

# CURRICULUM VITAE

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**NAME**                    **Daniel Axelrod**

**TITLE**                    Professor Emeritus of Physics  
Research Scientist Emeritus of Biophysics  
University of Michigan, Ann Arbor

**BIRTH**                    March 15, 1948, Brooklyn, NY

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## EDUCATION

	<i>Institution and location</i>	<i>Degree</i>	<i>Field</i>
1968	Brooklyn College of City Univ.of NY (Brooklyn, NY)	B.S.	Physics and Math
1974	University of California, Berkeley (Berkeley, CA) Ph.D. thesis title: Optical study of metal ion-nerve interactions.	Ph.D.	Physics (Biophysics)

## POSITIONS and DATES

1970-1974    Research Assistant, Laboratory of Chemical Biodynamics (group of Melvin Klein and Melvin Calvin), University of California, Berkeley.

1974-1977    NIH Postdoctoral Fellow, Section on Neurobiology and Behavior, and School of Applied and Engineering Physics (group of W.W. Webb), Cornell University (Ithaca).

1977-1981    Assistant Professor, Dept. of Physics and Assistant Research Scientist, Biophysics Research Division, Univ. of Michigan (Ann Arbor).

1981-1987    Associate Professor, Dept. of Physics and Associate Research Scientist, Biophysics Research Division, Univ. of Michigan (Ann Arbor),.

1987-2005    Professor, Dept. of Physics and Research Scientist, Biophysics Research Division, Univ. of Michigan (Ann Arbor).

2005-present    Professor Emeritus, Dept. of Physics and Research Scientist Emeritus, LSA Biophysics, Univ. of Michigan (Ann Arbor).

2012-present    Professor Emeritus in Service of Pharmacology, Univ. of Michigan Medical School (Ann Arbor)

## **PROFESSIONAL and CONSULTING SERVICE**

1984, 1985, 1990, 1998, 2000	Special site visit/review panels for the Natl. Inst. of Health
1991-1997	Associate Editor of Journal of Fluorescence
1992	Chair of Amer. Chem. Soc. Mtg. session
1994-5	Planning Committee, Satellite Conference on Reversible Reactions in Biology, Bethesda, 1996
1994-7	Planning Committee, International Conference on Fluorescence Microscopy and Probes, Prague, 1995 and 1997
2001	Member Natl. Research Council "Bio2010 Panel on Physics and Engineering"
2004-2008	NSF EPSCoR (Experimental Program To Stimulate Competitive Research), Sensors Advisory Board, University of Nevada
2002-2013	Short-term consulting for Callida Genomics, Apple (Advanced Computing Group); Pacific Biosciences; Cornell University/HHMI, University of Nevada, Olympus Microscope Co., and patent law firms.
2005-2009	Consultant, Nikon Instrument Company.
2005-2012	Lecturer in microscopy courses at Stanford University, Lewis and Clark University, University of British Columbia, Marine Biological Laboratory (Wood's Hole)
2012	Recorded lecture for online UCSF "iBiology" lecture series.
1977-present	Total of 147 invited scientific talks at national and international sites.

## **HONORS AND AWARDS**

1968	Theodore Smits Award (for outstanding Physics major, Brooklyn College, CUNY)
1974	NIH Postdoctoral Fellowship
1997	Year of Humanities and the Arts Award (for development of Univ. Michigan "Physics of Music" course)
1999	Fellow of the Biophysical Society (elected in the founding year of the Fellows Program, for "pioneering research that helped develop the field of TIRF microscopy")
1999	Univ. of Michigan, Literature, Science, and Arts College Excellence in Education Award
2009	Invention of TIRF microscopy listed by Nature Mag as one of 25 "mileposts" in the history of microscopy.
2010	Gregorio Weber Award for "excellence in fluorescence theory and application", selected by the Biological Fluorescence subgroup of the Biophysical Society

## PAPERS in REFEREED JOURNALS

1. Sutherland, J.C., Axelrod, D., and Klein, M.P. 1971. Zeeman effect in porphyrins: zero-field splitting of the excited electronic states. *J. Chem. Phys.* 54:2888-2898.
2. Axelrod, D. and Klein, M.P. 1974. Fluorescent Ca<sup>2+</sup> analogs in nerve: rare-earth ions. *Biochem. Biophys. Res. Comm.* 57:927-933.
3. Schlessinger, J., Koppel, D.E., Axelrod, D., Jacobson, K., Webb, W.W., and Elson, E.L. 1976. Lateral transport on cell membranes: the mobility of concanavalin A receptors on myoblasts. *Proc. Natl. Acad. Sci (USA)* 73:2409-2413.
4. Axelrod, D., Koppel, D.E., Schlessinger, J., Elson, E.L., and Webb, W.W. 1976. Mobility measurements by analysis of fluorescence photobleaching recovery kinetics. *Biophys. J.* 16:1055-1069.
5. Koppel, D.E., Axelrod, D., Schlessinger, J., Elson, E.L., and Webb, W.W. 1976. Dynamics of fluorescence marker concentration as a probe of mobility. *Biophys. J.* 16:1315-1329.
6. Schlessinger, J., Axelrod, D., Koppel, D.E., Elson, E.L., and Webb, W.W. 1977. Lateral transport of a lipid probe and labeled proteins on a cell membrane. *Science* 195:307-309.
7. Axelrod, D., Ravdin, P., Koppel, D.E., Schlessinger, J., Webb, W.W., Elson, E.L., and Podleski, T.R. 1976. Lateral motion of fluorescently labeled acetylcholine receptors in membranes of developing muscle fibers. *Proc. Natl. Acad. Sci. (USA)* 73:4594-4598.
8. Axelrod, D. 1977. Cell surface heating during fluorescence photobleaching recovery experiments. *Biophys. J.* 18:129-131.
9. Ravdin, P. and Axelrod, D. 1977. Fluorescent tetramethyl rhodamine derivatives of  $\alpha$ -bungarotoxin: preparation, separation, and characterization. *Anal. Biochem.* 80:585-592; and erratum, 83:336.
10. Axelrod, D., Wight, A., Webb, W.W., and Horwitz, A. 1978. Influence of membrane lipids on acetylcholine receptor and lipid probe diffusion in cultured myotube membrane. *Biochemistry* 17:3604-3609.
11. Axelrod, D., Ravdin, P., Podleski, T.R. 1978. Control of acetylcholine receptor mobility and distribution in cultured myotube membranes: a fluorescence study. *Biochim. Biophys. Acta* 511:23-38.
12. Podleski, T.R., Axelrod, D., Ravdin, P., Greenberg, I., Johnson, M.M., and Salpeter, M.M. 1978. Nerve extract induces increase and redistribution of acetylcholine receptors on cloned muscle cells. *Proc. Natl. Acad. Sci. (USA)* 75:2035-2039.

13. Axelrod, D. 1979. Carbocyanine dye orientation in red cell membrane studied by microscopic fluorescence polarization. *Biophys. J.* 26:557-574.
14. Thompson, N.L. and Axelrod, D. 1980. Reduced lateral mobility of a fluorescent lipid probe in cholesterol-depleted erythrocyte membrane. *Biochim. Biophys. Acta* 597:155-165.
15. Schwartz, M., Axelrod, D., Feldman, E.L., and Agranoff, B.W. 1980. Histological localization of binding sites of  $\alpha$ -bungarotoxin and of antibodies specific to acetylcholine receptor in goldfish optic nerve. *Brain Res.* 194:171-180.
16. Axelrod, D. 1980. Crosslinkage and visualization of acetylcholine receptors on myotubes with biotinylated  $\alpha$ -bungarotoxin and fluorescent avidin. *Proc. Natl. Acad. Sci (USA)* 78:4823-4827.
17. Thompson, N.L., Burghardt, T.P., and Axelrod, D. 1981. Measuring surface dynamics of biomolecules by total internal reflection with photobleaching recovery or correlation spectroscopy. *Biophys. J.* 33:435-454.
18. Burghardt, T.P. and Axelrod, D. 1981. Total internal reflection/fluorescence photobleaching recovery study of serum albumin adsorption dynamics. *Biophys. J.* 33:455-468.
19. Axelrod, D., Bauer, H.C., Styra, M., Christian, C.N. 1981. A factor from neurons induces partial immobilization of nonclustered acetylcholine receptors on cultured muscle cells. *J. Cell Biol.* 88:459-462.
20. Axelrod, D. 1981. Zero cost modification of bright field microscopes for imaging phase gradients on cells: schlieren optics. *Cell Biophys.* 3:167-173.
21. Axelrod, D. 1981. Cell-substrate contacts illuminated by total internal reflection fluorescence. *J. Cell Biol.* 89:141-145.
22. Feldman, E.L., Axelrod, D., Schwartz, M., Heacock, A.M., and Agranoff, B.W. 1981. Studies of the localization of newly added membrane in growing neurites. *J. Neurobiol.* 12:591-598.
23. Axelrod, D., Thompson, N.L., and Burghardt, T.P. 1983. Total internal reflection fluorescence microscopy. *J. Microsc.* 129:19-28.
24. Axelrod, D. 1983. Lateral diffusion of membrane proteins and biological function. *J. Memb. Biol.* 75:1-10.
25. Styra, M. and Axelrod, D. 1983. Diffusely distributed acetylcholine receptors can participate in cluster formation on cultured rat myotubes. *Proc. Natl. Acad. Sci. (USA)* 80:449-453.

26. Burghardt, T.P. and Axelrod, D. 1983. A total internal reflection study of energy transfer in surface adsorbed and dissolved bovine serum albumin. *Biochemistry* 22:979-985.
27. Thompson, N.L. and Axelrod, D. 1983. Immunoglobulin surface binding kinetics studied by total internal reflection with fluorescence correlation spectroscopy. *Biophys. J.* 43:103-114.
28. Styra, M. and Axelrod, D. 1983. The mobility and detergent extractibility of acetylcholine receptors on cultured rat myotubes: a correlation. *J. Cell Biol.* 97:48-51.
29. Axelrod, D., Burghardt, T.P., and Thompson, N.L. 1984. Total internal reflection fluorescence. *Ann. Rev. Biophys. Bioeng.* 13:247-268.
30. Axelrod, D. 1984. Total internal reflection fluorescence in biological systems. *J. Lumines.* 31 & 32:881-884. In "*Proc 1984 Intl Conf Lumin*", ed Yen, W.M & Wright, J.C. (North-Holland).
31. Styra, M. and Axelrod, D. 1984. Mobility of extrajunctional acetylcholine receptors on denervated adult muscle fibers. *J. Neurosci.* 4:70-74.
32. Smith, D.D., Thompson, N.L., and Axelrod, D. 1984. A general purpose photon-counting minicomputer interface. *Rev. Sci. Instrum.* 55:1098-1099.
33. Hellen, E.H. and Axelrod, D. 1987. Fluorescence emission at dielectric and metal-film interfaces. *J. Opt. Soc. Am. B* 4:337-350.
34. Axelrod, D., Lerner, D., and Sands, P.J. 1988. Refractive index within the lens of a goldfish eye determined from the paths of thin laser beams. *Vision Res.* 28:57-65
35. Scalettar, B., Selvin, P., Axelrod, D., Hearst, J., Klein, M.P. 1988. A fluorescence photobleaching study of the microsecond reorientational motions of DNA. *Biophys. J.* 53:215-226.
36. Velez, M. and Axelrod, D. 1988. Polarized fluorescence photobleaching recovery for measuring rotational diffusion in solutions and membranes. *Biophys. J.* 53:575-591.
37. Bloch, R.J., Velez, M., Krikorian, J., and Axelrod, D. 1989. Microfilaments and actin-associated proteins at sites of substrate attachment in acetylcholine receptor clusters of cultured rat myotubes. *Exp. Cell Res.* 182:583-596.
38. Stout, A.L. and Axelrod, D. 1989. Evanescent field excitation of fluorescence by epi-illumination microscopy. *Appl. Opt.* 28:5237-5242.
39. Velez, M., Barald, K.F., and Axelrod, D. 1990. Rotational diffusion of acetylcholine receptors on cultured rat myotubes. *J. Cell Biol.* 110:2049-2059.
40. Scalettar, B., Selvin, P., Axelrod, D., Hearst, J., Klein, M.P. 1990. Rotational diffusion of DNA in agarose gels. *Biochemistry* 29:4790-4798.

41. Selvin, P., Scalettar, B., Axelrod, D., Langmore, J.P., Hearst, J., Klein, M.P. 1990. Rotational diffusion of DNA in intact nuclei. *J. Molec. Biol.* 214:911-922.
42. Hellen, E.H. and Axelrod, D. 1990. An automatic focus/hold system for optical microscopes. *Rev. Sci. Instr.* 61:3722-3725.
43. Hellen, E. and Axelrod, D. 1991. Kinetics of epidermal growth factor/receptor binding on cells measured by total internal reflection/fluorescence recovery after photobleaching. *J. Fluor.* 1:113-128
44. Wang, D., Guo, S., and Axelrod, D. 1992. Reaction rate enhancement by surface diffusion of adsorbates. *Biophys. Chem.* 43:117-137.
45. Greenberg, M and Axelrod, D. 1993. Anomalously slow mobility of lipid probes in the plasma membrane of the yeast *Saccharomyces cerevisiae*. *J. Membrane Biol.* 131:115-127.
46. Fulbright, R.M. and Axelrod, D. 1993. Dynamics of nonspecific adsorption of insulin to erythrocyte membranes. *J. Fluor.* 3:1-16.
47. Axelrod, D. and Wang, D. 1994. Reduction-of-dimensionality kinetics at reaction-limited cell surface receptors. *Biophys. J.* 66:588-600.
48. Yuan, Y. and Axelrod, D. 1994. Photobleaching with a subnanosecond laser flash. *J. Fluor.* 4:141-151.
49. Wang, M.D. and Axelrod, D. 1994. Time-lapse total internal reflection fluorescence video of acetylcholine receptor cluster formation on myotubes. *Devel. Dynam.* 201:29-40.
50. Wang, M.D. and Axelrod, D. 1994. Microclustering patterns of acetylcholine receptors on myotubes studied by spatial fluorescence autocorrelation. *Bioimaging* 2:22-35.
51. Stout, A.L. and Axelrod, D. 1994. Reversible binding kinetics of a cytoskeletal protein at the erythrocyte submembrane. *Biophys. J.* 67:1324-1334.
52. Kwon, G., Axelrod, D., Neubig, R.R. 1994. Lateral mobility of TMR- $\alpha_0$  and TMR- $\beta\gamma$  in NG108 cells. *Cellular Signalling* 6:663-679.
53. Axelrod, D. 1994. New dimensions in two dimensions. *Biophys. J.* 67:1799-1800.
54. Uhlen, S., Axelrod, D., Keefer, J.R., Limbard, L.E., Neubig, R.R. 1995. Membrane organization and mobility of  $\alpha_2$  adrenergic receptors in MDCK cells. *Pharmacol. Comm.* 6:155-167.
55. Stout, A.L. and Axelrod, D. 1995. Spontaneous recovery of fluorescence by photobleached surface-adsorbed proteins. *Photochem. Photobiol.* 62:239-234.

56. Yuan, Y. and Axelrod, D. 1995. Subnanosecond polarized fluorescence photobleaching: rotational diffusion of acetylcholine receptors on developing muscle cells. *Biophys. J.* 69:690-700.
57. Omann, G.M. and Axelrod, D. 1996. Membrane proximal calcium transients in stimulated neutrophils seen by total internal reflection fluorescence. *Biophys. J.* 71:2885-2891.
58. Davis, D.I., Doten, I.C., Barald, K.F., Axelrod, D., Burch, J.B.E. 1996. Random sequence phosphorothioate oligonucleotides evoke dramatic phenotypic alterations in cardiac myocyte cultures. *Antisense & Nucl. Acid Drug Devel.* 6: 259-265.
59. Fulbright, R.M., Axelrod, D., Dunham, W.R., and Marcelo, C.L. 1997. Fatty acid alteration and the lateral diffusion of lipids in the plasma membrane of keratinocytes. *Exp. Cell Res.* 233:128-134.
60. Abney, J.R., Cutler, B., Fillbach, M.L., Axelrod, D., and Scalettar, B.A. 1997. Chromatin dynamics in interphase nuclei and its implications for nuclear structure. *J. Cell Biol.* 137:1459-1468.
61. McKiernan, A.M., MacDonald, R.C., MacDonald, R.I., and Axelrod, D. 1997. Cytoskeletal protein binding kinetics at planar phospholipid membranes. *Biophys. J.* 73:1987-1998.
62. Axelrod, D. 1997. Book review of "What is Life? The Next Fifty Years. Speculations on the Future of Biology". Ed. Murphy, M.M. and O'Neill, L., Cambridge Univ. Press. *Mathematical Biosciences* 141:149-153.
63. Sund, S.E., Swanson, J.A., and Axelrod, D. 1999. Cell membrane orientation visualized by polarized total internal reflection fluorescence. *Biophys. J.* 77: 2266-2283.
64. Han, W., Ng, Y-K, Axelrod, D., and Levitan, E.S. 1999. Neuronal peptide release is sustained by recruitment of rapidly diffusing secretory vesicles. *Proc. Natl. Acad. Sci. USA* 96:14577-14582.
65. Sund, S.E. and Axelrod, D. 2000. Actin dynamics at the living cell submembrane imaged by total internal reflection fluorescence photobleaching. *Biophys. J.* 79:1655-1669.
66. Schmoranzler, J., Goulian, M., Axelrod, D., and Simon, S.M. 2000. Imaging constitutive exocytosis with total internal reflection microscopy. *J. Cell Biol.* 149: 23-31.
67. Johns, L.M., Levitan, E.S., Shelden, E.A., Holz, R.W, and Axelrod, D. 2001. Restriction of secretory granule motion near the plasma membrane of chromaffin cells. *J. Cell Biol* 153: 177-190.
68. Axelrod, D. 2001. Selective imaging of surface fluorescence with very high aperture microscope objectives. *J. Biomed. Opt.* 6: 6-13.

69. Axelrod, D. 2001. Total internal reflection fluorescence microscopy in cell biology. *Traffic* 2:764-774.
70. Holz, R.W. and Axelrod, D. 2002. Localization of phosphatidylinositol 4,5-P<sub>2</sub> important in exocytosis and a quantitative analysis of chromaffin granule motion adjacent to the plasma membrane. *Annals NY Acad Sci* 971:232-243.
71. Dzakpasu, R., and Axelrod, D. 2004. Dynamic light scattering microscopy: a novel optical technique to image submicroscopic motions I: Theory. *Biophys. J.* 87:1279-1287.
72. Dzakpasu, R., and Axelrod, D. 2004. Dynamic light scattering microscopy: a novel optical technique to image submicroscopic II: Experimental applications. *Biophys. J.* 87:1288-1297.
73. Mattheyses, A., Hoppe, A., and Axelrod, D. 2004. Polarized fluorescence resonance energy transfer microscopy. *Biophys. J.* 87:2787-2797.
74. Allersma, M.W., Wang, L., Axelrod, D., and Holz, R.W. 2004. Visualization of regulated exocytosis with a granule-membrane probe using total internal reflection microscopy. *Molec. Biol. Cell* 15:4658-4668.
75. Chang, P.S., Axelrod, D., Omann, G.M., and Linderman, J.J. 2005. G-protein threshold behavior in the human neutrophil oxidant response: measurement of G-proteins available for signaling in responding and non-responding subpopulations. *Cellular Signalling* 17:605-614.
76. Mattheyses, A.L., and Axelrod, D. 2005. Fluorescence emission patterns near glass and metal-coated surfaces investigated with back focal plane imaging. *J. Biomed Optics* 10:054007/1-6.
77. Mattheyses, A. and Axelrod, D. 2006. Direct measurement of evanescent field profile and depth in TIRF microscopy. *J. Biomed Optics* 11:014006/1-7.
78. Mattheyses, A., Shaw, K.D., and Axelrod, D. 2006. Effective elimination of laser interference fringing in fluorescence microscopy by spinning azimuthal incidence angle. *Microscope Research and Technique* 69:642-647
79. Allersma, M.W., Bittner, M.A., Axelrod, D., and Holz, R.W. 2006. Motion matters: secretory granule motion adjacent to the plasma membrane and exocytosis. *Molec. Biol. Cell* 17:2424-2438.
80. Axelrod, D. and Omann, G.M. 2006. Combinatorial microscopy. *Nature Rev Mol Cell Biol.* 7(12):944-952.
81. Degtyar, V.E., Allersma, M.W., Axelrod, D., and Holz, R.W. 2007. Increased motion and travel, rather than stable docking, characterize the last moments before secretory granule fusion. *Proc. Natl. Acad. Sci. USA* 104:15929-15934.

82. Holz, R.W. and Axelrod, D. 2008. Secretory granule behavior adjacent to the plasma membrane before and during exocytosis: total internal reflection fluorescence studies. *Acta Physiol.* 192:303-307.
83. Wang, L., Bittner, M.A., Axelrod, D., and Holz, R.W. 2008. The structural and functional implications of linked SNARE motifs in SNAP25. *Molec. Biol. Cell* 19:3944-3955.
84. Anantharam, A., Onoa, B., Edwards, R.H., Holz, R.W., and Axelrod, D. 2010. Localized plasma membrane topological changes upon exocytosis visualized by polarized-TIRFM. *J. Cell Biol.* 188:415-428.
85. Anantharam, A., Axelrod, D., and Holz, R.W. 2010. Polarized TIRFM reveals changes in plasma membrane topology before and during Granule Fusion. *Cell Mol Neurobiol.* 30:1343-1349.
86. Anantharam, A., Bittner, M.A., Aikman, R.L., Stuenkel, E.L., Schmid, S.L., Axelrod, D., and Holz, R.W. 2011. A new role for the dynamin GTPase as a timer that controls fusion pore expansion. *Molec. Biol. Cell* 22:1-13.
87. Axelrod, D. 2012. Fluorescence excitation and imaging of single molecules near dielectric-coated and bare surfaces: a theoretical study. *J. Microscopy* 247:147-160.
88. Anantharam, A., Axelrod, D., and Holz, R.W. 2012. Real-time investigation of fusion pore expansion by imaging of plasma membrane deformations. *J. Neurochem.* 122:661-671.
89. Axelrod, D. 2013. Evanescent excitation and emission in fluorescence microscopy. (*Invited review*) *Biophys. J.* 104:1401-1409. Correction, 104:2321.
90. Ngatchou-Weiss, A., Bittner, M.A., Holz, R.W., Axelrod, D. 2014. Protein mobility within secretory granules. *Biophys. J.* 107:16-25.
91. Ngatchou-Weiss, A., Anantharam, A., Bittner, M.A., Axelrod, D., Holz, R.W. 2014. Luminal protein within secretory granules affects fusion pore expansion. *Biophys. J.* 107:26-33. Cited in BJ feature as "New and notable".
92. Rao, T.C., Rodriguez, Z.S., Bradberry, M.M., Ranski, A.H., Dahl, P.J., Schmidtke, M.W., Jenkins, P.M., Axelrod, D., Chapman, E.R., Giovannucci, D.R., and Anantharam, A. 2017. Synaptotagmin isoforms confer distinct activation kinetics and dynamics to chromaffin cell granules. *J. Gen. Physiol.* 149 (8):763-780. <https://doi.org/10.1085/jgp.201711757>.
93. Bohannon, K.P., Bittner, M., Lawrence, D.A., Axelrod, D., and Holz, R.W. 2017. Slow fusion pore expansion creates a unique reaction chamber for co-packaged cargo. *J. Gen Physiol* 149

(10):921-934. <https://doi.org/10.1085/jgp.201711842>. *Commentary by Jackson, M.*, <https://doi.org/10.1085/jgp.201711894>.

94. Bohannon, K.P., Holz, R.W., and Axelrod, D. 2017. Refractive index imaging of cells with variable-angle near TIR microscopy. *Microscopy and Microanalysis* 23:978-988. doi:10.1017/S1431927617012570. Awarded "2017 best biological science paper in M&M".
95. Axelrod, D., Elson, E., Schlessinger, J, and Koppel, D.E. 2018. Reminiscences on the "classic" 1976 FRAP paper in BJ. *Biophys J.* 115:1156–1159.
96. Abbineni, P.S., Axelrod, D., and Holz, R.W. 2018. Visualization of expanding fusion pores in secretory cells. *J. Gen Physiol.* 150:1640-1646.
97. Abbineni, S.A., Bittner, M.A., Axelrod, D., and Holz, R.W. 2019.. Chromogranin A, the major luminal protein in chromaffin granules, controls fusion pore expansion. *J. Gen Physiol.* 151:118-130.
98. Bittner, M.A., Bohannon, K.P., Axelrod, D., and Holz, R.W. 2019. Identification of  $\beta$ -synuclein on secretory granules in chromaffin cells and the effects of  $\alpha$ - and  $\beta$ -synuclein on post-fusion BDNF discharge and fusion pore expansion. *Neuroscience Lett.* 699:134-139
99. Axelrod, D., Axelrod, J., Holz, R.W., and Thompson, N.L. 2019. Small volumes in biology. *Microsc. Microanal.* 25 (Suppl 2):1226-1227.
100. Axelrod, J. and Axelrod, D. 2021. Light scattering in TIRF microscopy: a theoretical study of the limits to surface selectivity. *Biophys J.* 120:2952-2968. Awarded "BJ Editor's Pick".
101. Abbineni, P.S., Briguglio, J.S., Chapman, E.R., Holz, R.W., and Axelrod, D. 2022. Vamp2 and synaptotagmin mobility in chromaffin granule membranes: implications for regulated exocytosis *Mol Biol Cell* 33:ar53 (May 15), 1-13.
102. Morales, A., Mohan, R., Bendahmane, M. , Chen, X., Coffman, B., Watch, L., Bakshi, S., West, J., Traynor, J., Giovannucci, D., Kammermeier, P., Axelrod, D., Currie, K., Smrcka, A., and Anantharam, A. 2023. PACAP and acetylcholine cause distinct Ca<sup>2+</sup> signals and secretory responses in chromaffin cells. *J. Gen. Physiol.* 155(2):e202213180, 1-22.
103. Chen, X., Coffman, B.L., Brindley, R.L., Galpin, J.D., Ahern, C.A., Currie, K.P.M., Smrcka, A.V., Axelrod, D., Anantharam, A. 2023. Phospholipase C-epsilon defines a PACAP-stimulated pathway for secretion in the chromaffin cell *J. Neuroendocrinol.* 35:e13255, 1-17.
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## **OTHER PAPERS from students while in my research group**

1. Thompson, N.L. 1982. Surface binding rates of non-fluorescent molecules may be obtained by total internal reflection/fluorescence correlation spectroscopy. *Biophys. J.* 38:327-329.
2. Burghardt, T.P. 1983. Fluorescence depolarization by anisotropic rotational diffusion of a luminophore and its carrier molecule. *J. Chem. Phys.* 78:5913-5919.

## **CONFERENCE PROCEEDINGS PAPERS**

1. Axelrod, D., Hellen, E.H., and Fulbright, R.M. 1987. Biomolecular motion on surfaces and membranes. In "Lasers in Medicine", ed. Jaffe, S.N., Parrish, J.A., and Scott, R.S. *Proc. SPIE* 712:144-148.
2. Axelrod, D., Rubenstein, J., Yuan, Y. 1992. Fast rotational diffusion measured by fluorescence recovery after photobleaching. *Amer. Chem. Soc. Polymer Prepr.* 33:755-756.
3. Sund, S.E. and Axelrod, D. 1998. Imaging of the binding rates of cytoskeletal proteins at the submembrane of living cells. In *Advances in Optical Biophysics*, Joseph R. Lakowicz, J. B. Alexander Ross, Editors, *Proc. SPIE* Vol. 3256, 86-95.

## **CHAPTERS in BOOKS**

1. Elson, E.L., Schlessinger, J., Koppel, D.E., Axelrod, D., and Webb, W.W. 1976. Measurement of lateral transport on cell surfaces. In *Prog. Clin. Biol. Res.* 9 "Membranes and Neoplasia", Alan R. Liss, N.Y. p. 137-147.
2. Thompson, N.L. and Axelrod, D. 1985. Immunoglobulin surface adsorption studied by total internal reflection with fluorescence correlation spectroscopy. In "Physical Methods on Biological Membranes and Their Model Systems", NATO Adv. Sci. Inst. Series, ed. Conti, F., Blumberg, W.E., deGier, J., and Pocchain, F., Plenum Press, p.345-349.
3. Axelrod, D. 1985. Fluorescence photobleaching recovery techniques and lateral diffusion. In "Spectroscopy and the dynamics of molecular biological systems", ed Bayley, P.M. and Dale, R.E. Academic Press, London, p. 163-175.
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## Ph.D. THESIS

- Axelrod, D. 1974. Optical study of metal ion-nerve interactions. Ph.D. Thesis (Physics), University of California, Berkeley

**FULL SEMESTER COURSES TAUGHT (multiple times) at University of Michigan**

Biophysical Principles of Microscopy (graduate level)

Random Processes in Biophysics (advanced undergrad level)

Physics of Music (general undergrad level)

Modern Physics (sophomore physics level)

General Physics (intro for science majors)

Living with Physics (intro for non-science majors)

Science and Strategy in the Nuclear Arms Race (general advanced undergrad and grad level)