

## DAVID E. AXELROD

*Curriculum vitae*

January 26, 2016

### Position and Address:

Position: Professor  
Mailing address: Department of Genetics, Rutgers - The State University of New Jersey  
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### Research Interests:

Cellular and molecular oncology.  
Tumor cell heterogeneity. Tumor progression. Cell population dynamics. Biomarkers.  
Breast cancer: Diagnosis and prognosis of human breast cancer by computer-aided image cytometry.  
Colon cancer: Improved therapy schedules for human colon cancer prevention and therapy by agent-based computer modeling of stem cell dynamics in colon crypts.

### Personal Data:

Birth Date: August 25, 1940; Chicago, IL  
Home Address: 41 Coleman Ave. West, Chatham NJ 07928-2245  
Home Telephone: 973-665-0011

### Education:

University of Chicago, Chicago, IL	B.S.	1962	Physics
Univ. of Tennessee, Knoxville, TN	Ph.D.	1967	Microbial Genetics
Albert Einstein Coll. of Medicine, Bronx, NY	Postdoc.	1968-70	Molecular Biology

### Research and Professional Experience:

1963-67 Graduate student, mentor Dr. H.I. Adler, Public Health Service Predoctoral Trainee in Radiation Biology. University of Tennessee, Knoxville, TN and Oak Ridge National Laboratory, Oak Ridge, TN.

1968-70 Postdoctoral Fellow, mentor Dr. J. Hurwitz, National Cancer Institute Postdoctoral Fellowship. Department of Developmental Biology and Cancer, Albert Einstein College of Medicine, Bronx, NY.

1970-76 Assistant Professor, Department of Biological Sciences, Rutgers University. Faculty, Graduate Microbiology Program. Faculty, Genetics Training Grant.

1976-77 Research Biologist, Sabbatical leave with W.F. Anderson, Molecular Hematology Branch, NIH, Bethesda, MD.

1976-83 Associate Professor, Department of Biological Sciences, Rutgers University. Faculty, Graduate Microbiology Program. Faculty, Genetics Training Grant and Cancer Training Grant. Member, Bureau of Biological Research.

1983-97 Associate Professor, Waksman Institute of Microbiology, Department of Biological Sciences, Rutgers University. Faculty, Graduate Program in Microbiology and Molecular Genetics. Member, Cancer Institute of New Jersey.

1997-01 Associate Professor, Department of Genetics, Rutgers University. Graduate Program in Microbiology and Molecular Genetics. Member, Cancer Institute of New Jersey.

Current Professor, Department of Genetics, Rutgers University.  
Faculty, Joint Graduate Program in Molecular Biosciences, Rutgers and Robert Wood Johnson Medical School (Microbiology & Molecular Genetics; Cell & Developmental Biology)  
Member, Human Genetics Institute of New Jersey, Computational Genetics Program, Rutgers  
Member, Institute of Quantitative Biomedicine, Rutgers  
Member Associate II, Rutgers Cancer Institute of New Jersey (R-CINJ)  
Member, Ctr for Discrete Mathematics and Theoretical Computer Science (DIMACS), Rutgers

**Publications (refereed) :**

1. Axelrod, D.E. and H.I. Adler. 1969. Influence of the fertility episome on the survival of X-irradiated *Escherichia coli*. *J. Bacteriol.* 98:329-330.
2. Axelrod, D.E. 1972. Kinetics of differentiation of conidiophores and conidia by colonies of *Aspergillus nidulans*. *J. Gen. Microbiol.* 73:181-184.
3. Axelrod, D.E., M. Gealt and M. Pastushok. 1973. Gene control of developmental competence in *Aspergillus nidulans*. *Develop. Biol.* 34:9-15.
4. Gealt, M.A. and D.E. Axelrod. 1974. Coordinate regulation of enzyme inducibility and developmental competence in *Aspergillus nidulans*. *Develop. Biol.* 41:224-232.
5. Pastushok, M. and D.E. Axelrod. 1976. Effect of glucose, ammonium and media maintenance on the time of conidiophore initiation by surface colonies of *Aspergillus nidulans*. *J. Gen. Microbiol.* 94:221-224.
6. Hall, N.E.L. and D.E. Axelrod. 1977. Interference of cellular ferric ions with DNA extraction and the applications to methods of DNA determination. *Anal. Biochem.* 79:425-430.
7. Hall, N.E.L. and D.E. Axelrod. 1978. Sporulation competence in *Aspergillus nidulans*: a role for iron in development. *Cell Differentiation* 7:73-82.
8. Axelrod, D.E., T.V. Gopalakrishnan, M. Willing and W.F. Anderson. 1978. Maintenance of hemoglobin inducibility in somatic cell hybrids of tetraploid (2S) mouse erythroleukemia cells with mouse or human fibroblasts. *Somatic Cell Genetics* 4:157-168.
9. Miller, D.M., P. Turner, A.W. Nienhuis, D.E. Axelrod and T.V. Gopalakrishnan. 1978. Active conformation of the globin genes in induced and uninduced mouse erythroleukemia cells. *Cell* 14:511-521.
10. Miller, D.M., D.E. Axelrod, R. Croissant and A. Nienhuis. 1978. Structure of Globin Gene in Differentiating Erythroid Cells. pp. 17-32. *In Red Cell, Progress in Clinical and Biological Research, Vol. 21.* (ed.) G.J. Brewer, Alan R. Liss, Inc., New York.
11. Nienhuis, A.W., D.E. Axelrod, J.E. Barker, E.J. Benz, Jr., R. Croissant, D. Miller and N. Young. 1978. Regulation of the Individual Globin Genes. pp. 295-310. *In Differentiation of Normal and Neoplastic Hematopoietic Cells. Book A.* (eds.) B. Clarkson, P.A. Marks and J.E. Till. Cold Spring Harbor Conferences on Cell Proliferation, Vol. 5. Cold Spring Harbor Laboratory, Cold Spring, New York.
12. Anderson, W.F., M.C. Willing, D.E. Axelrod, T.V. Gopalakrishnan and E.G. Diacumakos. 1979. A New Approach in the Search for Globin Gene Regulatory Factors. pp. 779-792. *In Cellular Regulation in Hemoglobin Switching.* (eds.) G. Stamatoyannopoulos and Nienhuis. Grune and Stratton, New York.
13. Axelrod, D.E., R. Terry and F.G. Kern. 1979. Cell differentiation rates of Friend murine erythroleukemia variants isolated by sib selection. *Somatic Cell Genetics* 5:539-549.
14. Axelrod, D.E., S.K. Majumdar, J.A. Wivell and R.W. Terry. 1980. Tumorigenicity of Friend murine erythroleukemia cell lines differing in spontaneous differentiation rates. *Int. J. Cancer* 26:799-804.

15. Champe, S.P., M.G. Kurtz, L.M. Yager, N.J. Butnick, and D.E. Axelrod. 1981. Spore Formation in *Aspergillus nidulans*: Competence and Other Developmental Processes. pp. 255-276. *In Fungal Spore: Morphogenic Controls.* (eds.) G. Turian and H.R. Hohl. Academic Press, London.
16. Kern, F.G. and D.E. Axelrod. 1983. Dimethyl sulfoxide affects the amount of extrachromosomal spleen focus-forming DNA in murine erythroleukemia cells. *J. Virol.* 46: 113-124.
17. Hardies, S.C., D.E. Axelrod, M.H. Edgell and C.A. Hutchinson, III. 1983. Phenotypic variation associated with molecular alterations at a cluster of thymidine kinase genes. *Molec. Cell. Biol.* 3:1163-1171.
18. Krueger, L.J., R.W. Terry, A. Sussman, A.C. Tate and D.E. Axelrod. 1984. Interferon-induced growth modulation: low dose maintenance of the antiproliferative response. *Interferon Res.* 4:29-40.
19. Hardies, S.C., D.E. Axelrod, M.H. Edgell and C.A. Hutchinson, III. 1984. Concerted Hypermethylation and Stable Shutdown of a Cluster of Thymidine Kinase Genes. pp. 249-258. *In Gene Transfer and Cancer. Progress in Cancer Research and Therapy, Vol. 30.* (eds.) M.L. Pearson and N.L. Sternberg. Raven Press, New York.
20. Kuczek, T. and D.E. Axelrod. 1986. The importance of clonal heterogeneity and interexperiment variability in modeling the eukaryotic cell cycle. *Math. Biosci.* 79:87-96.
21. Axelrod, D.E., F.R. Haider and A.C. Tate. 1986. Distribution of interdivisional times of proliferating and differentiating Friend murine erythroleukemia cells. *Cell Tissue Kinetics* 19:547-556.
22. Kuczek, T. and D.E. Axelrod. 1987. Tumor cell heterogeneity: divided-colony assay for measuring drug response. *Proc. Natl. Acad. Sci. USA* 84:4490-4494.
23. Axelrod, D.E. and T. Kuczek. 1989. Clonal heterogeneity in populations of normal and tumor cells. *Computers Math. Applic.* 18: 871-881.
24. Kimmel, M. and D.E. Axelrod. 1990. Mathematical models of gene amplification with applications to cellular drug resistance and tumorigenicity. *Genetics* 125: 633-644.
25. Axelrod, D.E., E. Milcos-Livanos and N. Vibhakar. 1991. Colony size heritability: a new parameter for characterizing proliferating populations of normal and tumor cells. pp. 713-721. *In Mathematical Population Dynamics.* (eds.) A. Arino, D.E. Axelrod and M. Kimmel. Marcel Dekker, Inc., NY.
26. Gamel, J. and D.E. Axelrod. 1991. Inheritance and regression toward the mean in proliferating cell populations. *Cell Proliferation* 24: 281-292.
27. Huang, S. and D.E. Axelrod. 1991. Altered post-translational modification of *ras* p21 in a transformation-suppressed cell line. *Oncogene* 6: 1211-1218.
28. Kimmel, M. and D.E. Axelrod. 1991. Unequal cell division, growth and regulation and colony size of mammalian cells: a mathematical model and analysis of experimental data. *J. Theoret. Biol.* 153: 157-180.
29. Kimmel, M., D.E. Axelrod and G. Wahl. 1992. A branching process model of gene amplification following gene deletion from chromosomes. *Mutation Res.* 276: 225-239.

30. Axelrod, D.E., Y. Gusev, and T. Kuczek. 1993. Persistence of cell cycle times over many cell generations as determined by heritability of colony sizes of *ras* oncogene-transformed and non-transformed cells. *Cell Prolif.* 26:235-249.
31. Kimmel, M. and D.E. Axelrod. 1994. Fluctuation test for two-stage mutations: Applications to gene amplification. *Mutation Res.* 306: 45-60.
32. Axelrod, D.E. , K.A. Baggerly and M. Kimmel. 1994. Gene amplification by unequal sister chromatid exchange: Probabilistic modeling and analysis of drug resistance data. *J. Theoret. Biol.* 168: 151-159.
33. Gusev, Y. and D.E. Axelrod. 1995. Evaluation of models of inheritance of cell cycle times: computer simulation and recloning experiments. Pp. 97-116. *In* O. Arino, D.E. Axelrod and M. Kimmel (eds.). *Mathematical Population Dynamics: Analysis of Heterogeneity. Vol. 2. Carcinogenesis and Cell & Tumor Genetics.* Wuerz Publ. Ltd. Winnipeg.
34. Kimmel, M., O. Arino, and D.E. Axelrod. 1996. Backward/forward duality of branching processes and cell population dynamics. Pp. 233-240. *In* *Differential Equations an Application to Biology and to Industry.* M. Martelli, K. Cooke, E. Cumberbatch, B. Tang and H. Thieme (eds.) World Scientific Publ. Co. Singapore
35. Gusev, Y. and D.E. Axelrod. 1996. Simulation of drug-inhibited cell proliferation with a model of clonal inheritance of cell lifetimes. Pp. 3455-3461. *In* V. Lakshmikantham (ed.) *World Congress of Nonlinear Analysts '92.* Walter deGruyter. Berlin.
36. Stivers, D.N., M.K. Kimmel and D.E. Axelrod. 1996. A discrete-time, multi-type generational inheritance branching process model of cell proliferation. *Mathematical Biosciences*137: 25-50.
37. Axelrod, D.E., Y. Gusev and J.W. Gamel.1997. *Ras*-oncogene transformed and non-trans-formed cell population are each heterogeneous but respond differently to the chemotherapeutic drug cytosine arabinoside (Ara-C). *Cancer Chemotherapy and Pharmacology* 39: 445-451.
38. Bat, O., M. Kimmel and D.E. Axelrod. 1997. Computer simulation of expansion of DNA triplet repeats in the fragile X syndrome and Huntington's disease. *J. Theoret. Biol.*188: 53- 67.
39. Axelrod, D.E. 1997. Nonlinear analysis of tumor cell population dynamics. Pp. 143-154. *In* *Advances in Mathematical Population Dynamics: Molecules, Cells and Man.* O. Arino, D. Axelrod, M. Kimmel (eds.), World Sci. Publ. Inc., Singapore.
40. Bat, O., M. Kimmel, and D.E. Axelrod. 1997. Computer simulation of the expansions of CGG DNA triplet repeats in the fragile X syndrome. Pp. 47-68. *In* *Advances in Mathematical Population Dynamics: Molecules, Cells and Man.* O. Arino, D. Axelrod, M. Kimmel (eds.), World Sci. Publ. Inc., Singapore.
41. Staudte, R.G., R.M. Huggins, J. Zhang, D.E. Axelrod, and M. Kimmel. 1997. Estimating clonal heterogeneity and interexperiment variability with the bifurcating autoregressive model for cell lineage data. *Mathematical Biosciences* 143: 103-121.
42. Chapman, J.-A., E. Wolman, S.R. Wolman, Y. Remvikos, S. Shackney, D.E. Axelrod, H. Baisch, I. J. Christensen, R.A. White, L.S. Liebovitch, D.H. Moore, F.M. Waldman, C.J. Cornelisse, T.V. Shankey. 1998. Assessing genetic markers of tumour progression in the context of intra-tumour heterogeneity. *Cytometry* 31: 67-73.
43. Bat, O., M. Kimmel, and D.E. Axelrod. 1998. Simulation of biochemical contribution to trinucleotide repeat expansion in human hereditary diseases. *Math. Modeling and Sci. Computing* 9: 105-122.

44. Axelrod, D.E. 2000. A monthly period of symptoms associated with benign prostatic hyperplasia. *Urology* 55: 436iv-436vi. <http://www.elsevier.com/locate/urologyonline>
45. Subramanian, B. and D.E. Axelrod. 2001. Progression of heterogeneous breast tumors. *J. Theoret. Biol.* 210: 107-119.
46. Cornélissen, G., D.E. Axelrod, and F. Halberg. 2004. About-weekly variations in nocturia. *Biomed. Pharmacother.* 58: S140-S144.
47. Sontag, L. and D.E. Axelrod. 2005. Evaluation of pathways for progression of heterogeneous breast tumors. *J. Theoret. Biol.* 232: 179-189.
48. Alexe, G., S. Alexe, D.E. Axelrod, P.L. Hammer, and D.J. Weissman. 2005. Logical analysis of diffuse large B-cell lymphomas. *Artificial Intell. Med.* 34: 235-267.
49. Alexe, G., S. Alexe, D.E. Axelrod, E. Boros, M. Reiss, and P.L. Hammer. 2006 Combinatorial analysis of breast cancer data from gene expression microarrays. *Breast Cancer Res* 8:R41. doi: 10.1186/bcr1512.
50. Axelrod, R., D.E. Axelrod, and K.J. Pienta. Evolution of cooperation between tumor cells. 2006. *Proc. Natl. Acad. Sci. USA* 103:13474-12479. doi/10.1073/pnas.0606053103
51. Cardiff, R.D., J.P. Gregg, J.W. Miller, D.E. Axelrod, and A.D. Borowsky. 2006. Histopathology as a predictive biomarker: Strengths and limitations. *J. Nutrition* 136:2673S-2675S.
52. Chapman, J.-A.W., N.A. Miller, H.L.A. Lickley, J. Qian, W.A. Christens-Barry, Y. Fu, Y. Yuan, and D.E. Axelrod. 2007. Ductal carcinoma in situ of the breast (DCIS) with heterogeneity of nuclear grade: Prognostic effects of quantitative nuclear assessment. *BMC Cancer* 2007, 7:174 doi: 10.1186/1471-2407-7-174, URL <http://www.biomedcentral.com/1471-2407/7/174>
53. Axelrod, D.E., N.A. Miller, H.L. Lickely J.Qian, W.A. Christens-Barry, Y. Yuan, Y. Fu., J.-A.W. Chapman. 2008. Effect of quantitative nuclear image features on recurrence of ductal carcinoma in situ (DCIS) of the breast. *Cancer Informatics* 4:99-109. URL [http://la-press.com/article.php?article\\_id=583](http://la-press.com/article.php?article_id=583). PubMed Central ID 2531292.
54. Pienta, K., N. McGregor, R. Axelrod, and D.E. Axelrod. 2008. Ecological therapy for cancer: Defining tumors utilizing an ecosystem paradigm suggests new opportunities for novel cancer treatments. *Translational Oncology* 1:158-164. doi 10.1593/tlo.08178
55. Axelrod, D.E., N. Miller, and J.-A. Chapman. 2009. Avoiding pitfalls in the statistical analysis of heterogeneous tumors. *Biomedical Informatics Insights* 2:11-18. [http://la-press.com/article.php?article\\_id=1374](http://la-press.com/article.php?article_id=1374)
56. Miller, N.A., J.-A. Chapman, J. Qian, W.A. Christens-Barry, Y. Fu, Y. Yuan, H.L.A. Lickley, D.E. Axelrod. 2010. Heterogeneity Between Ducts of the Same Nuclear Grade Involved by *In Situ* Duct Carcinoma (DCIS) of the Breast. *Cancer Informatics* 9:201-216. <http://www.la-press.com/heterogeneity-between-ducts-of-the-same-nuclear-grade-involved-by-article-a2250>
57. Axelrod, D.E., Shah, K, Yang, Q., Haffty, B.G. 2012. Prognosis for Survival of Young Women with Breast Cancer by Quantitative p53 Immunohistochemistry. *Cancer and Clinical Oncology* 1:52-64. <http://dx.doi.org/10.5539/cco.v1n1p52>. doi: 10.5539/cco.v1n1p52, PMID: PMC4549804, NIHMSID: NIHMS714262

58. Bravo, R. and D.E. Axelrod. A calibrated agent-based computer model of stochastic cell dynamics in normal human colon crypts useful for in silico experiments. *Theoretical Biology and Medical Modeling* 10:66 (2013), DOI: 10.1186/1742-4682-10-66, <http://www.tbiomed.com/content/10/1/66>
59. Axelrod, D.E. and R. Bravo. Chemoprevention of colon cancer by intermittent pulse treatment schedules. (Submitted)

**Books:**

- Arino, O., D.E. Axelrod, and M. Kimmel (eds.). 1991. *Mathematical Population Dynamics. Proceedings of the 2nd International Conference, Rutgers-The State University of New Jersey, USA. Lecture Notes in Pure and Applied Mathematics.* Marcel Dekker, NY. 784 pp.
- Arino, O., D.E. Axelrod, M. Langlais and M. Kimmel (eds.). 1995. *Mathematical Population Dynamics. Vol. 1. Theory of Epidemics. Proceedings of the 3rd International Conference, Univeristy of Pau, Pau, France.* Wuerz Publ. Ltd. Winnipeg. 393 pp.
- Arino, O., D.E. Axelrod, and M. Kimmel (eds.). 1995. *Mathematical Population Dynamics. Vol. 2. Carcinogens; Cell and Tumor Genetics. Proceedings of the 3rd International Conference, Univeristy of Pau, Pau, France.* Wuerz Publ. Ltd. Winnipeg. 370 pp.
- Arino, O., D.E. Axelrod, and M. Kimmel (eds.). 1997. *Advances in Mathematical Population Dynamics: Molecules, Cells and Man.* O. Arino, D. Axelrod, M. Kimmel (eds.), World Sci. Publ. Inc., Singapore. 839 pp.
- Kimmel, M. and D.E. Axelrod. 2002. *Branching Processes in Biology.* Springer, NY. 230 pp.
- Kimmel, M. and D.E. Axelrod. 2015. *Branching Processes in Biology*, 2<sup>nd</sup> ed. Springer, NY, 280 pp.  
ISBN: 978-1-4939-1558-3 (Print) 978-1-4939-1559-0 (Online). Online version (Feb 18, 2015: <http://link.springer.com/book/10.1007/978-1-4939-1559-0>. Print version March 6, 2015. DOI 10.1007/978-1-4939-1559-0

**View Axelrod's publications in PubMed:**

<http://www.ncbi.nlm.nih.gov/sites/entrez?term=axelrod%20de&cmd=search&db=pubmed>

**Research Grant Support:**

1971-74	Physiological Genetics of Developmental Competence National Institutes of Health (GM-18310)	\$ 37,700
1975-77	Initiation of Eukaryotic Development National Science Foundation (BMS-75-07851)	\$ 55,000
1978-81	Gene Dosage Activation of Hemoglobin in Cell Hybrids National Science Foundation (PCM-78-05462)	\$ 99,946
1981-82	Flow Cytometer Instrument for Analysis of Cell Parameters D. Axelrod (P.I.) with 5 co-investigators National Science Foundation (PCM-80-17828)	\$ 52,867
1980-83	Differentiation and Tumorigenicity of Friend Cells National Science Foundation (PCM-78-05462)	\$ 80,000
1984-86	New Genes Which Support <i>Ras</i> Oncogene Mediated Cell Transformation NJ Commission on Cancer Research (NJSCC #384-011)	\$ 40,141
1987-88	New Genes Required for <i>Ras</i> Oncogene Cell Transformation NJ Commission on Cancer Research (NJSCC #687-002)	\$ 43,670
1986-90	Reversion of <i>Ras</i> Oncogene Mediated Cell Transformation National Institutes of Health (CA-42795)	\$201,505

David E. Axelrod		<i>Curriculum vitae</i>
1990-92	<i>Ras</i> Oncogene: Suppression/Modulation of Cell Transformation Council for Tobacco Research-USA, Inc. (No. 2778)	\$145,000
1994-95	Role of DNA Methylation in Tumor Cell Heterogeneity NJ Commission on Cancer Research (94-36-CCR-00)	\$44,000
1995-96	Role of DNA Methylation in Tumor Cell Heterogeneity, Renewal NJ Commission on Cancer Research (94-36-CCR-00)	\$44,000
1996-97	Instability of Human Breast Cancers Cancer Institute of New Jersey (RR1622 CRA/CINJ) D. Axelrod (P.I. Basic Science), D. August (P.I. Clinical)	\$15,000
1996-97	Oncoprotein Analysis of Primary Cell Cultures from Human Breast Tumors NJ Commission on Cancer Research (96-2006-CCR-00)	\$7,500
1993-97	Mechanism of Cholesterol Epoxide Mitogenesis-Carcinogenesis Peterson Trust (PT 15,223) C. Schaffner and D. Axelrod, Co-P.I's	\$50,000
1997-2000	Computer-aided Diagnosis of Breast Cancer Cells Hyde and Watson Foundation (#97-0731)	\$15,000
2001-2002	Quantitative Histopathology of Breast Carcinoma In Situ New Jersey State Commission on Cancer Research (01-1076-CCF-S-0)	\$49,500
2001-2003	Quantification of Protein Expression in Breast Cancer Tissue Microarrays Busch Biomedical Research Grant, Rutgers University	\$20,000
2002-2004	Quantitative Histopathology of Breast Carcinoma In Situ (Competitive Renewal) New Jersey State Commission on Cancer Research (01-176-CCF-S-0)	\$49,500
2003-2007	Optimal Support Set Selection in Data Analysis: Bioinformatics Applications National Science Fnd. (NSF-IIS-0312953) P.I. Hammer. Co-PI. Axelrod \$9,783	\$400,000
9/1/04-2/31/10	Development of a Virtual Tumor National Cancer Institute (NIH 1P20 CA113004, U56 CA 113005) Parent grant: P.I. T. Deisboeck. Subcontractor: P.I. D. Axelrod, \$128,430	\$1,443,761
1/1/14-6/30/14	Cancer Research Project Mini 2014. New Jersey Department of Health, New Jersey Commission on Cancer Research. P.I. DFHS14CRM001.	\$11,000
11/24/07-Current	New Jersey Breast Cancer Research Fund. Federated Department Stores Foundation	\$61,091

**Abstracts, Teaching, Service, and other information:** listed separately in CV Supplement