

## AJIT C. TAMHANE

### EDUCATION:

- Ph.D. (1975), M.S. (1973), Cornell University, Ithaca, NY, Major: Statistics and O.R.
- B. Tech. (First Class Honors), (1968), Indian Institute of Technology, Bombay, India, Major: Mechanical Engineering

### PROFESSIONAL EXPERIENCE:

- Northwestern University, Department of Industrial Engineering and Management Sciences: Assistant Professor (1975–1979), Associate Professor (1979–1987), Professor (1987–Present), Chairman (2001 -Present)
- Northwestern University, Department of Statistics: Associate Professor (1986–1987), Professor (1987–Present)
- Cornell University, School of Operations Research and Industrial Engineering: Visiting Associate Professor (1982–1983)
- Larson and Toubro, Ltd. (Bombay, India): Design Engineer (1968–1970)

### HONORS AND AWARDS:

- Fellow of the American Statistical Association (1991)
- Winner of the Youden Award for the best expository paper published in *Technometrics* (1985)

### RESEARCH INTERESTS:

- Mathematical Statistics: Multiple Comparisons; Design of Experiments; Ranking and Selection Procedures
- Applied Statistics: Multiplicity Problems in Biopharmaceutical Studies; Biomedical Applications; Chemical Engineering Applications; Quality Control

### BOOKS AND MONOGRAPHS:

- *Design of Experiments: Ranking and Selection (Essays in Honor of Robert E. Bechhofer)*, Marcel-Dekker, (1984), co-edited with T. J. Santner
- *Multiple Comparison Procedures*, John Wiley, (1987), co-authored with Y. Hochberg
- *Statistics and Data Analysis: From Elementary to Intermediate*, co-authored with D. Dunlop, Prentice Hall (2000).
- *Design of Experiments: Theory and Methods*, in preparation.

## RESEARCH PAPERS:

### Multiple Comparisons and Designing Experiments for Multiple Comparisons

1. "Multiple comparisons in model I one-way ANOVA with unequal variances," *Communications in Statistics, Ser. A* (1977), **6**, 15–32
2. "A comparison of procedures for multiple comparisons of means with unequal variances," *Journal of the American Statistical Association* (1979), **74**, 471–480
3. "Incomplete block designs for comparing treatments with a control: General theory," (with R. E. Bechhofer), *Technometrics* (1981), **23**, 45–57
4. "Design of experiments for comparing treatments with a control: Tables of optimal allocations of observations," (with R. E. Bechhofer), *Technometrics* (1983), **25**, 87–95
5. "Balanced treatment incomplete block (BTIB) designs for comparing treatments with a control: Minimal complete sets of generator designs for  $k = 3, p = 3(1)10$ ," (with W. I. Notz), *Communications in Statistics, Ser. A*, (1983), **12**, 1391–1412
6. "Incomplete block designs for comparing treatments with a control (II): Optimal designs for  $p = 2(1)6, k = 2$  and  $p = 3, k = 3$ ," (with R. E. Bechhofer), *Sankhyā, Ser. B* (1983), **45**, 193–224
7. "Multiple comparisons in a mixed model," (with Y. Hochberg), *The American Statistician* (1983), **37**, 305–307
8. "Tables of admissible and optimal BTIB designs for comparing treatments with a control," (with R. E. Bechhofer), *Selected Tables in Mathematical Statistics* (1985), **8**, 41–139
9. "An optimal procedure for partitioning a set of normal populations with respect to a control," *Sankhyā, Ser. A* (1987), **49**, 335–346
10. "Discussion of the paper 'Optimal designs for comparing treatments with controls' by A. S. Hedayat, M. Jacroux and D. Majumdar," (with R. E. Bechhofer), *Statistical Science* (1988), **3**, 477–480
11. "Two-stage procedures for comparing treatments with a control: Elimination at the first stage and estimation at the second stage," (with R. E. Bechhofer and C. W. Dunnett), *Biometrical Journal* (1989), **31**, 545–561
12. "Sample size determination for step-down multiple test procedures: Orthogonal contrasts and comparisons with a control," (with A. J. Hayter), *Journal of Statistical Planning and Inference* (1990), **27**, 271–290
13. "Step-down multiple tests for comparing treatments with a control in unbalanced one-way layouts," (with C. W. Dunnett), *Statistics in Medicine* (1991), **10**, 939–947
14. "A step-up multiple test procedure," (with C. W. Dunnett), *Journal of the American Statistical Association*, (1992), **87**, 162–170
15. "A Bayesian approach to comparing treatments with a control," (with G. V. S. Gopal) (1992), *Multiple Comparisons, Selection and Applications to Biometry, A Festschrift in Honor of Charles W. Dunnett*, (Ed. F. Hoppe), Marcel-Dekker, 267–292
16. "Comparisons between a new drug and active and placebo controls in an efficacy clinical trial," (with C. W. Dunnett), *Statistics in Medicine*, (1992), **11**, 1057–1063

17. "Power comparisons of some step-up multiple test procedures," (with C. W. Dunnett), *Statistics and Probability Letters*, (1993), **16**, 55–58
18. "Step-up multiple testing of parameters with unequally correlated estimates," (with C. W. Dunnett), *Biometrics*, (1995), **51**, 217–227
19. "Row column designs for comparing treatments with a control," (with D. Majumdar), *Journal of Statistical Planning and Inference*, (1996), **49**, 387–400
20. "Multiple test procedures for dose finding," (with Y. Hochberg and C. W. Dunnett), *Biometrics*, (1996), **52**, 21–37
21. "Multiple comparisons," A chapter in *Handbook of Statistics*, vol. 13 (Eds. S. Ghosh and C. R. Rao), (1996), 587– 630
22. "Multiple testing to establish superiority/equivalence of a new treatment with  $k$  standard treatments," (with C. W. Dunnett), *Statistics in Medicine*, (1997), **16**, 2489– 2506
23. "A generalized step-up-down multiple test procedure," (with W. Liu and C. W. Dunnett), *Canadian Journal of Statistics*, (1998), **26**, 353–363
24. "Some new multiple test procedures for dose finding," (with C. W. Dunnett), *Journal of Biopharmaceutical Statistics*, (1998), **8**, 353–366
25. "Stepwise multiple test procedures with biometric applications," (with C. W. Dunnett), *Journal of Statistical Planning and Inference*, (1999), **82**, 55–68
26. "Multiple test procedures for identifying the maximum safe dose," (with C. W. Dunnett, J. Green and J. Wetherington), *Journal of the American Statistical Association*, (2001), **96**, 835–843
27. "Combining global and marginal tests to compare two treatments on multiple endpoints," (with B. R. Logan), *Biometrical Journal*, (2001), **43**, 591–604
28. "Nonparametric multiple comparisons in repeated measures designs for data with ties," (with U. Munzel), *Biometrical Journal*, (2002), **44**, 762–779
29. "Multiple test procedures for identifying the minimum effective and maximum safe doses of a drug," (with B. R. Logan), *Journal of the American Statistical Association*, (2002), **97**, 293 -301
30. "Accurate critical constants for the one-sided approximate likelihood ratio test of a normal mean vector when the covariance matrix is estimated," (with B. R. Logan), *Biometrics*, (2002), **58**, 176 -182
31. "On O'Brien's OLS and GLS tests for multiple endpoints," (with B. R. Logan), in "Recent Developments in Multiple Comparison Procedures," IMS Lecture Notes and Monograph Series (Eds.: Y. Benjamini, F. Bretz and S. Sarkar), (2004), 76-88
32. "A superiority-equivalence approach to one-sided tests on multiple endpoints," (with B. R. Logan), *Biometrika*, (2004), **91**, 715-727
33. "Comparing variances of several measurement methods using a randomized block design with repeat measurements: A case study," (with A. J. Hayter), in "Advances in Ranking and Selection, Multiple Comparisons and Reliability (Essays in Honor of S. Panchapkesan)," Birkhäuser/Springer-Verlag, (2004), 165-178
34. "Finding the maximum safe dose for heteroscedastic data," (with B. R. Logan), *Journal of Biopharmaceutical Statistics*, (2004), **14**, 843–856

35. "Power and sample size determination for a multiple test procedure for finding the maximum safe dose," (with K. S. Shi and K. Strassburger), to appear in *Journal of Statistical Planning and Inference*, Special Issue in Memory of Shanti S. Gupta
36. "Discussion of 'False Discovery Rate Adjusted Multiple Confidence Intervals for Selected Parameters' by Y. Benjamini and D. Yekutieli," to appear in *Journal of the American Statistical Association*, (2005), **100**
37. "Multiple comparison procedures for dose response studies," (with B. R. Logan), to appear in "Design and Analysis of Dose Response Clinical Trials," (Ed. N. Ting), Birkhäuser/Springer-Verlag

### Ranking and Selection Procedures

38. "An iterated integral representation for a multivariate normal integral having block covariance structure," (with R. E. Bechhofer), *Biometrika* (1974), **61**, 615–619
39. "A three-stage elimination type procedure for selecting the largest normal mean (common unknown variance)," *Sankhyā, Ser. B* (1976), **38**, 339–349
40. "Ranking and selection problems for normal populations with common known coefficient of variation," *Sankhyā, Ser. B* (1977), **39**, 344–361
41. "A two-stage minimax procedure with screening for selecting the largest normal mean," (with R. E. Bechhofer), *Communications in Statistics, Ser. A* (1977), **6**, 1003–1033
42. "A two-stage minimax procedure with screening for selecting the largest normal mean (II): An improved PCS lower bound and associated tables," (with R. E. Bechhofer), *Communications in Statistics, Ser. A* (1979), **8**, 337–358
43. "Selecting the better Bernoulli treatment using a matched samples design," *Journal of the Royal Statistical Society, Ser. B* (1980), **42**, 26–30
44. "On a class of multistage selection procedures with screening for the normal means problem," *Sankhyā, Ser. B* (1980), **42**, 197–216
45. "Designing experiments for selecting a normal population with a large mean and a small variance," (with T. J. Santner), *Design of Experiments: Ranking and Selection* (Eds. T. J. Santner and A. C. Tamhane), Marcel-Dekker, (1984), 179–198
46. "Some sequential procedures for selecting the better Bernoulli treatment by using a matched samples design," *Journal of the American Statistical Association* (1985), **80**, 455–460
47. "A survey of literature on quantal response curves with a view toward application to the problem of selecting the curve with the smallest q-quantile (ED100q)," *Communications in Statistics, Ser. A* (1986), **15**, 2679–2718
48. "Designing experiments for selecting the largest normal mean when the variances are known and unequal: Optimal sample size allocation," (with R. E. Bechhofer and A. J. Hayter), *Journal of Statistical Planning and Inference* (1991), **28**, 271–289

## Chemical Engineering Applications and Quality Control

49. "Detection of gross errors in process data," (with R. S. H. Mah), *AIChE Journal* (1982), **28**, 828–830
50. "Performance studies of the measurement test for detection of gross errors in process data," (with C. Iordache and R. S. H. Mah), *AIChE Journal* (1985), **27**, 1187–1201
51. "Data reconciliation and gross error detection in chemical process networks," (with R. S. H. Mah), *Technometrics* (1985), **27**, 409–422
52. "A composite statistical test for detecting changes of steady states," (with S. Narasimhan, R. S. H. Mah, J. W. Woodward and J. C. Hale), *AIChE Journal* (1986), **32**, 1409–1418
53. "A Bayesian approach to gross error detection in chemical process data (I): Model development," (with C. Iordache and R. S. H. Mah), *Chemometrics and Intelligent Laboratory Systems* (1988), **4**, 33–45
54. "A Bayesian approach to gross error detection in chemical process data (II): Simulation results," (with C. Iordache and R. S. H. Mah), *Chemometrics and Intelligent Laboratory Systems* (1988), **4**, 131–146
55. "Gross error detection in serially correlated process data," (with C. J. Kao and R. S. H. Mah), *Industrial and Engineering Chemistry Research* (1990), **29**, 1004–1012
56. "Gross error detection in serially correlated process data (II): Dynamic systems," (with C. J. Kao and R. S. H. Mah), *Industrial and Engineering Chemistry Research*, (1992), **31**, 254–262
57. "A general prewhitening procedure for process and measurement noises," (with C. J. Kao and R. S. H. Mah), *Chemical Engineering Communications*, (1992), **118**, 49–57
58. "Process trending with piecewise linear smoothing," (with R. S. H. Mah, A. Patel and S. H. Tung), *Computers and Chemical Engineering*, (1995), **19**, 127–136
59. "Nonlinear partial least squares," (with E. Malthouse and R. S. H. Mah), *Computers and Chemical Engineering*, (1997), **21**, 875–890
60. "Control charts for autocorrelated process data," (with E. Malthouse), (1997), Chapter 24 in *Advances in Statistical Decision Theory and Applications* (eds. S. Panchapakesan and N. Balakrishnan), Amsterdam: North Holland, 371–385.
61. "The beta distribution as a latent response model for ordinal data (I): Estimation of location and dispersion parameters," (with B. A. Ankenman and Y. Yang), *Journal of Statistical Computing and Simulation*, (2002), **72**, 473 - 494.
62. "The beta distribution as a latent response model for ordinal data (II): Testing of location and dispersion parameters," (with B. A. Ankenman and Y. Yang), in preparation.

## Biomedical Applications

63. "Conflicting birthweight and infant mortality trends in a high-risk urban neighborhood," (with J. Reis and S. R. Pliska), Center for Health Services and Policy Research Tech. Report (1985), Northwestern University

64. "Comparison of the hamster sperm motility assay to the mouse one-cell and two-cell embryo bioassays as quality control tests for in vitro fertilization," (with M. J. Gorrill, J. S. Rinehart and M. Gerrity), *Fertility and Sterility* (1991), **55**, 345–354
65. "Clinical assessment of venous thromboembolic risk in surgical patients," (with J. A. Caprini, J. I. Arcelus, J. H. Hasty and F. Fabrega), *Seminars in Thrombosis and Hemostasis* (1991), **17(3)**, 304–312
66. "A model-based approach for estimating the AIDS-free time distribution using longitudinal data," (with D. D. Dunlop, J. Chmiel and J. P. Phair), *Journal of Biopharmaceutical Statistics*, (1994), **4**, 129–146
67. "Dry pea (*Pisum sativum* L) response to low rates of selected foliar- and soil-applied sulfonyleurea and growth regulator herbicides," (with K. Al-Khatib), *Weed Technology* (1999), **13**, 753–758

### Statistical Inference and Other Topics

68. "Inference based on regression estimator in double sampling," *Biometrika* (1978), **65**, 419–427
69. "Randomized response techniques for multiple sensitive attributes," *Journal of the American Statistical Association* (1981), **76**, 916–923
70. "A note on the use of residuals for detecting an outlier in linear regression," *Biometrika* (1982), **69**, 488–489
71. "Exact repeated confidence intervals for Bernoulli parameters in a group sequential clinical trial," (with P. R. Coe), *Controlled Clinical Trials*, (1993), **14**, 19–29
72. "Small sample confidence intervals for the difference, ratio and odds ratio of two success probabilities," (with P. R. Coe), *Communications in Statistics, Series B (Comp. and Simula.)* (1993), **22**, 925–938

### TECHNICAL REPORTS AND OTHER PUBLICATIONS:

1. "On minimax multistage screening type rules for selecting the largest normal mean," Ph.D. Dissertation (1975), Cornell University
2. "A minimax two-stage permanent elimination type procedure for selecting the smallest normal variance," Tech. Report No. 260 (1975), Dept. of Operations Research, Cornell University
3. "A randomized response technique for investigating several sensitive attributes," *ASA Proceedings of Social Statistics* (1977), 273–278
4. "A simplified approach to the maximum likelihood estimation of the covariance matrix," Letter to the Editor, *The American Statistician* (1979), **33**, 92–93
5. "Selecting the normal population with the smallest coefficient of variation," (with A. J. Hayter), Dept. of Statistics Tech. Report (1988), Northwestern University
6. Review of the book "*Design and Analysis of Experiments for Statistical Selection, Screening and Multiple Comparisons*" by R. E. Bechhofer, T. J. Santner and D. M. Goldsman, *Technometrics* (1996), **38**, 289–290
7. "A multiple comparison procedure for three- and four- armed controlled clinical trials," (with L. A. Hothorn), Letter to the Editor, *Statistics in Medicine* (2001), **20**, 317–318

## **SPONSORED RESEARCH:**

1. DuPont, “Finding the maximum safe dose levels for heteroscedastic or ordinal data,” July 2000 – June 2003.
2. NSF (Div. of Undergraduate Education), “Quality Engineering Laboratory,” (with B. Ankenman), 9/1/97–8/31/00
3. DuPont, “Multiple test procedures for dose finding in safety assessments of crop protection compounds,” 8/1/96– 7/31/97
4. NSF (Mathematical Sciences), “Mathematical Sciences Computing Research Environments,” (with M. Tanner, S. Haberman and T. Severini), 8/1/95–7/31/97
5. Northrop Corporation, “Statistical analysis of MANTECH data,” 2-93 to 3-94
6. British Science and Engineering Research Council: Visiting research fellowship, School of Mathematics, University of Bath, 6–88 to 9–88
7. NSF, “Development of computing aids and techniques for process analysis,” 2–86 to 1–89. (co-P.I. with R. S. H. Mah)
8. Ford Foundation, “City of Chicago’s demonstration/evaluation initiative under the maternal and child health block grant program,” Faculty Participant, Center for Health Services and Policy Research, 10–83 to 7–87
9. NSF, “Statistical multiple comparisons of several competing treatments,” 4–77 to 8–79
10. Office of Research and Sponsored Programs, Northwestern University, Faculty research grants in Summer 1975 and academic years 1976–77, 1980–82

## **TEACHING AWARDS:**

- Voted as one of the outstanding professors at Northwestern in 1983–84 by a survey of undergraduates and listed in the Associated Student Government Faculty Honor Roll
- The first Graduate Teaching Award in 1987–88 sponsored by the ORSA Student Chapter at Northwestern

## **GRADUATE STUDENT SUPERVISION:**

### **• Ph.D. Students Supervised or Under Supervision**

1. C. Iordache, “A Bayesian Approach to Gross Error Detection in Process Data,” (co-advisor with R. S. H. Mah), Chem. Engg., March 1987
2. De Juran Richardson, “A Parametric Group Sequential Procedure for Comparing Survival Distributions of Two Treatments,” Mathematics, May 1987
3. Paul Coe, “Exact Repeated Confidence Intervals for Binomial Parameters in Group Sequential Experiments,” Statistics, October 1988
4. Dorothy Dunlop, “Developing Risk Factor and Disease Progression Marker Models for Longitudinal Cohort Data with Survival Endpoint,” IE/MS, November 1990
5. C. J. Kao, “Gross Error Detection in Serially Correlated Process Data for Static and Dynamic Processes,” (co-advisor with R. S. H. Mah), Chem. Engg., February 1991
6. G. V. S. Gopal, “A Bayesian Approach to Comparing Treatments with a Control,” IE/MS, December 1991

7. Edward Malthouse, "Nonlinear Partial Least Squares Using Neural Networks," (co-advisor with R. S. H. Mah), Statistics, August 1995
8. Brent Logan, "Contributions to Multiple Endpoints and Dose Finding," Statistics, June 2001
9. Ying Yang, "Identifying Location and Dispersion Effects for Ordinal Data from Industrial Experiments," IE/MS (co-advisor with B. Ankenman), December 2002
10. Kunyang Shi, "Topics in Multiple Endpoints and Dose Finding," Statistics, December 2004 (Expected)
11. Jiaxiao Shi, "Application of False Discovery Rate in Drug Screening," Statistics, August 2005 (Expected)
12. Dingxi Qui, "Cluster Analysis," (co-advisor with B. Ankenman), IE/MS, August 2005 (Expected)
13. Cindy Wang, "Multiple Endpoints, Statistics, August 2006 (Expected)

• **M.S. Thesis Committees Served On**

Barbara Grabowski (IE/MS), Byung Ho Kim (IE/MS), C. Iordache (Chem. Engg.), S. Narasimhan (Chem. Engg.), A. Kretsovalis (Chem. Engg.), J. Rosenberg (Chem. Engg.), D. Brickman (Mech. Engg.)

• **Ph.D. Thesis Committees Served On**

Bryan Deurmeyer (IE/MS), Kathleen Flaherty (IE/MS), Hernando Gomez (Psychology), George Knafl (Mathematics), Dorothy Karlsen (Education), S. Narasimhan (Chem. Engg.), A. Kretsovalis (Chem. Engg.), Molly Walsh (Statistics), Daniel Hall (Statistics), Jun Ku Park (Chem. Engg.), Kris Hoyer (IE/MS), Jill Glassman (Statistics), S. H. Tung (Chem. Engg.), Justin Boesel (IE/MS), William McDaniel (IE/MS), Ana Ivelisse Aviles (IE/MS), Hui Liu (IE/MS), Seong-Hee Kim (IE/MS), Bahar Deler (IE/MS), C. W. Shen (IE/MS), Hong Wan (IE/MS), Jeff Hong (IE/MS)

**SEMINARS AT UNIVERSITIES AND PROFESSIONAL MEETINGS:**

1. *Multistage Elimination Type Procedures for Selecting the Largest Normal Mean*
  - Ohio State University (Statistics Dept.), March 1974
  - Northwestern University (IE/MS Dept.), April 1974
  - Johns Hopkins University (Math. Sciences Dept.), April 1974
  - IMS Annual Meeting (Contributed Talk), Atlanta, August 1975
2. *Multiple Comparisons in Model I One-Way ANOVA with Unequal Variances*
  - IMS Annual Meeting (Contributed Talk), New Haven, August 1976
  - Northwestern University (Statistics Seminar), November 1976
3. *Randomized Response and Weighing Design Techniques for Multiple Sensitive Attributes*
  - ASA Annual Meeting (Contributed Talk), Chicago, August 1976
  - Northwestern University (Statistics Seminar), March 1977
4. *Inference Based on Regression Estimator in Double Sampling*
  - Northwestern University (Statistics Seminar), October 1977
5. *Multiple Comparisons of Regression Models Based on Integrated Mean Square Prediction Error Criterion*
  - University of Kentucky (Statistics Dept.), November 1977

6. *A Comparison of Procedures for Multiple Comparisons of Means with Unequal Variances*
  - Western Regional Meeting of IMS and WNAR (*Invited Talk*), Los Angeles, June 1979
7. *Incomplete Block Designs for Comparing Treatments with a Control*
  - Northwestern University (Statistics Seminar), February 1979
  - Northwestern University (ORSA Brown Bag Seminar), April 1979
  - University of Bombay (Statistics Dept.), April 1979
  - I. I. T., Bombay (Mathematics Dept.), India, April 1979
  - Rensselaer Polytechnic Institute (Statistics and OR Dept.), March 1984
8. *Designing Experiments for Selecting the Best of Several Normal Populations with Known Unequal Variances: Optimal Sample Size Allocation*
  - Joint Annual Statistical Meetings (*Invited Talk*), Houston, August 1980
  - Cornell University (Statistics Seminar), November 1982
  - University of Rochester (Statistics Dept.), November 1982
  - Syracuse University (Mathematics Dept.), January 1983
  - McMaster University (Math. Sciences Dept.), March 1983
  - University of Bombay (Statistics Dept.), India, April 1984
  - I. I. T., Bombay (Mathematics Dept.), India, April 1984
  - University of South Carolina (Statistics Dept.), November 1984
  - University of Bath (School of Mathematics), U.K., July 1988
  - Northwestern University (Statistics Seminar), November 1988
9. *Multiple Comparisons: When and Why?*
  - Chicago ASA Chapter (Biostatistics Interest Group), November 1980
  - N. E. Illinois ASA Chapter, October 1984
  - ENAR Spring Meeting (*Invited Talk*), Raleigh, March 1985
  - 42nd Annual Applied Statistics Conference (*Three Hour Invited Tutorial*), Atlantic City, December 1986
10. *Teaching Careers in Statistics*
  - ASA Chicago Chapter Careers Forum, November 1981
11. *Selecting the Better Bernoulli Treatment Using a Matched Samples Design*
  - University of Illinois at Chicago (Mathematics, Statistics and Computer Science Dept.), May 1982
12. *Selecting a Normal Population with a Large Mean and a Small Variance*
  - University of Chicago (Statistics Dept.), February 1984
13. *Data Reconciliation and Gross Error Detection in Chemical Process Networks*
  - Northwestern University (ORSA Brown Bag Seminar), April 1984
14. *Some Problems in Probability Inequalities Arising in Multiple Comparisons of Means in Unbalanced Designs*
  - Miniconference on Multiple Comparisons (*Invited Talk*), Urbana-Champaign, August 1984
15. *Conflicting Birthweight and Infant Mortality Trends in a High-Risk Urban Neighborhood*

- Northwestern University (Center for Health Services and Policy Research Seminar), November 1984.
16. *Modern Methods for Quality Control and Improvement*
    - Illinois Technology Networking Quality Control Clinic, July 1986, March 1987
    - Chicago Society for Coatings Technology, November 1987
  17. *A Bayesian Approach to Gross Error Detection in Chemical Process Data*
    - Northwestern University (Statistics Seminar), May 1987
  18. *Multiplicity Problems in Biostatistics*
    - 44th Annual Applied Statistics Conference (*Three Hour Invited Tutorial*), Atlantic City, December 1988
    - Northwestern University (ORSA Brown Bag Seminar), February 1990
  19. *Designing Experiments for Step-Down Multiple Testing Procedures*
    - University of Michigan (Biostatistics Dept.), February 1989
    - Cornell University (Statistics Seminar), March 1989
    - University of Poona (Statistics Dept.), India, September 1989
    - Ohio State University (Statistics Dept.), November 1989
    - Northwestern University (Statistics Seminar), November 1989
  20. *A Step-Up Multiple Test Procedure*
    - North Carolina State University (Statistics Dept.), June 1990
    - Northern Illinois University (Div. of Statistics), April 1991
    - Northwestern Univ. (Dept. of Statistics and Dept. of Community Health and Preventive Medicine Joint Seminar), November 1991
  21. *A Bayesian Approach to Comparing Treatments with a Control*
    - Symposium in Honor of C. W. Dunnett (*Invited Talk*), McMaster University, May 1991
  22. *Some Recent Developments in Multiple Comparisons*
    - Northern N. J. Chapter of the American Statistical Association (*3 Hour Invited Tutorial*), Rahway, N. J., June 1993
  23. *Stepwise Multiple Test Procedures and Their Applications*
    - 49th Annual Applied Statistics Conference (*Three Hour Invited Tutorial (with C. W. Dunnett)*), Atlantic City, N. J., December 1993
    - Dept. of Mathematics & Statistics, Univ. of South Alabama, Mobile, AL (*A Series of 3 Invited Seminars*), July 1995
    - Univ. of Hannover and Solvay Pharmaceuticals, Hannover (Germany), November 1995
    - The First NIU Symposium on Statistical Sciences (*Invited Talk*), N. Illinois University (Div. of Statistics), September 1996
    - Dept. of Biostatistics, School of Public Health, University of Illinois at Chicago, September 1997
  24. *Multiple Test Procedures for Dose Finding*

- Northern N. J. Chapter of the American Statistical Association (*Invited Talk*), Rahway, N. J., March 1995
  - Multiple Decision Theory & Related Topics – A Conference in Honor of Shanti S. Gupta, (*Invited Talk*), Purdue University, June 1995
  - Swiss and German Biopharmaceutical Meeting, Basle (Switzerland), November 1995
  - The First International Conference on Multiple Comparisons, Univ. of Tel Aviv, Israel, June 1996
25. *Multiple Test Procedures for Identifying the Maximum Safe Dose*
- Stine-Haskell Research Center, DuPont, Newark, N.J., February 1997
  - Dept. of Statistics, Northwestern University, February 1998
  - IMS Annual Statistical Meeting, (*Invited Talk*), Dallas, TX, August 1998
26. *Multiple Test Procedures for Identifying the Minimum Effective and Maximum Safe Doses of a Drug*
- 10th European Workshop on Statistical Methodology in Clinical R & D, Drug Information Association, Prague (Czech Republic), April 1999
  - International Conference on Applied Statistics, Rider University, Lawrenceville, NJ, May 1999
  - 2nd International Conference on Multiple Comparisons, Berlin, Germany, June 2000
  - N. E. Illinois ASA Chapter Meeting, October 2000
  - International Conference on Statistics, Combinatorics and Related Topics, I.I.T. Bombay, India, December 2000
  - Department of Statistics, University of Poona, Pune, India, December 2000
27. *Accurate Critical Constants for the One-Sided Approximate Likelihood Ratio Test of a Normal Mean Vector when the Covariance Matrix is Estimated*
- Department of Statistics, Northwestern University, February 2001
  - IISA Fourth Biennial International Conference on Statistics, Probability and Related Areas, (*Invited Talk*), Northern Illinois University, DeKalb, Illinois, June, 2002
28. *Multiple Endpoints: Review and New Developments*
- Invited talk at the NSF-CBMS Regional Conference on “New Developments in Multiple Comparison Procedures” at Temple University, Philadelphia, PA, August 2001
29. *A Superiority-Equivalence Approach to One-Sided Tests on Multiple Endpoints*
- The Third International Conference on Multiple Comparisons, Bethesda, MD, August 2002
  - Department of Math., Statistics and Computer Science, McMaster University, Hamilton, Ontario, CANADA, November 2002
  - Division of Biostatistics, Medical College of Wisconsin, Milwaukee, WI, March 2003
30. *Multiple Comparisons*
- Invited talk at SUMSRI, Miami University, Oxford, OH, July 2003
  - Invited talk at U. of Illinois at Chicago, April 2004.
31. *Multiple Comparison Procedures for Dose Response Studies*
- Invited talk at “Dose Response Clinical Trials Conference, organized by Barnett Educational Services, Philadelphia, PA, November 2004.

## SHORT COURSES:

1. *Multiple Comparisons, One-Day Course*
  - Spring Biometrics Society (ENAR) Meeting, Cleveland, OH, April 1994
  - Ciba-Geigy Corporation, Summit, NJ, November 1983, December 1993
  - Schering-Plough Corporation, Kenilworth, NJ, November 1987
2. *Multiple Comparisons (with Y. Hochberg), Two-Day Course*
  - Groupe Biopharmacie-ASU, Paris, France, June 1993
3. *Multiplicity Problems in Pharmaceutical Studies (with B. W. Turnbull), Two-Day Course*
  - Food and Drug Administration, Rockville, MD, December 1988
  - Abbott Laboratories (together with G. D. Searle Co.), North Chicago, IL, June 1989
  - Sterling Drug Inc., Rensselaer, NY, June 1989
  - Merrell Dow Research Institute, Cincinnati, OH, June 1990
  - Bristol-Myers-Squibb, Hartford, CT, September 1990
4. *Design of Industrial Experiments*
  - Northrop Corporation (Defense Systems Division), Rolling Meadows, IL, December 1990 – February 1991, October 1992–December 1992
  - McCormick School of Engg. & Applied Sciences Continuing Education Program (with J. Mellon), October 1994
5. *Design of Experiments Workshop for High School AP Stats Teachers*
  - Council of AP Stats Teachers and N. E. Illinois ASA Chapter, October 2000

## CONSULTING:

1. Johnson & Johnson Pharmaceutical Research & Development, Raritan, N.J. (1998 -2004)
2. Harza Engineering, Chicago, IL (2001 -2002)
3. Medical Research Laboratories, Buffalo Grove, IL (2000 - 2002)
4. Technology Management Group, Des Plaines, IL (1998 -2000)
5. Haemoscope Corporation, Skokie, IL (1997 -1998)
6. NCM Publishers Inc., New York, NY (1995)
7. RCT, Wheeling, IL (1994 -1995)
8. Venatech Inc., Evanston, IL (1993 -1997)
9. American College of Pathologists, Northfield, IL (1992)
10. Northrop Corporation (Defense Systems Division), Rolling Meadows, IL (1990–1994)
11. National Cement and Ceramics Laboratory, Evanston, IL (1990–1991)
12. Glenbrook Hospital Human IVF Laboratory, Glenview, IL (1989–1990)
13. Vascular Care Technology Inc., Glenview, IL (1989–1993)
14. Northwestern University Medical School (1988–1990)
15. United Refining and Smelting, Franklin Park, IL (1988)
16. Kendall Research Center, Barrington, IL (1981–1986)
17. Engineered Coated Products, Northbrook, IL (1986)

18. Mark Control Inc., Evanston, IL (1981)
19. Bell and Howell Educational Group Inc., Evanston, IL (1981)
20. Educational Testing Service, Evanston, IL (1980)
21. Northwestern Illinois Planning Commission, Chicago, IL (1980)
22. Shure Brothers Inc., Evanston, IL (1979)

#### **PROFESSIONAL ACTIVITIES:**

- Member:
  - Institute of Mathematical Statistics
  - American Statistical Association (Fellow)
  - Biometrics Society (ENAR)
  - American Society for Quality
  - INFORMS
  - Institute of Industrial Engineers
- Associate Editor:
  - *Communications in Statistics* (1993–Present)
  - *Naval Research Logistics* (2003–Present)
  - *Biometrical Journal* (2003–Present)
- Guest Editor:
  - *Journal of Biopharmaceutical Statistics*, Special Issue of Papers Presented at MCP2002 (with Peter H. Westfall)
  - *Journal of Statistical Planning and Inference*, Special Issue of Papers Presented at MCP2002 (with Peter H. Westfall)
- Reviewer:
  - Refereed more than 150 manuscripts for more than 30 journals
  - Referee for NSF, NSA and AFOSR proposals
  - Referee for several promotion and tenure decisions
  - Judge for the Wilcoxon and Youden Awards, 1976-1982
- Other:
  - Assistant Program Secretary, IMS Annual Meeting, Chicago, IL, August 1986
  - Program Committee, N. E. Illinois ASA Chapter, 1989–1992
  - President, N. E. Illinois ASA Chapter, 1993
  - Member, Organizing Committee, 1st International Conference on Multiple Comparisons, Tel-Aviv, Israel, June 1996; 2nd International Conference on Multiple Comparisons, Berlin, Germany, June 2000
  - Co-chair, 3rd International Conference on Multiple Comparisons, Bethesda, MD, August 2002; 4th International Conference on Multiple Comparisons, Shanghai, July 2005

#### **UNIVERSITY ADMINISTRATION:**

1. Chairman, IE/MS Department (2001 -Present)

2. Associate Director, Center for Statistics and Probability (1979–1982)
3. Chair, IE/MS Undergraduate Program (1980–1988, 1994 - 2000), Member of numerous other committees
4. Member, McCormick School Promotion and Tenure Committee (1989–1995, 1996-1999), Provost's Undergraduate Task Force on Quantitative Analysis (1988–1989), CTEC Review Advisory Committee (1991–1994)
5. In-Charge of Consulting, Department of Statistics (1988–1989)
6. Graduate Admissions Officer, Department of Statistics (1989 -2001)
7. Director, IE/MS Undergraduate Computing Laboratory (1995 - 1998) and Co-Director, IE/MS Quality Engineering Laboratory (1996–Present)

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