-P.I.s "Neurotransmitter modulation of second messenger systems in retinal ganglion cells and their effects on membrane properties" 1989-94.
- 4) United States-Israel Binational Science Foundation Research Grant 90-00461/2. Co-investigator with Prof. Ido Perlman. \$3000. 1992-1994.

PUBLICATIONS

1. Arden, G.B., Friedmann, A. and Kolb, H. 1962 Anticipation of chloroquine retinopathy. *The Lancet*, 1 : 1164-1165.
2. Arden, G.B. and Kolb, H. 1964 Electrophysiological investigation of retinal metabolic diseases: their range and application. *Exp. Eye Res.*, 3 : 334-347.
3. Kolb, H. and Galloway, N. 1964 Three cases of unilateral pigmentary degeneration. *Brit. J. Ophthalm.*, 48 : 471-479.
4. Maguire, A. and Kolb, H. 1964 The effect of a synthetic antimalarial (Amodiaquine) on the retina. *Brit. J. Derm.*, 76 : 471-474.
5. Arden, G.B. and Kolb, H. 1964 The effect of pressure blinding on dark adaptation. *J. Physiol.*, 175 : 39-40 P.
6. Kolb, H. 1965 Electro-oculogram findings in patients treated with antimalarial drugs. *Brit. J. Ophthalm.*, 49 : 573-590.
7. Blach, R., Jay, B. and Kolb, H. 1966 Electrical activity of the eye in high myopia. *Brit. J. Ophthalm.*, 50 : 629-641.
8. Arden, G.B. and Kolb, H. 1966 Antimalarial therapy and early retinal changes in patients with rheumatoid arthritis. *Brit. Med. J.*, 1 : 270-273.
9. Smith, G.F., Kolb, H. and Faunch, J.A. 1968 Spindle bridge and mid-body in cultured lymphocytes. *Blood*, 31 : 1975-1979.

10. Kolb, H., Boycott, B.B. and Dowling, J.E. 1969 A second type of midget bipolar cell in the primate retina. Appendix. Phil. Trans. Roy. Soc. (Lond) B, 255 : 177-184.
11. Kolb, H. 1970 Organization of the outer plexiform layer of the primate retina: Electron microscopy of Golgi-impregnated cells. Phil. Trans. Roy. Soc. (Lond) B, 258 : 261-283.
12. Hodgkinson, B.J. and Kolb, H. 1970 A preliminary study of the effect of chloroquine on the rat retina. Arch. Ophthalmol., 84 : 509-515.
13. Boycott, B.B. and Kolb, H. 1973 The connections between bipolar cells and photoreceptors in the retina of the domestic cat. J. Comp. Neurol. 148 : 91-114.
14. Boycott, B.B. and Kolb, H. 1973 The horizontal cells of the rhesus monkey retina. J. Comp. Neurol., 148 : 115-140.
15. Kolb, H. and Gouras, P. 1974 Electron microscopic observations of human retinitis pigmentosa: dominantly inherited. Invest. Ophthalmol., 13 : 487-498.
16. Kolb, H. 1974 The connections between the horizontal cells and photoreceptors in the retina of the cat: Electron microscopy of Golgi preparations. J. Comp. Neurol., 155 : 1-14.
17. Kolb, H. and Famiglietti, E.V. 1974 Rod and cone pathways in the inner plexiform layer of cat retina. Science, 186 : 47-49.
18. Famiglietti, E.V. and Kolb, H. 1975 A bistratified amacrine cell, its gap junctions and synaptic circuitry in the inner plexiform layer of cat retina. Brain Res., 84 : 293-300.
19. Nelson, R., v. Lutzow, A., Kolb, H. and Gouras, P. 1975 Horizontal cells in cat with independent dendritic systems. Science, 189 : 137-139.
20. Boycott, B.B., Dowling, J.E., Fisher, S.K., Kolb, H. and Laties, A.M. 1975 Interplexiform cells of the mammalian retina and their comparison with catecholamine-containing retinal cells. Proc. Roy. Soc. (Lond) B, 191 : 353-368.
21. Kolb, H., Famiglietti, E.V. and Nelson, R. 1976 Neural connections in the inner plexiform layer of the cat's retina. "The structure of the eye III." Published by Jap. J. Ophthalmol., (Eds. Yamada and Mishima), pp. 319-332.
22. Famiglietti, E.V. and Kolb, H. 1976 Structural basis for ON- and OFF center responses in retinal ganglion cells. Science, 194 : 193-195.
23. Kolb, H. and Famiglietti, E.V. 1976 Rod and cone pathways in the retina of the cat. Invest. Ophthalmol., 15 : 935-946.
24. Nelson, R., Kolb, H., Famiglietti, E.V. and Gouras, P. 1976 Neural responses in rod and cone systems of the cat retina: Intracellular records and Procion stains. Invest. Ophthalmol., 15 : 935-945.
25. Kolb, H. 1977 The organization of the outer plexiform layer in the retina of the cat: electron microscopic observations. J. Neurocytol., 6 : 131-153.
26. Kolb, H. and West, R. 1977 Synaptic connections of the interplexiform cell in the retina of the cat. J. Neurocytol., 6 : 155-170.
27. Kolb, H. and Famiglietti, E.V. 1977 Rod and cone pathways in the retina of the cat. Veterinary Digest.
28. Nelson, R., Famiglietti, E.V. and Kolb, H. 1978 Intracellular staining reveals different levels of stratification for on-center and off-center ganglion cells in the cat retina. J. Neurophysiol., 41 : 472-483.
29. Rosenthal, A.R., Kolb, H., Bergsma, D., Huxoll, D. and Hopkins, J.L. 1978 Chloroquine retinopathy in the rhesus monkey. J. Invest. Ophthalmol. and Vis. Sci., 47 : 1158-1175.

30. Kolb, H. 1979 The inner plexiform layer in the retina of the cat: electron microscopic observations. *J. Neurocytol.*, 8 : 295-329.
31. Normann, R. A, Kolb, H., Hanani, M., Pasino, E. and Holub, R. 1979 Orientation of horizontal cell axon terminals in the streak of the turtle retina. *Nature*, 280 : 60-62.
32. Kolb, H., Mariani, A. and Gallego, A. 1980 A second type of horizontal cell in the monkey retina. *J. Comp. Neurol.*, 189 : 31-44.
33. Kolb, H., Nelson, R. and Mariani, A. 1981 Amacrine cells, bipolar cells and ganglion cells of the cat retina: a Golgi study. *Vision Res.*, 21 : 1081-1114.
34. Kolb, H. and Nelson, R. 1981 Amacrine cells of the cat retina. *Vision Res.*, 21 : 1625-1633.
35. Nelson R., Kolb, H., Robinson, M.M. and Mariani, A.P. 1981 Neural circuitry of the cat retina: cone pathways to ganglion cells. *Vision Res.*, 21 : 1527-1536.
36. Normann, R. and Kolb, H. 1981 Anatomy and physiology of the horizontal cells of the visual streak region of the turtle retina. *Vision Res.*, 21 : 1585-1588.
37. Kolb, H. 1982 The morphology of the bipolar cells, amacrine cells and ganglion cells in the retina of the turtle, *Pseudemys scripta elegans*. *Phil. Trans. Roy. Soc. (Lond) B*, 298 : 355-393.
38. Kolb, H. and Jones, J. 1982 Light and electron microscopy of the photoreceptors in the retina of the red-eared slider, *Pseudemys scripta elegans*. *J. Comp. Neurol.*, 209 : 331-338.
39. Kolb, H. and Normann, R.A. 1982 A-type horizontal cells of the superior edge of the visual streak of the rabbit retina have oriented, elongated dendritic trees. *Vision Res.*, 22 : 905-916.
40. Kolb, H. and Nelson, R. 1983 Rod pathways in the retina of the cat. *Vision Res.*, 23 : 301-312.
41. Nelson, R. and Kolb, H. 1983 Synaptic patterns and response properties of bipolar and ganglion cells in the cat retina. *Vision Res.*, 23 : 1183-1195.
42. Kolb, H. 1983 Preface to the ARVO Electrophysiology Symposium "Neural interactions in the vertebrate retina". *Vision Res.*, 23 : 1139-1141.
43. Kolb, H. 1984 Cone pathways in the mammalian retina. In "Molecular and cellular basis of Visual Acuity". (Eds. Hilfer, S. R. and Sheffield, J. B.) Springer Verlag, pp 55-78.
44. Kolb, H. and Nelson, R. 1984 Neural architecture of the cat retina. In "Progress in Retinal Research". vol 3 (Eds. Osborne, N.N. and Chader, G.J.) Pergamon Press, pp 21-60.
45. Mariani, A. P., Kolb, H. and Nelson, R. 1984 Dopamine-containing amacrine cells of rhesus monkey retina parallel rods in spatial distribution. *Brain Res.*, 322 : 1-7.
46. Kolb, H. and Jones, J. 1984 Synaptic organization of the outer plexiform layer of the turtle retina: an electron microscope study of serial sections. *J. Neurocytol.*, 13 : 567-591.
47. Normann, R. A., Perlman, I., Kolb, H., Jones, J. and Daly, S. 1984 Direct excitatory interactions between cones of different spectral types in the turtle retina. *Science*, 224 : 625-627.
48. Nelson, R. and Kolb, H. 1984 Amacrine cells in scotopic vision. *Ophthalmic Res.*, 16 : 21-26.
49. Nelson, R. and Kolb, H. 1985 A17: A broad-field amacrine cell of the rod system in the retina of the cat. *J. Neurophysiol.*, 54 : 592-614.
50. Kolb, H. and Jones, J. 1985 Electron microscopy of Golgi-impregnated photoreceptors reveals connections between red and green cones in the turtle retina. *J. Neurophysiol.*, 54 : 304-317.

51. Kolb, H. and Wang, H. 1985 The distribution of photoreceptors, dopaminergic amacrine cells and ganglion cells in the retina of the North American opossum (*Didelphis virginia*). *Vision Res.*, 25 : 1207-1221.
52. Kolb, H. and Nelson, R. 1985 Functional neurocircuitry of amacrine cells in the cat retina. In "Neurocircuitry of the Retina: A Cajal memorial". (Eds. Gallego, A. and Gouras, P.), Elsevier Press, pp 215-232.
53. Nelson, R., Lynn, T., Dickinson-Nelson, A. and Kolb, H. 1985 Spectral mechanisms in cat horizontal cells. In "Neurocircuitry of the Retina: A Cajal memorial". (Eds. Gallego, A. and Gouras, P.), Elsevier Press, pp 109-121.
54. Normann, R. A., Perlman, I. and Kolb, H. 1985 Chromatic interactions between cones of differing spectral classes: anatomical and electrophysiological studies in turtle. In "Neurocircuitry of the Retina: A Cajal memorial". (Eds. Gallego, A. and Gouras, P.), Elsevier Press, pp 19-34.
55. Kolb, H., Wang, H. H. and Jones, J. 1986 Cone synapses with Golgi-stained bipolar cells that are morphologically similar to a center-hyperpolarizing and a center-depolarizing bipolar cell type in the turtle retina. *J. Comp. Neurol.*, 205 : 510-520.
56. Ahnelt, P. K., Kolb, H. and Pflug, R. 1987 Identification of a subtype of cone photoreceptor, likely to be blue sensitive, in the human retina. *J. Comp. Neurol.*, 255 : 18-34.
57. Kolb, H. and Jones, J. 1987 The distinction by light and electron microscopy of two types of cones containing colorless oil droplets in the retina of the turtle. *Vision Res.*, 27 : 1445-1458.
58. Kolb, H., Cline, C., Wang, H. H. and Brecha, N. 1987 Distribution and morphology of dopaminergic amacrine cells in the retina of the turtle (*Pseudemys scripta elegans*). *J. Neurocytol.*, 16 : 577-588.
59. Kolb, H., Perlman, I. and Normann, R. A. 1988 Neural organization of the retina of the turtle *Mauremys caspica*. *Visual Neurosci.*, 1 : 47-72.
60. Guiloff, G. D., Jones, J. and Kolb, H. 1988 Organization of the inner plexiform layer of the turtle retina: An electron microscope study. *J. Comp. Neurol.*, 272 : 280-292.
61. Lasater, E.M., Normann, R. A. and Kolb, H. 1989 Signal integration at the pedicle of turtle cone photoreceptors: an anatomical and electrophysiological study. *Vis. Neurosci.*, 2 : 553-564.
62. Cuenca, N., and Kolb, H. 1989 The morphology and distribution of neurons immunoreactive for substance P in the turtle retina. *J. Comp. Neurol.*, 290 : 391-411.
63. Ahnelt, P. K., Keri, C. and Kolb, H. 1990 Identification of pedicles of putative blue-sensitive cones in human retina. *J. Comp. Neurol.*, 243 : 39-53.
64. Ammermüller, J., Guiloff, G., Normann, R. A. and Kolb, H. 1990 A "puff and advance" technique for visually controlled staining of turtle ganglion cells. *J. Neuroscience Meth.*, 32 : 235-243.
65. Kolb, H., Cuenca, N., Wang, H.-H. and DeKorver, L. 1990 The synaptic organization of the dopaminergic amacrine cell in the cat retina. *J. Neurocytol.*, 19 : 343-366.
66. Wang, H.-H., Cuenca, N. and Kolb, H. 1990 The development of morphological types and distribution patterns of amacrine cells immunoreactive to tyrosine hydroxylase in the cat retina. *Vis. Neurosci.*, 4 : 159-175.
67. Cuenca, N., Fernandez, E. and Kolb, H. 1990 Distribution of immunoreactivity to protein kinase C in the turtle retina. *Brain Res.* 532 : 278-287.

68. Kolb, H. and Lipetz, L. 1991 The anatomical basis for colour vision in the vertebrate retina. In "Vision and Visual Dysfunction, vol. 7: The Perception of Colour". (Ed. Gouras, P.) The Macmillan Press Ltd. London, pp 128-1145.
69. Kolb, H. 1991 The neural organization of the human retina. In "Principles and Practice of Clinical Electrophysiology of Vision" (Eds. Heckenlively, J. R. and Arden, G. B.) Mosby Year-Book Inc. St. Louis, pp 25-52.
70. Kolb, H. and DeKorver, L. 1991 Midget ganglion cells of the parafovea of the human retina: A study by electron microscopy and serial section reconstructions. *J. Comp. Neurol.* 303 : 617-636.
71. Kolb, H. 1991 Anatomical pathways for color vision in the human retina. *Vis. Neurosci.* 7 : 61-74.
72. Muller, J. F., Ammermüller, J., Normann, R. A. and Kolb, H. 1991 Synaptic inputs to physiologically defined turtle retinal ganglion cells. *Vis. Neurosci.* 7 : 409-430.
73. Kolb, H., Cuenca, N. and DeKorver, L. 1991 Postembedding immunocytochemistry for GABA and glycine reveals the synaptic relationships of the dopaminergic amacrine cell of the cat retina. *J. Comp. Neurol.* 310 : 267-284.
74. Crooks, J. and Kolb, H. 1992 Localization of GABA, glycine, glutamate and tyrosine hydroxylase in the human retina. *J. Comp. Neurol.* 315 : 287-302.
75. Guiloff, G. D. and Kolb, H. 1992 Ganglion cell types of the turtle retina that project to the optic tectum: Intracellular HRP-injections of retrogradely, rhodamine-marked cell bodies. *Vis. Neurosci.* 8 : 295-313.
76. Kolb, H., Linberg, K. A. and Fisher, S. K. 1992 The neurons of the human retina: a Golgi study. *J. Comp. Neurol.* 318 : 147-187.
77. Guiloff, G. D. and Kolb, H. 1992 Neurons immunoreactive to choline acetyl transferase in the turtle retina. *Vision Res.*, 32 : 2023-2030.
78. Zhang, L., DeKorver, L. and Kolb, H. 1992 Immunocytochemical staining with antibodies against protein kinase C and its isozymes in the turtle retina. *J. Neurocytol.* 21: 833-847.
79. Djamgoz, M. B. A. and Kolb, H. 1993 Ultrastructural and functional connectivity of intracellularly stained neurones in the vertebrate retina: Correlative analyses. *J. Elect. Micr. Res. Techn.* 24 : 43-66.
80. Nelson, R., Kolb, H. and Freed, M. 1993 OFF-alpha and OFF-beta ganglion cells in cat retina. I. Intracellular electrophysiology and HRP stains. *J. Comp. Neurol.*, 329: 68-84.
81. Kolb, H. and Nelson, R. 1992 OFF-alpha and OFF-beta ganglion cells in cat retina. II. Neural circuitry as revealed by electron microscopy of HRP stains. *J. Comp. Neurol.*, 329: 85-110.
82. Kolb, H., Zhang, L. and DeKorver, L. 1993 Differential staining of neurons in the human retina with antibodies to protein kinase C isozymes. *Vis. Neurosci.*, 10: 341-351.
83. Fernandez, E. and Kolb, H. 1993 A method for selective intracellular labeling of immunostained neurons in turtle retina. *J. Histochem. Cytochem.*, 41: 635-641.
84. Fernandez, E., Eldred, W. D., Ammermüller, J., Block, A., von Bloh, W. and Kolb, H. 1994 Complexity and scaling properties of amacrine, ganglion, horizontal and bipolar cells in the turtle retina. *J. Comp. Neurol.*, 347: 397-408.
85. Ahnelt, P. and Kolb, H. 1994a Horizontal cells and cone photoreceptors in primate retina: A Golgi-Light microscope study of spectral connectivity. *J. Comp. Neurol.*, 343: 387-405.

86. Ahnelt, P. and Kolb, H. 1994b Horizontal cells and cone photoreceptors in primate retina: A Golgi-Electron microscope study of spectral connectivity. *J. Comp. Neurol.*, 343: 406-427.
87. Kolb, H., Fernandez, E., Schouten, J., Ahnelt, P., Linberg, K. A. and Fisher, S. K. 1994 Are there three types of horizontal cell in the human retina? *J. Comp. Neurol.*, 343: 370-386.
88. Kolb, H. 1994 The architecture of functional neural pathways in the vertebrate retina. Proctor Award Lecture. *Invest. Ophthalm. Vis. Sci.*, 35: 2385-2404.
89. Guiloff, G. and Kolb, H. 1994 Ultrastructural and immunocytochemical analysis of the circuitry of two putative direction selective ganglion cells in the turtle retina. *J. Comp. Neurol.*, 347: 321-339.
90. Goede, P. and Kolb, H. 1994 Identification of the synaptic pedicles belonging to the different spectral types of photoreceptor in the turtle retina. *Vision Res.*, 34: 2801-2811
91. Kolb, H. 1994 The organization of the mammalian retina - a videotape presentation. In the Publication in Honor of the John A. Moran Eye Center Opening, June 1993. pp. 31-40.
92. Ahnelt, P. and Kolb, H. 1995 Short-wavelength-specific cones: Morphology and color-specific connections. In "Color Vision Deficiencies XII" (Ed. B. Drum), Kluwer Academic Publishers, Dordrecht, Boston, London.
93. Ammermüller, J., and Kolb, H. 1995 The organization of the turtle inner retina. I. The organization of ON and OFF-center pathways. *J. Comp. Neurol.*, 358: 1-34.
94. Ammermüller, J., Muller, J. and Kolb, H. 1995 The organization of the turtle inner retina. II. Color and motion detection. *J. Comp. Neurol.*, 358: 35-62.
95. Kolb, H. and Nelson, R. 1995 The organization of photoreceptor to bipolar synapses in the outer plexiform layer of the vertebrate retina. In "Neurobiology and Clinical Aspects of the Outer Retina" (Eds. M.B.A. Djamgoz, S.N. Archer and S. Vallergera), Chapman-Hall. pp. 273-296.
96. Cuenca, J. DeJuan and Kolb, H. 1995 Substance P immunoreactive neurons in the human retina. *J. Comp. Neurol.*, 356: 491-504.
97. Freed, M.A., Pflug, R., Kolb, H. and Nelson, R. 1996 ON-OFF amacrine cells in the cat retina. *J. Comp. Neurol.*, 364: 556-566.
98. Goede, P. and Kolb, H. 1995 Three dimensional reconstruction and surface rendering of cone pedicles in the turtle retina. *J. Neurosci. Meth.*, 62: 83-88.
99. Kolb, H., Fernandez, E., Ammermüller, J. and Cuenca, N. 1995 Substance P: A neurotransmitter of amacrine and ganglion cells in the vertebrate retina. *Histol. and Histopath.*, 10: 947-968.
100. Kolb, H. 1995 The architecture of functional neural circuits in the cat retina. In "Basic and clinical perspectives in vision research-a celebration of the career of Hisako Ikeda. (Robbins, J.G., Djamgoz, M.B.A. and Taylor, A. Eds), Plenum Press, New York London, U.K. pp. 37-51.
101. Ammermüller, J. and Kolb, H. 1996 Functional architecture of the turtle retina. *Prog. in Retinal & Eye Res.* 15 : 393-433.
102. Rungger, E., Kolb, H. and Niemeyer, G. 1996 Histochemical demonstration of glycogen in neurons of the cat retina. *Invest. Ophthalm. Vis. Sci.* 37: 702-715.
103. Kolb, H. and Nelson, R. 1996 Hyperpolarizing, small-field amacrine cells in cone pathways of cat retina. *J. Comp. Neurol.* 371: 415-436.
104. Kolb, H. and Zhang, L. 1997 Immunostaining with antibodies against protein kinase C isoforms in the fovea of the monkey retina. *Microscopy Res. Techn.* 36: 57-75.

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