

## RESUME

**Edward L. Frome**

### PERSONAL INFORMATION:

Edward L. Frome was born on April 19, 1942, in Baltimore, Maryland, and is married to Ann (Price); two children (Daniel and Julie).

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### EDUCATION:

(1960-64) B.S., Physics, University of Florida, Gainesville, Florida  
(1964-66) M.S., Statistics, University of Florida, Gainesville, Florida  
(1969-72) Ph.D., Statistics and Biometry, Emory University, Atlanta, Georgia  
(1972-73) Postdoctoral Fellow, Department of Anesthesiology, Emory University

### DISSERTATION:

Nonlinear Regression and Spectral Estimation in Biomedical Data Analysis (1972). Department of Statistics and Biometry, Emory University, Atlanta, Georgia.

### HONORS:

**Special Research Fellowship** from the National Institute of General Medical Sciences (5 FO3 GM 45025) - 1969-1972.

Elected **fellow** of *The American Statistical Association*, 1996

### TEACHING INTEREST:

Statistical data analysis, generalized linear models, biostatistics and statistical computing.

### RESEARCH INTEREST:

Nonlinear estimation, statistical computing and statistical data analysis. Development and/or application of statistical methods to problems in epidemiology and biology. Generally, my interest is in the use of statistics and computers in data analysis and problem solving.

PROFESSIONAL AFFILIATIONS:

American Statistical Association- Fellow  
Biometric Society - ENAR  
Radiation Research Society

PROFESSIONAL ACTIVITIES:

Associate Editor of *The American Statistician* (1983 - 1993 )

Statistical Consultant for *Radiation Research Society* ( 1991- )

Member of the Organizing Committee for the Coolfont Conference on the *Analysis and Assessment of Ionizing Radiation from Scientific and Statistical Perspectives* sponsored by the American Statistical Association, 1983 - 89.

Chairman of the Organizing Committee for the 1985 Coolfont Conference on Radiation and Health

Member of the Information Systems Working Group for the DOE Comprehensive Epidemiologic Data Resource (CEDR): 1990 - 1993

Member of the American Statistical Association Committee on Statistics and the Environment (1986-1988)

Member of the Statistics Test Panel for Data Management Systems in Genetic Toxicology, sponsored by the US EPA through Integrated Laboratory Systems (1987-1990)

GRANTS AND CONTRACTS:

Oak Ridge Associated Universities, Medical and Health Sciences Division (1977-81). Biostatistics Group Leader. Prepared proposals for periodic renewal of epidemiologic studies for U. S. Department of Energy ( Contract No. DE-AC05-760R0033), and made presentations before various review and advisory committees.

Oak Ridge National Laboratory, Mathematical Sciences Section, (1987- ). Prepare proposals for biostatistics research in the biological and environmental research program ( Principal investigator on DOE Work Proposals ERKP077 and EHHA077 ).

Co-Principal Investigator (with L. G. Littlefield) : "Cytogenetic Indices-Direct vs Indirect Radiation Action ", NIH, Dept. of Health and Human Services,1990-1994

PROFESSIONAL EXPERIENCE:

*July, 1981 to present*

**Senior Research Staff , Statistics Group, Mathematical Sciences Section, Oak Ridge National Laboratory.** My research is in biostatistics, statistical epidemiology, statistical computing, and the analysis of large-complex data sets. I am currently the leader of the

Section's Biometrics Project ( research in biostatistics and collaboration with scientists in the ORNL's Biology Division and Health and Safety Research Division ). I have developed regression methods for the analysis of discrete data, censored data, and for low-dose extrapolation. These methods are used in the analysis of biological experiments in radiation carcinogenesis, respiratory toxicology, and experimental genetics. I have developed new statistical methods for use in life table analysis in occupational epidemiology.

*April, 1986 to June, 1997 (Adjunct Associate Professor) July1, 1997 to date*

**Adjunct Professor, Department of Biostatistics, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.** I was a member of the Research Planning Group for the ORAU-UNC collaborative epidemiologic studies of nuclear industry employees (1980-1994). I worked with graduate students and faculty from the School of Public Health that are involved in these and subsequent related studies.

*June, 1977 to June, 1981*

**Biostatistics Section Leader, Epidemiology Group, Medical and Health Sciences Division of Oak Ridge Associated Universities.** I was responsible for the development of biostatistical methods required for Medical and Health Sciences Division's research programs. My principal areas of research were statistical epidemiology and cytogenetic dosimetry. I was responsible for the statistical analysis of data obtained in a large historical follow-up study of nuclear industry workers who had a potential for exposure to low level radiation and other hazardous materials. I was a consultant on statistical aspects of biomedical research problems and provided statistical data analysis support for Medical Division research programs.

*September, 1973 to May, 1977*

**Assistant Professor of Statistics, The University of Texas at Austin.** Teaching undergraduate and graduate courses (Sampling, Regression Analysis, Applied Time Series). Research Associate with Center for Cybernetic Studies and Drug Dynamics Institute. Research in statistical computing and biomedical data analysis. Specific results were the development of linear programming algorithms for least absolute values (L-1 Norm) regression, statistical estimation for nonlinear regression models and the development of new methods of analysis for use in bioavailability studies.

*September, 1972 to August, 1973*

**Postdoctoral Fellow in Department of Anesthesiology and Research Associate in the Department of Biometry, Emory University, Atlanta, Georgia.** Application of spectrum analysis to phonocardiography. Developed a method for real time analysis (during open heart surgery) of cardiac indicator-dilution curves. Also considered the development of other digital computer patient-monitoring procedures.

*September, 1969 to August, 1972*

**Research Fellow in the Department of Statistics and Biometry, Emory University, Atlanta, Georgia.** Completed course work and other training related to Ph.D. degree requirements, research which resulted in the development of new methods of biomedical data analysis.

*March, 1968 to August, 1969*

**Statistician in Marketing Research Department, Coca-Cola USA, Atlanta, Georgia.**

Developed methods for collection and analyzing similarity and preference data; the application of cluster analysis to marketing problems; and interactive computer forecasting models for seasonal sales data.

*July, 1966 to March, 1968*

**Statistician, Medical and Health Sciences Division, Oak Ridge Associated Universi-**

**ties.** Consulted with scientific staff on statistical problems. This included retrospective analysis of a large data base to examine the effect of therapeutic radiation on cancer patients and the development of new methods for analyzing pulmonary waveform data.

*September, 1964 to July, 1966*

**Graduate Assistant, Department of Statistics, University of Florida, Gainesville,**

**Florida.** Designed experiments for Florida Citrus Commission and assisted in undergraduate statistics course.

*September, 1961 to Summer, 1963*

**Summer Student, Martin-Marietta Company, Orlando, Florida.** Responsible for data collection in an experiment comparing programmed instruction with conventional methods.

## PUBLICATIONS

Frome, E. L. and Beauchamp, J. J. (1968), "Maximum Likelihood Estimation of Survival Curve Parameters," *Biometrics*, 24, 595-605.

Lushbaugh, C. C., Frome, E. L., Davis, H. T., and Bibler, D. S. (1969), "Power Spectrum of the Impedance Pneumograph: A Data Reduction System Producing an Analytical Parameter of Potential Clinical Usefulness," *Aerospace Medicine*, 30, 425-429.

Ricks, R. C., Lushbaugh, C. C., McDow, E., and Frome, E. (1972), "Pulmonary- Impedance Power Spectral Analysis: A Facile Means of Detecting Radiation- Induced Gastrointestinal Distress and Performance Decrement in Man," *Proceedings of the National Symposium on Natural and Man-made Radiation in Space*, ed., E. A. Warman, NASA TM X-2440.

Frome, E. L., Kutner, M. H., and Beauchamp, J. J. (1973), "Regression Analysis of Poisson-Distributed Data," *Journal of The American Statistical Association*, 68, 935-940.

Frome, E. L. (1974), "Algorithm AS 73: Cross-Spectrum Smoothing Via the Finite Fourier Transform," *Applied Statistics*, 23, 238-244.

Frome, E. L., and Frederickson, E. L. (1974), "Digital Spectrum Analysis of The First and Second Heart Sounds," *Computers and Biomedical Research* . 7, 421-432.

Frome, E. L., Frederickson, E. L., and Ricks, R. C. (1973), "Power Spectrum of the Respiratory System Via the Pulmonary Impedance Pneumograph," In: *Proc. Tenth Symposium on Biomathematics and Computer Science in the Life Sciences*, 8-9.

- Charnes, A., Frome, E. L. and Yu, P. L. (1976). "The Equivalence of Generalized Least Squares and Maximum Likelihood Estimation in the Exponential Family," *Journal of The American Statistical Association*, 71: 169-172.
- Armstrong, R. D. and Frome, E. L. (1976). "The Calculation of Least Absolute Value Estimators for Two-Way Tables," In: *Proc. Stat. Comput. Sec., Am. Stat. Assoc.*, Boston, MA, 101-106.
- Frome, E. L., Frederickson, E. L. and Lushbaugh, C. C. (1976). "Power Spectrum of the Respiratory System," *Biometrics*, 32: 423-428.
- Armstrong, R. D., and Frome, E. L. (1976), "A Branch and Bound Solution of a Restricted Least Squares Problem," *Technometrics*, 18, 447-450.
- Armstrong, R. D., and Frome, E. L. (1976), "A Comparison of Two Algorithms for Absolute Deviation Curve Fitting," *Journal of The American Statistical Association*, 71, 328-330.
- Armstrong, R. D., and Frome, E. L. (1977), "A Special Purpose Linear Programming Algorithm for Obtaining Least Absolute Value Estimators in a Linear Model with Dummy Variables," *Commun. Stat.*, B6(4), 383-398.
- Yakatan, G. J., Smith, R. B., Frome, E. L., and Dolluisio, J. T. (1977), "Pharmacokinetics of Orally Administered Hydroflumethiazide in Man," *J. Clin. Pharm.*, 17: 37-47.
- Frome, E. L., and Armstrong, R. D. (1977), "A Robust Procedure for Estimating the Trend-Cycle Component of an Economic Time Series," *Computer Science and Statistics: Tenth Annual Symposium on the Interface*, U.S. National Bureau of Standards Special Publication 503, 271-375.
- Armstrong, R. D., and Frome, E. L. (1978), "A Remark on Algorithm AS 108," *Applied Statistics*, 27, 378.
- Yakatan, G. J., Frome, E. L., Leonard, R. G., Shah, A. C., and Dolluisio, J. T. (1978), "Bioavailability of Acetazolamide Tablets," *J. Clin. Pharm. Sci.*, 67, 252-255.
- Armstrong, R. D., and Frome, E. L. (1979), "Least Absolute Value Estimators for One-Way and Two-Way Tables," *Nav. Log. Res. Quart.*, 26, 79-96.
- Armstrong, R. D., Frome, E. L., and Kung, D. S. (1979), "A Revised Simplex Algorithm for the Absolute Deviation Curve Fitting Problem," *Commun. Stat.*, 8B, 175-190.
- DuFrain, R. J., Littlefield, L. G., Joiner, E. E., and Frome, E. L. (1979), "Human Cytogenetic Dosimetry: A Dose Response Relationship for Alpha Particle Radiation from Americium-241," *Health Physics*, 37, 279-289.
- Frome, E. L., and DuFrain, R. D. (1979), "Estimation of the Amount of Exposure to an Environmental Clastogen Using Human Cytogenetic Dosimetry," *Proceedings of the 1978 DOE Statistical Symposium*, November 1-3, Albuquerque, NM, 169-172.

- DuFrain, R. J., Littlefield, L. G., Joiner, E. E., and Frome, E. L. (1980), "In Vitro Human Cytogenetic Dose Response Systems," *The Medical Basis for Radiation Accident Preparedness, Proc. Int. Conf. Oak Ridge, TN 1979*, eds., K. F. Hubner and S. A. Fry, 357-374.
- Frome, E. L., and Hudson, D. R. (1980), "A Jackknife Procedure for Estimating Standardized Mortality Ratios," *Proceedings of the American Statistical Association, Computing Section*, August 13-16, Washington, DC, 323-327.
- Frome, E. L., and Khare, M. (1980), "Comments on Brodsky's Statistical Methods for Evaluating Epidemiological Results (Letter to the Editor)," *Health Phys.*, 39, 695-697.
- Frome, E. L., and Yakatan, G. J. (1980), "Statistical Estimation of the Pharmacokinetic Parameters in the One-Compartment Open Model," *Commun. Stat.*, B9(3), 201-222.
- Polednak, A. P., and Frome, E. L. (1980), "Mortality Among Men Employed (Between 1943 and 1947) at a Uranium-Processing Plant," *Proceedings of the 1979 DOE Statistical Symposium*, Gatlinburg, TN, 116-127.
- Armstrong, R. D., Frome, E. L., and Sklar, M. G. (1981), "Linear Programming in Exploratory Data Analysis," *Journal of Educational Statistics*, 5, 293-308.
- Frome, E. L. (1981), "Poisson Regression Analysis," *The American Statistician*, (35): 262-263).
- Frome, E. L. (1981), AS335: A Remark on AS 73: Cross-Spectrum Smoothing via the Finite Fourier Transform," *Applied Statistics*, 30, 354.
- Frome, E. L., and Hudson, D. R. (1981), "A General Statistical Data Structure for Epidemiologic Studies of DOE Workers," *Proceedings of the 1980 DOE Statistical Symposium*, October 29-31, Oakland/Berkeley, CA, 206-218.
- Frome, E., and Hudson, D. (1981), "Interval Estimation for X-Predictions When the Dependent Variable Follows the Poisson Distribution," *Proc. of the Am. Stat. Assoc., Statistical Computing Section*, August 11-14, Houston, TX, 294-297.
- Polednak, A. P., and Frome, E. L. (1981), "Mortality Among Men Employed Between 1943 and 1947 at a Uranium-Processing Plant," *Journal of Occupational Medicine*, 23, 169-178.
- DuFrain, R. J., Littlefield, L. G., Wilmer, J. L., and Frome, E. L. (1982), "Evaluation of Chemically Induced Cytogenetic Lesions in Rabbit Oocytes, II, A Comparison of Streptonigrin Effects on Somatic and Germ Cells," *Mutation Research*, 94: 103-114.
- Frome, E. L. (1982), "Fisher's Exact Variance Test for the Poisson Distribution," *Applied Statistics*, 31: 67-71.
- Littlefield, L. G., Colyer, S. P., Joiner, E. E., DuFrain, R. J., Frome, E. L., and Cohen, M. M. (1982), "Chromosomal Radiation Sensitivity in Ataxia Telangiectasia Long-Term, Lymphoblastoid Cell Lines," *Cytogenetics and Cell Genetics*, 31: 203-213.
- Holland, J.M. and Frome, E.L. (1983), "Statistical Evaluations in the Carcinogenesis of Bioassay of

- Petroleum Hydrocarbons," In: *Adv in Modern Env Toxicol, Applied Toxicology of Hydrocarbons*, MacFarland, H.N. et al, ed., Princeton, New Jersey, Vol. VI, pp. 151-166.
- Frome, E. L. (1983), "The Analysis of Rates Using Poisson Regression Models," *Biometrics*, 39: 665-674.
- Lushbaugh, C. C., Fry, S. A., Shy, C. M. and Frome, E. L. (1983), "DOE Health and Mortality Study at Oak Ridge," In: *Health Physics Society: Epidemiology Applied to Health Physics, Proceedings of the Sixteenth Midyear Topical Symposium*, U.S. Department of Energy Report, CONF-830101, pp. 105- 114, Albuquerque, NM 1983.
- Frome, E. L. and McLain, R. (1984), "A SAS Macro for Fitting Nonlinear Models to Poisson Distributed Data," In: *Proceedings of the Ninth Annual SUGI Conference*, Hollywood Beach, Florida, pp. 883-883.
- Frome, E. L. (1984), "Response to Nelder's Reaction on Poisson Rate Analysis," *Biometrics*, 40: 1160-1162.
- Frome, E. L. and Checkoway, H. (1985), "The Use of Poisson Regression Models in Estimating Incidence Rates and Ratios," *American Journal of Epidemiology*, 309-323.
- Frome, E. L. (1986), "Regression Methods for Binomial and Poisson Distributed Data," In: *Proceedings of American Association of Physicists in Medicine First Midyear Topical Symposium on Multiple Regression Analysis, Applications in the Health Sciences*, Herbert, D., and Meyers, R., eds., The American Institute of Physics, New York, 84-123.
- Frome, E. L. and DuFrain, R. J. (1986), "Maximum Likelihood Estimation for Cytogenetic Dose-Response Curves," *Biometrics*, 42: 73-84 .
- Lindenschmidt, R. C., Tryka, A. F., Godfrey, G. A., Frome, E. L., and Witschi, H., (1986), "Intra-tracheal versus Intravenous Administration of Bleomycin in Mice: Acute Effects," *Toxicol. Appl. Pharmacol.*, vol. 85, pp. 69-77.
- McLain, R. and Frome, E.L. (1986), "A System for the Analysis of Cohort Mortality Data", in *SAS Users Group International Proceedings*, 874-876.
- Littlefield, L.G., Joiner, E.E., Colyer, S.P., and Frome, E.L., (1987), "Effects of Cryopreservation on the Recovery of Radiation-Induced Chromosome Aberrations in Human Lymphocytes," *Radiation Protection Dosimetry Journal*, 18: 25-29.
- Witschi, H., Godfrey, G. A., Frome, E. L., and Lindenschmidt, R. C., (1987), "Pulmonary Toxicity of Cytostatic Drugs: Cell Kinetics", *Fundamental and Applied Toxicology* ,8: 253-262.
- Carpenter, A.V., Flanders, W.D., Frome, E.L., Crawford-Brown, D.J., and Fry, S.A. (1987), "Central Nervous System Cancers and Radiation Exposures: A Case-Control Study Among Workers at Two Nuclear Facilities," *Journal of Occupational Medicine*, 29: 601-604.
- Witschi, H.P., Smith, L.H., Frome, E.L., Pequet-Goad, M.E., Griest, W.H., Ho, C.H., Guerin, M.R. (1987), "Skin Tumorigenic Potential of Crude and Refined Coal Liquids and Analogous Petroleum Products", *Fundamental and Applied Toxicology* ,9: 297-303.

- Carpenter,A.V., Flanders,W.D., Frome,E.L., Cole,P.,and Fry,S.A. (1987), "Brain Cancer and Non-occupational Risk Factors : A Case-Control Study Among Workers at Two Nuclear Facilities," *The American Journal of Public Health*,77: 1180-1182.
- Littlefield, L.G.,Joiner,E.E ,Colyer,S.P., Sayer,A.M. and Frome,E.L.(1988), "Modulation of Radiation-Induced Chromosome Aberrations By DMSO- An OH Radical Scavenger," *The International Journal of Radiation Biology* ,53: 875-890.
- Carpenter,A.V., Flanders,W.D., Frome,E.L., Tankersley, W.G.,and Fry,S.A. (1988), "Chemical Exposures and Central Nervous System Cancers: A Case-Control Study Among Workers at Two Nuclear Facilities," *The American Journal of Industrial Medicine*,13:351-362.
- Frome, E. L., and Morris, M. D. (1989), "Evaluating Goodness of Fit of Poisson Regression Models in Cohort Studies",*The American Statistician*,43:144-147.
- Littlefield, L. G., Sayer, A. M.,and Frome, E. L. (1989), "Comparisons of Dose Response Parameters For Radiation-Induced Acentric Fragments and Micronuclei Observed in Cytokinesis-Arrested Lymphocytes", *Mutagenesis*,4:265-270.
- Ostrouchov, G. and Frome, E. (1989), "A Model Search Procedure for Hierarchical Log-Linear Models",*Proceedings Of Statistical Computing Section of American Statistical Assoc*,277-282.
- Frome, E.L., Cragle ,D.L., and McLain,R. (1990), "Poisson Regression Analysis of The Mortality Among a Cohort of World War II Nuclear Industry Workers ", *Radiation Research*,123:138-152.
- Frome, E. L., (1991), "Statistical Analysis of Cytogenetic Dose-Response Curves," in *Statistical Methods in Toxicological Research*, eds. D. Krewski and C. Franklin, Gordon & Breach Science Publications, Inc., 281-298.
- Wing,S., Shy,C.M., Wood,J., Wolf, S., Cragle, D.,and Frome, E.(1991), "Mortality Among Workers at Oak Ridge National Laboratory: Evidence of Radiation Effects in Follow-up Through 1984" *Journal of The American Medical Association*,256:1397-1402.
- Generoso,W.M., Cain,K.T., Cornett,C.V., and Frome,E.L.(1991), "Comparison of Two Stocks of Mice in Spermatogonial response to Different Conditions of Radiation Exposure",*Mutation Research*,249,301-310.
- Littlefield,L.G., Sayer,A.M., Sallam,F., Frome,E.L., and Kleinerman,R.A., (1992),"Experience With The Cytochalasin-B Method for Quantifying Radiation Induced Micronuclei in Human Lymphocytes" *Proc. International Congress of Radiation Research*, Toronto, Canada, pp 183-188.
- Ostrouchov, G. and Frome, E. (1993), "A Model Search Procedure for Hierarchical Models",*Computational Statistics and Data Analysis*, 15, 285-296.
- Littlefield, L.G.,Joiner,E.E ,Colyer,S.P.,Sallam,F., and Frome,E.L.(1993), "Concentration Dependent Protection Against X-ray Induced Chromosome Aberrations in Human Lymphocytes by The Aminothiols WR-1065" *Radiation Research* 133, 88-93.

- Wing,S., Shy,C.M., Wood,J., Wolf, S., Cragle, D.,and Frome, E. (1993), "Job Factors, Radiation and Cancer Mortality at Oak Ridge National Laboratory: Follow-up Through 1984",*American Journal of Industrial Medicine* 23, 265-279.
- Frome,E.L., Smith,M.,Littlefield,G.,Neubert,R. and Colyer,S. (1994) , "Statistical Methods For The Analysis of a Screening Test For Chronic Beryllium Disease",*ORNL-6818* , pp 1-61.
- Littlefield, L.G.,Joiner,E.E ,Colyer,S.P., and Frome,E.L.(1994), "Radioprotective Chemicals as Tools for Studying Mechanisms of Radiation-Induced Chromosome Damage in Human Lymphocytes" in *Chromosomal Alterations*, eds. G. Obe and A. T. Natarajan,Springer-Verlag,New York, pp 132-139.
- Fry SA, Cragle DL, Crawford-Brown DJ, Dupree EA, Frome EL, Gilbert ES,*et al.* (1995), "Health and Mortality Among Contractor Employees at US Department of Energy Facilities", in *Radiation and Public Perception Benefits and Risks, Advances in Chemistry Series*, eds.Young JP and Yalow RS, American Chemical Society, Washington, DC, 239-258.
- Frome,E.L., Smith,M.,Littlefield,G.,Neubert,R. and Colyer,S. (1996) , "Statistical Methods for the Blood Beryllium Lymphocyte Proliferation Test ", *Environmental Health Perspectives, Vol 105, Supplement 5*,957-968 .
- Frome, E.L., Cragle, D.L., Watkins, J., Wing, S., Shy, S., Tankersley, W., and West, C. (1997), "A Mortality Study of Employees of the Nuclear Industry in Oak Ridge, Tennessee",*ORNL 6785* , pp 1-58. (See URL: <http://www.epm.ornl.gov/frome/ORMS>)
- Watkins,J.P., Reagan, J.L., Cragle, D.L.,Frome, E.L., West, C.M., Crawford-Broen,D. , and Tankersley, W.G. (1997), "Collection, Validation, and Treatment of Data for a Mortality Study of Nuclear Industry Workers ", *Applied Occupational and Environmental Hygiene*,12:195-205.
- Mitchell,T.J., Ostrouchov,G., Frome, E. and Kerr, G. (1997),"A Method For Estimating Occupational Dose To Individuals, Using Weekly Dosimetry Data", *Radiation Research*,147:195-207.
- Frome, E.L., Newman L.S.,and Mroz M.M. (1997), "Results of the Analysis of The Blood Lymphocyte Proliferation Test Data From The National Jewish Center", *ORNL TM-13338*,pp 1-37.
- Frome, E.L., Cragle, D.L., Watkins, J., Wing, S., Shy, S., Tankersley, W., and West, C. (1997), "A Mortality Study of Employees of the Nuclear Industry in Oak Ridge, Tennessee",*Radiation Research*,148:64-80.