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Pranab Kumar Sen: Life and works

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Abstract: In this article, we describe briefly the highlights and various accomplishments in the personal as well as the academic life of Professor Pranab Kumar Sen.

Pranab Kumar Sen (born: November 7, 1937) had his school and college education (B.Sc (1955), M.Sc. (1957) and Ph.D. (1962), all in Statistics) from Calcutta University, where he served as a lecturer in the Post-graduate Department of Statistics (1961–64) before proceeding to the University of California, Berkeley (1964–65) as a visiting faculty member in Statistics. He moved to the University of North Carolina (UNC) at Chapel Hill in the Fall of 1965, and since then, he has been there (visiting 1965–67, Associate Professor 1967–70 and Professor 1970–). He is currently Cary C. Boshamer Professor of Biostatistics (1982–), and Professor of Statistics and Operations Research (1988–) at UNC. He was Richard Metron Guest Professor at the Albert-Ludwig University, Freiburg, Germany (1974–75) and also the Eugene Lukacs Distinguished Professor, Bowling Green State University, Ohio (1997 Spring). In 1993 he was made an Adjunct (life-long) Professor, Indian Statistical Institute. He has travelled extensively and visited many Universities all over the world, and quite frequently to University of Sao Paulo, Brazil, Institute of Statistical Science, Academia Sinica (and National Health Research Institute), Taipei, Taiwan, Charles University, Prague, Czech Republic, and the Indian Statistical Institute.

Professor Sen was elected Fellow of the Institute of Mathematical Statistics in 1968, Fellow of the American Statistical Association in 1969, and Elected Member of the International Statistical Institute in 1973. He was a NSF-CBMS Lecturer (1983) at the University of Iowa, S.N. Roy Memorial Lecturer, Calcutta University, 1976, Fifth Special Invited Lecturer at the Institute of Statistical Science, Academia Sinica, Taipei (2001), and Platinum Jubilee Lecturer, Indian Statistical Institute (2007). He was awarded the Boltzman Medal, Czech Union of Mathematicians and Physicists (CUMP) in 1988, and in 1998, the CUMP Commemoration Medal for outstanding contributions to Statistics and Probability Theory. At UNC, in 1996, he was awarded the McGavran Teaching Excellence Award. In 2002, the American Statistical Association presented the Senior Noether Award to him for life-long achievements in research and teaching (nonparametrics).

Professor Sen has supervised more than 80 doctoral students (1969–2007) in Statistics, Biostatistics, and Psychometry, all at UNC. He has (co-)authored and

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(co-)edited 22 books and monographs in Statistics, Biostatistics, Stochastic Processes, and related fields. Besides, he has more than 600 publications in Statistics, Probability Theory, Stochastic Processes, and Biostatistics in leading journals in these areas. He has served on the Editorial Boards of Journal of Multivariate Analysis (1972–78), Journal of the American Statistical Association (1973–78), Communications in Statistics, Theory and Methods (1972–82), Journal of Statistical Planning and Inference (1979–90, 1995–2006), Brazilian Journal of Probability and Statistics (1988–), Journal of Nonparametric Statistics (1991–94), Lifetime Data Analysis (2005–), Metron (2005–07), and Scientiae Mathematicae Japonicae (2003–). He was the Founding (joint) Editor of Sequential Analysis (1982–95), also of Statistics and Decisions (1982–2002). He is the Chief Editor, Sankhya (2007–2009).

Sen's research impact has mostly been in the original and innovative developments of nonparametrics and asymptotics in a broad spectrum of Statistical (and Biostatistical) Science, encompassing both theory and applications in interdisciplinary fields. In his doctoral work, he developed the jackknife theory for U-statistics (1960), and with S.K. Chatterjee (1964), laid down the foundation of multivariate nonparametrics; the field was evolutionary in the late 1960's and culminated with the monograph of Puri and Sen (1971). In 1970–74, Malay Ghosh and Sen did most innovative research in sequential nonparametrics, and with S. K. Chatterjee (1972–74), he developed the theory of time-sequential nonparametrics, both culminating in his 1981 monograph and 1983 NSF-CBMS Lectures. With Madan Puri, he had a second monograph on nonparametrics for general linear models (1985). At that time, he started working on robustness with Jana Jurečková and their long collaboration led to their 1996 monograph on this field of research. Sequential analysis and applications in clinical trials captured much of his interest during the 1980's and 1990's, and the 1997 monograph relates to some of these developments. Pitman Closeness measure has been a major point of interest for his research, and the Keating–Mason–Sen (1993) monograph reveals a lot of their work along with others. At the intermediate level, the Sen–Singer (1993) monograph served as a good text/reference for many graduate students in Biostatistics and Applied Satatistics fields. Two other notable monographs with late Jaroslav Hajek and Z. Šidák (1999) and Mervyn Silvapulle (2005) have received considerable attention from Statistics Communities all over the world. During the past 15 years, Sen is more inclined to research in Biostochastics, Environmetrics, and Bioinformatics and continuing basic methodological work to bridge the gap between theory and applications. Beyond Parametrics is a phrase that Sen coined to encompass the entire field of Nonparametrics and Semiparametrics (including Bayesian methods) that captures better the reality of interdisciplinary research and serves as the guiding post for statistical innovations.

We have taken the liberty of including the following verse Sen composed a couple of years ago.

My chancy life as a statistician

Pranab Kumar Sen
University of North Carolina, Chapel Hill

> Is there any human life without the chance in manifestation?
> Could it be any less chancy for a converted (bio-)statistician?
> When I was born, the chances were that I might not even survive,

not to speak of the fact that I would be in a stochastic blow-pipe!
Although not from an affluent family, the first ten years swept smoothly.
Then the first throw of a dice was the demise of my father, abruptly.
Crippled with the political partition of Bengal (albeit independence),
the chance for survival became too much relatives' dependence.
The last four years of the high school was without any glamour,
my mind was set for more attractions on the roadside games-parlours.
My poor mother gave up all the hopes for any smooth matriculation,
yet by a second throw of a dice, I topped the list of school graduation.
I was trying to optimize my chances of getting into a medical school,
alas, being underaged, I was denied chancy entrance to the physicians' pools.
In disgust, I ran to the (Calcutta) Presidency College courtyards,
and grabbed a spot in both mathematics and physics honours charts.
A third throw of a dice: came an old friend in utter surprise,
and asked me to switch to statistics major on his chancy advise.
The family financial burden was about to knock me out of college,
but the chancy success in the B.Sc. examination, opened the PG page.
With the march of countless dice, I could step outside the masters,
and embarked on a chancy ambition of wearing doctorate feathers.
Flanked by my chancy success, I stood at the ISICAL doorsteps,
in quest of an assistantship, for which I was even aptitude tested!
Another throw of a dice: I was not selected. Not because of merit,
nor of underage, but for not enough money to cover my family need.
I turned my face back to my alma mater, and locked my chance
of being in predoctoral training program in thrilled enhance.
Those six years in the Calcutta University were the paradise of my life,
I could have a glance of the statistics interface in broad delight.
I got a chance to visit the University of California, Berkeley, in 1962,
however, family situation kept me anchoring to Calcutta for a year or two.
A shower of chance in 1964: via Berkeley, we came to Chapel Hill,
a small town, home for the rest of my life, in a chancy exile.
I never dreamed of becoming a statistician, not to speak of an applied one,
yet the nonparametric I specialized, chanced me to this open direction.
Back in 1961 when I was asked to introduce a course in bioassay,
the odds were in my favour for pouring nonparametrics in this say.
There, Shoutir Chatterjee and I embarked on multivatiate nonparametrics,
a chancy step that extended all the way to Chapel Hill in all peroratives.
Fortune to have Madan Puri on my side in incessant youthful delight,
to carry the rank-permutation banner; a combination eventually out of sight.
Time-sequential as well as sequential nonparametrics evolved soon after,
Shoutir Chatterjee and Malay Ghosh set the chancy collaboration to ponder.
At that time, I was more rank (analysis) minded, albeit with some robustness,
and had a chance to set collaboration with Jana Jurečková in a long process.
Got a chance to traverse preliminary test inference to a shrunken base,
with the company of Saleh, Kubokawa and Keating for the Pitman closeness.
In quest of this, the finite sample approaches led to the asymptotics,
and Julio Singer joined me to build a sand-castle in simple acquities.
Could not refuse an appealing call from Mrs. Hájek and Zbyněk Šidák
to restore and update a classical text on the theory of test based on rank;
it took a while to add new material in a unifying but still original style,
all for the respect to late Jaroslav Hájek, not for any personal stake.
Life is full of constraints, contrary to our expectation,
in statistical inference too, constraints are no exception.
I was delighted to have Mervyn Silvapulle in active cooperation,
taking the lead in a constraint inference monograph in resolution.

The agony of being denied medical college entrance chanced me a signal:
stick to biostatistics to fathom out chance mysteries of a clinical trial.
Soon after bioinformatics and genomics rocked the field with data mining,
and I have the chance to come up with biostochastics in the offing.
Let me cherish the chance beauty of stochastics in applicable methodology,
and gauge knowledge discovery and data mining, in the chance ideology.

RESEARCH MONOGRAPHS AND ADVANCED TEXT BOOKS

(1) *Nonparmetric Methods in Multivariate Analysis* (co-author: M.L. Puri), John Wiley and Sons, New York, 197l.

(2) *Sequential Nonparametrics: Invariance Principles and Statistical Inference.* John Wiley and Sons, New York, 1981.

(3) *Contributions to Statistics: Essays in Honor of Norman L. Johnson* (edited). North-Holland, Amsterdam, 1983.

(4) *Handbook of Statistics, Volume 4: Nonparametric Methods* (co-editor: P.R Krishnaiah), North-Holland, Amsterdam, 1984.

(5) *Biostatistics: Statistics in Biomedical, Public Health and Environmental Sciences* (edited). North-Holland, Amsterdam, 1985.

(6) *Nonparametric Methods in General Linear Models* (co-author: M.L. Puri), John Wiley and Sons, New York, 1985.

(7) *Theory and Applications of Sequential Nonparametrics.* SIAM Publication (CBMS NSF), Philadelphia, 1985.

(8) *Goodness of Fit* (co-editor with Pal Revesz and Karoly Sarkadi), North-Holland, Amsterdam, l986.

(9) *Handbook of Sequential Analysis* (co editor: B.K. Ghosh), Marcel Dekker, N.Y. 1991.

(10) *Pitman's Measure of Closeness: A Comparison of Statistical Estimators* (co-authors: J.P. Keating and R.L. Mason), SIAM, Philadelphia, 1993.

(11) *Large Sample Methods in Statistics: An Introduction with Applications* (co-author: J.M. Singer), Chapman and Hall, 1993.

(12) *Order Statistics and Nonparametrics: Theory and Applications* (co-editor: I. A. Salama), North-Holland, Amsterdam, 1992.

(13) *Stochastic Processes, a Festschrift in honour of Gopinath Kallianpur* (co-editors: S. Cambanis, J.K. Ghosh and R.L. Karandikar), Springer-Verlag, New York, 1993.

(14) *Collected Works of Wassily Hoeffding* (co-editor: N. I. Fisher), Springer-Verlag, 1993.

(15) *Statistical Theory and Applications: Papers in Honor of Herbert A. David* (co-editors H.N. Nagaraja and D. Morrison), Springer-Verlag, New York, 1995.

(16) *Robust Statistical Procedures: Asymptotics and Inter-relations* (co-author: J. Jurečková), John Wiley and Sons, New York, 1996.

(17) *Sequential Estimation* (co-authors: M. Ghosh and N. Mukhopadhyay), John Wiley and Sons, New York, 1997.

(18) *Theory of Rank Tests, 2nd Edition* (co-authors: J. Hájek and Z. Šidák). Academic Press, United Kingdom, 1999.

(19) *Handbook of Statistics, Volume 18: Bioenvironmental and Public Health Statistics,* (co-editor: C. R. Rao). Elsevier, Amsterdam, 2000.

(20) *Perspectives in Statistical Sciences,* (co-editors: A. Basu, J. K. Ghosh, P. K. Sen and B. K. Sinha. Oxford India, Delhi, 2000.

(21) *Constrained Statistical Inference: Inequality, Order, and Shape Restrictions,* (co-author : M. J. Silvapulle), John Wiley and Sons, New York, 2005.

(22) *Excursions in Biostochastics: Biometry to Biostatistics to Bioinformatics,* Invited Lecture Notes, No. 5, Academia Sinica, Taipei, Taiwan, 2004.

PH.D. GUIDANCE

Served as the adviser and supervised the doctoral dissertations of the following persons (all at the University of North Carolina, Chapel Hill):

1. R.R. Obenchain	(Mathematical Statistics)	1969
2. M. Ghosh	(Mathematical Statistics)	1969
3. T.M. Gerig	(Mathematical Statistics)	1971
4. K. Dutta	Mathematical Statistics)	1971
5. G.W. Williams	(Biostatistics)	1972
6. R.F. Woolson	(Biostatistics)	1973
7. M.R. Mahmoud	(Biostatistics)	1973
8. Y. Hochberg	(Biostatistics)	1974
9. K.L. Monti	(Biostatistics) 1975 (co-adviser: D. Quade)	
10. H. Majumdar	(Biostatistics)	1976
11. C. Silva	(Biostatistics) (co-adviser: D. Quade)	1977
12. J.C. Gardiner	(Mathematical Statistics) (co-adviser: G. Simons)	1978
13. Y. Tsong	(Mathematical Statistics)	1979
14. V.M. Chinchilli	(Mathematical Statistics)	1979
15. F.E. Harrell, Jr.	(Biostatistics)	1979
16. A.N. Sinha	(Biostatistics)	1979
17. E.R. DeLong	(Biostatistics)	1979
18. S.I. Bangdiwala	(Biostatistics)	1980
19. Y.C. So	(Mathematical Statistics)	1981
20. I.N. Agung	(Biostatistics)	1981
21. K. Kouri	(Biostatistics)	1981
22. G. Feeney	(Biostatistics) (co-adviser: M. Symons)	1982
23. M.N. Boyd	(Biostatistics)	1982
24. J. Singer	(Biostatistics)	1983

25. D.L. Hawkins	(Biostatistics)	1983
26. R.A. Smith	(Mathematical Statistics)	1983
	(co-adviser: W. Hoeffding)	
27. Y.C. Yuan	(Biostatistics)	1984
28. R.W. Falk	(Biostatistics)	1985
29. D. Hoberman	(Biostatistics)	1986
30. A.R. Karmous	(Biostatistics)	1986
31. M.T. Tsai	(Mathematical Statistics)	l987
32. G.R. Jerdack	(Biostatistics)	l987
33. D.C. Trost	(Biostatistics)	1988
34. D. Sengupta	(Mathematical Statistics)	1988
35. Rick Williams	(Biostatistics)	1988
36. C.Y. Wada	(Biostatistics)	1988
37. S.A. Murphy	(Mathematical Statistics)	1989
38. J.I. Crowell	(Mathematical Statistics)	1990
39. J.J. Ren	(Mathematical Statistics)	1990
40. L.J. Edwards	(Biostatistics)	1990
41. Nelson Oliveira	(Biostataistics)	1992
	(co-advisor: D. Quade)	
42. Subha Das	(Mathematical Statistics)	1993
43. Ming Zhang	(Mathematical Statistics)	1993
44. Ralph DeMasi	(Biostatistics)	1994
	(co-advisor: B. Qaqish)	
45. S. Munoz	(Biostatistics)	1995
	(co-advisor: S. I. Bangdiwala)	
46. A. Pedroso de Lima	(Biostatistics)	1995
47. Habib El-Moalem	(Biostatistics)	1995
48. Moh. A. Chaudhary	(Biostatistics)	1995
49. Kentaro Hayashi	(Psychometry)	1996
50. Zhenwei Zhou	(Mathematical Statistics)	1996
51. Pai-Lien Chen	(Biostatistics)	1996
52. Solange Andreoni	(Biostatistics)	1996
53. Stoffel Moeng	(Biostatistics)	1996
	(co-advisor: C.M. Suchindran)	
54. Ho Kim	(Biostatistics)	1996
55. Lin X. Clegg	(Biostatistics)	1997
	(co-advisor: Jianwen Cai)	
56. Mario Chen Mok	(Biostatistics)	1997
57. Maha Karnoub	(Biostatistics) 1997	
	(co-advisor: Francoise Seillier-Moiseiwitsch)	
58. Hildete P. Pinheiro	(Biostatistics)	1997
	(co-advisor: Francoise Seillier-Moiseiwitsch)	
59. H.-C. Tien	(Biostatistics)	1998
60. Michael Marion	(Mathematical Statistics)	1998
61. J. E. MacDougal	(Biostatistics)	1999
62. Ming Zhong	(Biostatistics)	1999
	(co-advisor: J. Cai)	
63. Antonio J. Sanhueza	(Biostatistics)	2000
64. H. Chakravarty	(Dr.P.H. Biostatistics)	2000
	(co-advisor: R. Helms)	
65. Karen Kessler	(Biostatistics)	2000
66. Dubois Bowman	(Biostatistics)	2000
	(co-advisor: P. Stewart)	
67. Joe Galanko	(Biostatistics)	2000
	(co-advisor: D. Quade)	

68. Chula Komoltri	(Dr. P.H. Biostatistics)	2001
	(co-advisor: K. Bangdiwalla)	
69. Jianmin Wang	(Biostatistics)	2001
	(co-advisor: C. M. Suchindran)	
70. Kouros Owzar	(Mathematical Statistics)	2002
71. Stephanie Cano	(Biostatistics)	2003
	(co-advisor: C. M. Suchindran)	
72. Tejas Desai	(Biostatistics)	2003
73. Lan Kong	(Biostatistics)	2003
	(co-advisor: Jianwen Cai)	
74. Szu-Yun Leu	(Biostaistics)	2003
75. Inkyung Jung	(Biostatistics)	2004
76. Lily Wang	(Biostatistics)	2004
77. George Capuano	(Biostatistics)	2005
78. Munni Begum	(Dr.P.H., Biostatistics)	2005
79. George Luta	(Biostatistics)	2006
	(co-advisor: Gary Koch)	
80. Munsu Kang	(Biostatistics)	2007

Selected publications of Pranab K. Sen

Athreya, K. B., Ghosh, M., Low, L. Y. and Sen, P. K. (1984). Laws of large numbers for bootstrapped U-statistics. *Journal of Statistical Planning and Inference*, **9**, 185–194.

Bhattacharjee, M. C. and Sen, P. K. (1995). On Kolmogorov-Smirnov type tests for NB(W)UE alternates under censoring schemes. In H. L. Koul and J. V. Deshpande, editors, *Analysis of Censored Data (IMS Lecture Notes Monograph Series, Volume 27)*, pages 25–38. Institute of Mathematical Statistics.

Bhaumik, D. K. and Sen, P. K. (1999). Universal optimality of Bayesian experimental designs and optimal data augmentations. *Sankhyā, Series B*, **61**, 469–487.

Cai, J., Sen, P. K., and Zhou, H. (1999). A random effects model for multivariate failure time data from multicenter clinical trials. *Biometrics*, **55**(1), 182–189.

Chakraborty, H., Helms, R. W., Sen, P. K., and Cohen, M. S. (2003). Estimating correlation by using a general linear mixed model: Evaluation of the relationship between the concentration of $HIV-1$ RNA in blood and semen. *Statistics in Medicine*, **22**, 1457–1464.

Chatterjee, S. K. and Sen, P. K. (1964). Nonparametric tests for the bivariate two sample location problem. *Calcutta Statistical Association Bulletin*, **13**, 18–58.

Chatterjee, S. K. and Sen, P. K. (1966). Nonparametric tests for the multivariate multisample location problem. *Essays in Probability and Statistics:*, Roy Memorial Volume, 197–228.

Chatterjee, S. K. and Sen, P. K. (1973a). Nonparametric testing under progressive censoring. *Calcutta Statistical Association Bulletin*, **22**, 13-50.

Chatterjee, S. K. and Sen, P. K. (1973b). On Kolmogorov Smirnov type test for symmetry. *Annals of the Institute of Statistical Mathematics*, **25**, 288-300.

Chatterjee, S. K. and Sen, P. K. (2000). On stochastic ordering and a general class of poverty indexes. *Calcutta Statistical Association Bulletin*, **50**(199-200), 137–155.

Chaubey, Y. P. and Sen, P. K. (1996). On smooth estimation of survival and density functions. *Statistics and Decisions*, **14**, 1–22.

Chaudhary, M. A. and Sen, P. K. (2002). Reconciliation of asymptotics for unequal

probability sampling without replacement. *Journal of Statistical Planning and Inference*, **102**(1), 71–89.

Chen, P.-L. and Sen, P. K. (2001). Quality-adjusted survival estimation with periodic observations. *Biometrics*, **57**, 868–874.

Chinchilli, V. M. and Sen, P. K. (1981a). Multivariate linear rank statistics and the union-intersection principle for hypothesis testing under restricted alternatives. *Sankhyā, Series B*, **43**, 135–151.

Chinchilli, V. M. and Sen, P. K. (1981b). Multivariate linear rank statistics and the union-intersection principle for the orthant restriction problems. *Sankhyā, Series B*, **43**, 152–171.

Chinchilli, V. M., Schwab, B. H., and Sen, P. K. (1989). Inference based on ranks for the multiple-design multivariate linear model. *Journal of the American Statistical Association*, **84**, 517–524.

Clegg, L. X., Cai, J., and Sen, P. K. (1999). A marginal mixed baseline hazards model for multivariate failure time data. *Biometrics*, **55**(3), 805–812.

Das, S. and Sen, P. K. (1994). Restricted canonical correlations. *Linear Algebra and its Applications*, **210**, 29–47.

Das, S. and Sen, P. K. (1995). Simultaneous spike-trains and stochastic dependence. *Sankhyā, Series B*, **57**, 32–47.

Das, S. and Sen, P. K. (1996). Asymptotic distribution of restricted canonical correlations and relevant resampling methods. *Journal of Multivariate Analysis*, **56**, 1–19.

DeMasi, R. A., Qaqish, B., and Sen, P. K. (1997). Statistical models and asymptotic results for multivariate failure time data with generalized competing risks. *Sankhyā, Series A*, **59**, 408–434.

Dewanji, A., Nayak, T. K., and Sen, P. K. (1995). Estimating the number of components of a system of superimposed renewal processes. *Sankhyā, Series A*, **57**, 486–499.

Gangopadhyay, A. K. and Sen, P. K. (1990). Bootstrap confidence intervals for conditional quantile functions. *Sankhyā, Series A*, **52**, 346–363.

Gardiner, J. C. and Sen, P. K. (1979). Asymptotic normality of a variance estimator of a linear combination of a function of order statistics. *Zeitschrift für Wahrscheinlichkeitstheorie und verwandte Gebiete*, **50**, 205–221.

Ghosh, M. and Sen, P. K. (1971a). On a class of rank order tests for regression with partially informed stochastic predictors. *Annals of Mathematical Statistics*, **42**, 650–661.

Ghosh, M., Sen, P. K., and E. G. J. (1973). Nonparametric methods in longitudinal studies. *Journal of the American Statistical Association*, **68**, 29–36.

Ghosh, J. K. and Sen, P. K. (1985). On the asymptotic performance of the log likelihood ratio statistic for the mixture model and related results. In L. M. Le Cam and R. A. Olshen, editors, *Proceedings of the Berkeley Conference in Honor of Jerzy Neyman and Jack Kiefer (Vol. 2)*, pages 789–806. Wadsworth Publishing Co Inc.

Ghosh, J. K., Sen, P. K., and Mukerjee, R. (1994). Second-order Pitman closeness and Pitman admissibility. *The Annals of Statistics*, **22**, 1133–1141.

Ghosh, J. K., Mukerjee, R., and Sen, P. K. (1996). Second-order Pitman admissibility and Pitman closeness: The multiparameter case and Stein-rule estimators. *Journal of Multivariate Analysis*, **57**, 52–68.

Ghosh, M. and Sen, P. K. (1977). Sequential rank tests for regression. *Sankhyā, Series A*, **39**, 45–62.

Ghosh, M. and Sen, P. K. (1983). On two-stage James-Stein estimators. *Sequential*

Analysis, **2**, 359–367.

Ghosh, M., Nickerson, D. M. and Sen, P. K. (1987). Sequential shrinkage estimation. *Annals of Statistics*, **15**, 817–829.

Ghosh, M. and Sen, P. K. (1989). Median unbiasedness and Pitman closeness. *Journal of the American Statistical Association*, **84**, 1089–1091.

Ghosh, M. and Sen, P. K. (1991). Bayesian Pitman closeness (Disc: P3679-3695). *Communications in Statistics: Theory and Methods*, **20**, 3659–3678.

Ghosh, M., Saleh, A. K. M. E., and Sen, P. K. (1989). Empirical Bayes subset estimation in regression models. *Statistics and Decisions*, **7**, 15–35.

Ghosh, M., Keating, J. P., and Sen, P. K. (1993). Comment on "Is Pitman closeness a reasonable criterion?". *Journal of the American Statistical Association*, **88**, 63–66.

Harrell, F. E. and Sen, P. K. (1979). Statistical inference for censored bivariate normal distributions based on induced order statistics. *Biometrika*, **66**, 293–298.

Hayashi, K. and Sen, P. K. (1998). On covariance estimators of factor loadings in factor analysis. *Journal of Multivariate Analysis*, **66**, 38–45.

Hoffman, E. B., Sen, P. K., and Weinberg, C. R. (2001). Within cluster resampling. *Biometrika*, **88**, 1121–1134.

Hušková, M. and Sen, P. K. (1985). On sequentially adaptive asymptotically efficient rank statistics. *Sequential Analysis*, **4**, 125–151.

Inagaki, N. and Sen, P. K. (1985). On progressively truncated maximum likelihood estimators. *Annals of the Institute of Statistical Mathematics*, **37**, 251–269.

Jammalamadaka, S. R., Tiwari, R. C., Sen, P. K., and Ebneshahrashoob, M. (1991). A rank test based on the number of "near-matches" for ordered alternatives in randomized blocks. *Sankhyā, Series A*, **53**, 183–193.

Jung, I. and Sen, P. K. (2006). Robust r-estimation of a consensus value from multi-center studies. *Communications in Statistics, Theory and Methods*, **35**, 2127–2144.

Jurečková, J. and Sen, P. K. (1981). Invariance principles for some stochastic processes relating to M-estimators and their role in sequential statistical inference. *Sankhyā, Series A*, **43**, 190–210.

Jurečková, J. and Sen, P. K. (1982). M estimators and L estimators of location: uniform integrability and asymptotic risk-efficient sequential versions. *Sequential Analysis*, **1**, 27–56.

Jurečková, J. and Sen, P. K. (1987). A second-order asymptotic distributional representation of M-estimators with discontinuous score functions. *The Annals of Probability*, **15**, 814–823.

Jurečková, J. and Sen, P. K. (1989). Uniform second order asymptotic linearity of M-statistics in linear models. *Statistics and Decisions*, **7**, 263–276.

Jurečková, J. and Sen, P. K. (1990). Effect of the initial estimator on the asymptotic behavior of one-step M-estimator. *Annals of the Institute of Statistical Mathematics*, **42**, 345–357.

Jurečková, J. and Sen, P. K. (2006). Robust multivariate location estimation, admissibility and shrinkage estimation. *Statistics and Decisions*, **24**, 191–206.

Jurečková, J., Picek, J., and Sen, P. K. (2003). Goodness-of-fit test with nuisance regression and scale. *Metrika*, **58**(3), 235–258.

Karmous, A. R. and Sen, P. K. (1988a). The harmonic *G*ini coefficient and affluence indexes. *Mathematical Social Sciences*, **8**, 65–76.

Karmous, A. R. and Sen, P. K. (1988b). Isotonic M-estimation of location: Union intersection principle and preliminary test versions. *Journal of Multivariate Analysis*, **27**, 300–318.

Kong, L., Cai, J., and Sen, P. K. (2004). Weighted estimating equations for semiparametric transformation models with censored data from a case cohort design. *Biometrika*, **91**, 305–319.

Koul, H. L. and Sen, P. K. (1991). Weak convergence of a weighted residual empirical process in autoregression. *Statistics and Decisions*, **9**, 235–262.

Mason, R. L., Keating, J. P., Sen, P. K., and Blaylock, Neil, W. J. (1990). Comparison of linear estimators using Pitman's measure of closeness. *Journal of the American Statistical Association*, **85**, 579–581.

Mukhopadhyay, N., Sen, P. K., and Sinha, B. K. (1989). Stopping rules, permutation invariance and sufficiency principle. *Annals of the Institute of Statistical Mathematics*, **41**, 121–138.

Murphy, S. A. and Sen, P. K. (1991). *C*ox regression model with time dependent covariates. *Stochastic Processes and their Applications*, **39**, 153–180.

Nandi, H. K. and Sen, P. K. (1963). On the properties of U statistics when the observations are not independent. part two: Unbiased estimation of the parameter of a finite population. *Calcutta Statistical Association Bulletin*, **12**, 125–148.

Owzar, K., Seng, Y., and Sen, P. K. (2007). A copula approach for detecting prognostic genes associated with survival outcome in microarray studies. *Biometrics*, to appear.

Paula, G. A. and Sen, P. K. (1994). Tests of ordered hypotheses in linkage in heredity. *Statistics and Probability Letters*, **20**, 395–400.

Paula, G. A. and Sen, P. K. (1995). One-sided tests in generalized linear models with parallel regression lines (Corr: 96V52 p1164). *Biometrics*, **51**, 1494–1501.

Pedroso de Lima, A. C. and Sen, P. K. (1997). A matrix-valued counting process with first-order interactive intensities. *The Annals of Applied Probability*, **7**(2), 494–507.

Pedroso de Lima, A. C. and Sen, P. K. (1999). Time-dependent coefficients in a multi-event model for survival analysis. *Journal of Statistical Planning and Inference*, **75**, 393–414.

Pinheiro, H. P., Pinheiro, A. S., and Sen, P. K. (2005). Comparison of genomic sequences by the Hamming distance. *Journal of Statistical Planning and Inference*, **130**, 325–339.

Puri, M. L. and Sen, P. K. (1969). A class of rank order tests for a general linear hypothesis. *Annals of Mathematical Statistics*, **40**, 1325–1343.

Puri, M. L., Sen, P. K., and Gokhale, D. V. (1970). On a class of rank order tests for independence in multivariate distributions. *Sankhyā, Series A*, **32**, 271–298.

Puri, M. L. and Sen, P. K. (1973). A note on asymptotic distribution free tests for sub hypotheses in multiple linear regression. *The Annals of Statistics*, **1**, 553–556.

Ren, J.-J. and Sen, P. K. (1991). On Hadamard differentiability of extended statistical functional. *Journal of Multivariate Analysis*, **39**, 30–43.

Ren, J.-J. and Sen, P. K. (1994). Asymptotic normality of regression *M*-estimators: Hadamard differentiability approaches. In P. Mandl, M. Huskova, and M. Hušková, editors, *Asymptotic Statistics. Proceedings of the Fifth Prague Symposium*, pages 131–147. Physica-Verlag Ges.m.b.H.

Ren, J.-J. and Sen, P. K. (1995). Hadamard differentiability on $D[0,1]^p$. *Journal of Multivariate Analysis*, **55**, 29–47.

Ren, J.-J. and Sen, P. K. (2001). Second order Hadamard differentiability in statistical applications. *Journal of Multivariate Analysis*, **77**(2), 187–228.

Salama, I. A. and Sen, P. K. (1992). Spherical uniformity and some characterizations of the Cauchy distribution. *Journal of Multivariate Analysis*, **41**, 212–219.

Saleh, A. K. M. E. and Sen, P. K. (1978). Nonparametric estimation of location

parameter after a preliminary test on regression. *The Annals of Statistics*, **6**, 154–168.

Saleh, A. K. M. E. and Sen, P. K. (1985). On shrinkage M-estimators of location parameters. *Communications in Statistics: Theory and Methods*, **14**, 2313–2329.

Sarkar, S. K., Sen, P. K., and Finner, H. (2004). On two results in multiple testing. In Y. Benjamini, F. Bretz, , and S. Sarkar, editors, *Recent Developments in Multiple Comaprison Procedures*, volume 47 of *Lecture Notes and Monograph*, pages 89–99. Institute of Mathematical Statistics.

Sen, P. K. (1959). On the moments of the sample quantiles. *Calcutta Statistical Association Bulletin*, **9**, 1–20.

Sen, P. K. (1960). On some convergence properties of U statistics. *Calcutta Statistical Association Bulletin*, **10**, 1–18.

Sen, P. K. (1961). On some properties of the asymptotic variance of the sample quantiles and mid ranges. *Journal of the Royal Statistical Society, Series B*, **23**, 453–459.

Sen, P. K. (1963a). On the estimation of relative potency in dilution (direct) assays by distribution free methods. *Biometrics*, **19**, 532–552.

Sen, P. K. (1963b). On the properties of U statistics when the observations are not independent. part one: Estimation of non serial parameters of a stationary process. *Calcutta Statistical Association Bulletin*, **12**, 69–92.

Sen, P. K. (1964). On some properties of the rank weighted means. *Journal of the Indian Society of Agricultural Statistics*, **16**, 51–61.

Sen, P. K. (1965). Some nonparametric tests for m dependent time series. *Journal of the American Statistical Association*, **60**, 134–147.

Sen, P. K. (1966a). On a class of bivariate two-sample nonparametric tests. *Proceedings of the Fifth Berkeley Symposium in Mathematical Statistics and Probability*, **1**, 638–656.

Sen, P. K. (1966b). On a class of multivariate multisample rank order tests. *Sankhyā, Series A*, **28**, 353–376.

Sen, P. K. (1966c). On a distribution-free method of estimating asymptotic efficiency of a class of nonparametric tests. *Annals of Mathematical Statistics*, **37**, 1759–1770.

Sen, P. K. (1966d). On nonparametric simultaneous confidence regions and tests in the one criterion analysis of variance problem. *Annals of the Institute of Statistical Mathematics*, **18**, 319–366.

Sen, P. K. (1967a). Asymptotically most powerful rank order tests for grouped data. *Annals of Mathematical Statistics*, **38**, 1229–1239.

Sen, P. K. (1967b). Nonparametric tests for multivariate interchangeability. part one: The problem of location and scale in bivariate distributions. *Sankhyā, Series A*, **29**, 351–371.

Sen, P. K. (1967c). A note on asymptotically distribution-free confidence bounds for $P\{X < Y\}$, based on two independent samples. *Sankhyā, Series A*, **29**, 95–102.

Sen, P. K. (1967d). A note on the asymptotic efficiency of Friedman's χ_r^2-test. *Biometrika*, **54**, 677–679.

Sen, P. K. (1967e). Some nonparametric generalizations of Wilks' tests for Hm, Hvc and Hmvc, I. *Annals of the Institute of Statistical Mathematics*, **19**, 451–467.

Sen, P. K. (1968a). Asymptotically efficient test by the method of n-ranking. *Journal of the Royal Statistical Society, Series B*, **30**, 312–317.

Sen, P. K. (1968b). Estimates of the regression coefficient based on Kendall's tau. *Journal of the American Statistical Association*, **63**, 1379–1389.

Sen, P. K. (1968c). On a class of aligned rank order tests in two way layouts. *Annals*

of Mathematical Statistics, **39**, 1115–1124.

Sen, P. K. (1968d). On a further robustness property of the test and estimator based on Wilcoxon's signed rank statistic. *Annals of Mathematical Statistics*, **39**, 282–285.

Sen, P. K. (1968e). On the asymptotic normality of sample quantiles for m-dependent processes. *Annals of Mathematical Statistics*, **39**, 1724–1730.

Sen, P. K. (1968f). Robustness of some nonparametric procedures in linear models. *Annals of Mathematical Statistics*, **39**, 1913–1922.

Sen, P. K. (1969). Nonparametric tests for multivariate interchangeability. part two: The problem of MANOVA in two way layouts. *Sankhyā, Series A*, **31**, 145–156.

Sen, P. K. (1970a). The Hajek-Renyi inequality for sampling from a finite population. *Sankhyā, Series A*, **32**, 181–188.

Sen, P. K. (1970b). A note on order statistics for heterogeneous distributions. *Annals of Mathematical Statistics*, **41**, 2137–2139.

Sen, P. K. (1970c). On some convergence properties of one-sample rank order statistics. *Annals of Mathematical Statistics*, **41**, 2140–2143.

Sen, P. K. (1971a). Asymptotic efficiency of a class of aligned rank order tests for multiresponse experiments in some incomplete block designs. *Annals of Mathematical Statistics*, **42**, 1104–1112.

Sen, P. K. (1971b). A note on weak convergence of empirical processes for sequences of $\phi-$mixing random variables. *Annals of Mathematical Statistics*, **42**, 2132–2133.

Sen, P. K. (1972a). Finite population sampling and weak convergence to a brownian bridge. *Sankhyā, Series A*, **34**.

Sen, P. K. (1972b). On the weak convergence of extremal processes for random sample sizes. *Annals of Mathematical Statistics*, **43**, 1355–1362.

Sen, P. K. (1972c). The Hajek-Renyi inequality for sampling from a finite population. *Sankhyā, Series A*, pages 33–52.

Sen, P. K. (1973a). An almost sure invariance principle for multivariate Kolmogorov-Smirnov statistics. *The Annals of Probability*, **1**, 488–496.

Sen, P. K. (1973b). On fixed size confidence bands for the bundle strength of filaments. *The Annals of Statistics*, **1**, 526–537.

Sen, P. K. (1973c). Asymptotic sequential tests for regular functionals of distribution functions. *Teoriya Veroyatnostei i ee Primeneniya*, **18**.

Sen, P. K. (1974a). Almost sure behaviour of U-statistics and von Mises' differentiable statistical functions. *The Annals of Statistics*, **2**, 387–395.

Sen, P. K. (1974b). The invariance principle for one-sample rank-order statistics (Corr: V2 p1358). *The Annals of Statistics*, **2**, 49–62.

Sen, P. K. (1974c). Weak convergence of generalized U-statistics. *The Annals of Probability*, **2**, 90–102.

Sen, P. K. (1974d). Weak convergence of multidimensional empirical processes for stationary ϕ-mixing processes. *The Annals of Probability*, **2**, 147–154.

Sen, P. K. (1976a). An almost sure invariance principle for the extrema of certain sample functions. *The Annals of Probability*, **4**, 80–89.

Sen, P. K. (1976b). A note on invariance principles for induced order statistics. *The Annals of Probability*, **4**, 474–479.

Sen, P. K. (1976c). A two-dimensional functional permutational central limit theorem for linear rank statistics. *The Annals of Probability*, **4**, 13–26.

Sen, P. K. (1976d). Weak convergence of progressively censored likelihood ratio statistics and its role in asymptotic theory of life testing. *The Annals of Statistics*, **4**, 1247–1257.

Sen, P. K. (1977a). Almost sure convergence of generalized U-statistics. *The Annals*

of Probability, **5**, 287–290.

Sen, P. K. (1977b). Some invariance principles relating to jackknifing and their role in sequential analysis. *The Annals of Statistics*, **5**, 316–329.

Sen, P. K. (1977c). Tied-down Wiener process approximations for aligned rank order processes and some applications. *The Annals of Statistics*, **5**, 1107–1123.

Sen, P. K. (1979a). Asymptotic properties of maximum likelihood estimators based on conditional specification. *The Annals of Statistics*, **7**, 1019–1033.

Sen, P. K. (1979b). Invariance principles for the coupon collector's problem: A martingale approach. *The Annals of Statistics*, **7**, 372–380.

Sen, P. K. (1979c). Weak convergence of some quantile processes arising in progressively censored tests. *The Annals of Statistics*, **7**, 414–431.

Sen, P. K. (1980). Limit theorems for an extended coupon collector's problem and for successive subsampling with varying probabilities. *Calcutta Statistical Association Bulletin*, **29**, 113–132.

Sen, P. K. (1981a). The Cox regression model, invariance principles for some induced quantile processes and some repeated significance tests. *The Annals of Statistics*, **9**, 109–121.

Sen, P. K. (1981b). Some invariance principles for mixed rank statistics and induced order statistics and some applications. *Communications in Statistics, Series A*, **10**, 1691–1718.

Sen, P. K. (1982a). Asymptotic properties of likelihood ratio tests under conditional specifications. *Statistics and Decisions*, **1**, 81–106.

Sen, P. K. (1982b). Invariance principles for recursive residuals. *The Annals of Statistics*, **10**, 307–312.

Sen, P. K. (1982c). On asymptotic normality in sequential sampling tagging. *Sankhyā, Series A*, **44**, 352–363.

Sen, P. K. (1982d). On M tests in linear models. *Biometrika*, **69**, 245–248.

Sen, P. K. (1982e). A renewal theorem for an urn model. *The Annals of Probability*, **10**, 838–843.

Sen, P. K. (1982f). Tests for change-points based on recursive U-statistics (Corr: V2 p85). *Sequential Analysis*, **1**, 263–284.

Sen, P. K. (1984a). A James-Stein type detour of U-statistics. *Communications in Statistics: Theory and Methods*, **13**, 2725–2747.

Sen, P. K. (1984b). Subhypotheses testing against restricted alternatives for the Cox regression model. *Journal of Statistical Planning and Inference*, **10**, 31–42.

Sen, P. K. (1985). Nonparametric testing against restricted alternatives under progressive censoring. *Sequential Analysis*, **4**, 247–273.

Sen, P. K. (1986a). Are BAN estimators the Pitman-closest ones too? *Sankhyā, Series A*, **48**, 51–58.

Sen, P. K. (1986b). The Gini coefficient and poverty indexes: Some reconciliations. *Journal of the American Statistical Association*, **81**, 1050–1057.

Sen, P. K. (1986c). On the asymptotic distributional risks of shrinkage and preliminary test versions of maximum likelihood estimators. *Sankhyā, Series A*, **48**, 354–371.

Sen, P. K. (1987). What do the arithmetic, geometric and harmonic means tell us in length-biased sampling? *Statistics and Probability Letters*, **5**, 95–98.

Sen, P. K. (1988a). Combination of statistical tests for multivariate hypotheses against restricted alternatives. In S. Dasgupta and J. K. Ghosh, editors, *Proceedings of the International Conference on Advances in Multivariate Statistical Analysis*, pages 377–402. Indian Statistical Institute.

Sen, P. K. (1988b). Functional approaches in resampling plans: A review of some

recent developments. *Sankhyā, Series A*, **50**, 394–435.
Sen, P. K. (1988c). Functional jackknifing: Rationality and general asymptotics. *The Annals of Statistics*, **16**, 450–469.
Sen, P. K. (1989). The mean-median-mode inequality and noncentral chi square distributions. *Sankhyā, Series A*, **51**, 106–114.
Sen, P. K. (1990). On the Pitman closeness of some sequential estimators. *Sequential Analysis*, **9**, 383–400.
Sen, P. K. (1994a). Incomplete multiresponse designs and surrogate endpoints in clinical trials. *Journal of Statistical Planning and Inference*, **42**, 161–186.
Sen, P. K. (1994b). Isomorphism of quadratic norm and *PC* ordering of estimators admitting first order *AN* representation. *Sankhyā, Series A*, **56**, 465–475.
Sen, P. K. (1995). Statistical analysis of some reliability models: Parametrics, semiparametrics and nonparametrics. *Journal of Statistical Planning and Inference*, **43**, 41–66.
Sen, P. K. (1996). Regression rank scores estimation in ANOCOVA. *The Annals of Statistics*, **24**(4), 1586–1601.
Sen, P. K. (1998a). Multiple comparisons in interim analysis. *Journal of Statistical Planning and Inference*, **72**, 5–23.
Sen, P. K. (1998b). Some remarks on Simes-type multiple tests of significance. *Journal of Statistical Planning and Inference*, **82**, 139–145.
Sen, P. K. (1999). Utility-oriented Simpson-type indexes and inequality measures. *Calcutta Statistical Association Bulletin*, **49**, 1–22.
Sen, P. K. (2001). Toxicology: Statistical perspectives. *Current Science*, **80**, 1167–1175.
Sen, P. K. (2002a). Measures of quality adjusted life and quality of life deficiency: Statistical perspectives. In Mesbah et al., editor, *Statistical Methods for Quality of Life Studies: Design, Methods and Analysis*, pages 275–286. Kluwer Netherlands.
Sen, P. K. (2002b). Neuronal Spatio-temporal models: High-dimensional Implications and Statistical Perspectives. *Scientiae Mathematicae Japonicae*, **56**, 613–648.
Sen, P. K. (2002c). Shapiro-wilk type goodness-of-fit tests for normality: Asymptotics revisited. In C. Huber-Carol et al., editor, *Goodness-of-Fit Tests and Model Valaidity*, pages 73–88. Birkhauser, Boston.
Sen, P. K. (2002d). Shifting goals and mounting challenges for statistical methodology at the present time. *Journal of Modern Statistical Methods*, **1**(1), 3–18.
Sen, P. K. (2005). Gini diversity index, Haming distance and cause of dimensionality. *Metron*, **63**, 329–350.
Sen, P. K. (2006). Robust statistical inference for high-dimensional data models with applications to genomics. *Austrian Journal of Statistics*, **35**, 197–214.
Sen, P. K. (2007). Burden of bioinformatics in medical research: Statistical perspectives and controversies. *Journal of Statistical Planning and Inference*, to appear.
Sen, P. K. and Bhattacharyya, B. B. (1976). Asymptotic normality of the extremum of certain sample functions. *Zeitschrift für Wahrscheinlichkeitstheorie und verwandte Gebiete*, **34**, 113–118.
Sen, P. K. and Bhattacharyya, B. B. (1977). Weak convergence of the Rao-Blackwell estimator of a distribution function. *The Annals of Probability*, **5**, 500–510.
Sen, P. K. and Boyd, M. N. (1986). Union intersection rank tests for ordered alternatives in ANOCOVA. *Journal of the American Statistical Association*, **81**, 526–532.
Sen, P. K. and Dutta, K. (1971). On the Bahadur representation of sample quantiles

in some stationary multivariate auto regressive processes. *Journal of Multivariate Analysis*, **1**, 186–198.

Sen, P. K. and Ghosh, B. K. (1976). Comparisons of some bounds in estimation theory. *The Annals of Statistics*, **4**, 755–765.

Sen, P. K. and Ghosh, M. (1971). On bounded length sequential confidence intervals based on one sample rank order statistics. *Annals of Mathematical Statistics*, **42**, 189–203.

Sen, P. K. and Ghosh, M. (1973a). A Chernoff-Savage representation of rank order statistics for stationary $\phi-$mixing processes. *Sankhyā, Series A*, **35**.

Sen, P. K. and Ghosh, M. (1973b). A law of iterated logarithm for one-sample rank order statistics and an application. *The Annals of Statistics*, **1**, 568–576.

Sen, P. K. and Ghosh, M. (1974). Sequential rank tests for location (Corr: V4 p821). *The Annals of Statistics*, **2**, 540–552.

Sen, P. K. and Ghosh, M. (1980). On the Pitman efficiency of sequential tests. *Calcutta Statistical Association Bulletin*, **29**, 65–72.

Sen, P. K. and Jurečková, J. (1999). Second-order asymptotic relations and goodness of fit tests. *Journal of Statistical Planning and Inference*, pages 377–398.

Sen, P. K. and Margolin, B. H. (1995). Inhalation toxicology: Awareness, identifiability, statistical perspectives and risk assessment. *Sankhyā, Series B*, **57**, 252–276.

Sen, P. K. and Mehra, K. L. (1969). On a class of conditionally distribution free tests for interactions in factorial experiments. *Annals of Mathematical Statistics*, **40**, 658–664.

Sen, P. K. and Miller, R. G. (1972). Weak convergence of U-statistics and von Mises' differentiable statistical functions. *Annals of Mathematical Statistics*, **43**, 31–41.

Sen, P. K. and Puri, M. L. (1967). On the theory of rank order tests for location in the multivariate one sample problem. *Annals of Mathematical Statistics*, **38**, 1216–1228.

Sen, P. K. and Puri, M. L. (1969). On the asymptotic normality of one sample rank order test statistics. *Teoriya Veroyatnostei i ee Primeneniya*, **14**, 167–172.

Sen, P. K. and Rao, C. R. (2002). Permutation scores tests for homogeneity of angular and compositional gaussian distribution. *Journal of Nonparametric Statistics*, **14**, 421–434.

Sen, P. K. and Salama, I. A. (1983). The Spearman footrule and a Markov chain property. *Statistics and Probability Letters*, **1**, 285–289.

Sen, P. K. and Saleh, A. K. M. E. (1985). On some shrinkage estimators of multivariate location. *The Annals of Statistics*, **13**, 272–281.

Sen, P. K. and Saleh, A. K. M. E. (1987). On preliminary test and shrinkage M-estimation in linear models. *The Annals of Statistics*, **15**, 1580–1592.

Sen, P. K. and Sengupta, D. (1991). On characterizations of Pitman closeness of some shrinkage estimators. *Communications in Statistics: Theory and Methods*, **20**, 3551–3580.

Sen, P. K. and Tsai, M.-T. (1999). Two-stage likelihood ratio and union-intersection tests for one-sided alternatives multivariate mean with nuisance dispersion matrix. *Journal of Multivariate Analysis*, **68**, 264–282.

Sen, P. K., Bhattacharyya, B. B., and Suh, M. W. (1973). Limiting behaviour of the extrema of certain sample functions. *Annals of Statistics*, **1**, 297–311.

Sen, P. K., Kubokawa, T., and Saleh, A. K. M. E. (1989). The Stein paradox in the sense of the Pitman measure of closeness. *The Annals of Statistics*, **17**, 1375–1386.

Sen, P. K., Salama, I. A., and Quade, D. (2003). Spearman footrule under progressive censoring. *Journal of Nonparmetric Statistics*, **15**, 53–60.

Sen, P. K., Tsai, M. J., and Jou, Y. S. (2007). High-dimension low sample size perspectives in constrained statistical inference: The sarscovrna genome in illustration. *Journal of the American Statistical Association*, **102**, 685–694.

Sengupta, D. and Sen, P. K. (1991). Shrinkage estimation in a restricted parameter space. *Sankhyā, Series A*, **53**, 389–411.

Silvapulle, M. J. and Sen, P. K. (1993). Robust tests in group sequential analysis: One- and two-sided hypotheses in the linear model. *Annals of the Institute of Statistical Mathematics*, **45**, 159–171.

Singer, J. M. and Sen, P. K. (1985). M-methods in multivariate linear models. *Journal of Multivariate Analysis*, **17**, 168–184.

Singer, J. M. and Sen, P. K. (1986). M-methods in growth curve analysis. *Journal of Statistical Planning and Inference*, **13**, 251–261.

Sinha, B. K. and Sen, P. K. (1989). On averaging over distinct units in sampling with replacement. *Sankhyā, Series B*, **51**, 65–83.

Szekely, G. J. and Sen, P. K. (2002). Characterization of diagonal symmetry: Location unknown, and a test based on allied U-processes. *Journal of Statistical Planning and Inference*, **102**(2), 349–358.

Tien, H.-C. and Sen, P. K. (2002). A proportional hazards model for bivariate survival data under interval censoring. *Sankhyā, Series A*, **64**(2), 409–428.

Tsai, M. T. and Sen, P. K. (2004). On the inadmissibility of Hotelling T^2 test for restricted alternatives. *Journal of Multivariate Analysis*, **89**, 87–96.

Tsai, M.-T. and Sen, P. K. (2005). Asymptotically optimal tests for parametric functions against ordered functional alternatives. *Journal of Multivariate Analysis*, **95**(1), 37–49.

Tsai, M. T. and Sen, P. K. (2007). Locally best rotation-invariant rank tests for model location. *Journal of Multivariate Analysis*, **98**, 1160–1179.

Tsai, M.-T., Sen, P. K., and Yang, Y.-H. (1994). Power-robustness of likelihood ratio (union-intersection score) tests for some restricted alternative problems. *Statistics and Decisions*, **12**, 231–244.

Tsai, M.-T. M. and Sen, P. K. (1991). Asymptotic optimality and distribution theory of UI-LMP rank tests for restricted alternatives. *Sankhyā, Series B*, **53**, 151–175.

Wang, L. and Sen, P. K. (2005). Extreme value theory in some statistical analysis of genomic sequences. *Extremes*, **8**(4), 295–310.