# 1. Biography of Lucien Le Cam

## **Personal Data**

Date of Birth:	November 18, 1924
Place of Birth:	Croze Creuse, France
Citizenship	French

### Education

1947	License es Sciences, University of Paris, France
1947-48	Graduate Studies, Sorbonne, France
1952	Ph.D., University of California, Berkeley, California

#### **Positions Held**

1945-50	Statistician, Electricité de France, Paris
1950-52	Lecturer in Mathematics and Research Assistant,
	University of California, Berkeley
1952-53	Instructor in Mathematics and Junior Research
	Statistician, University of California, Berkeley
1953-55	Assistant Professor of Mathematics, Statistical
	Laboratory, University of California, Berkeley
1955-58	Assistant Professor, Department of Statistics,
	University of California, Berkeley
1958-60	Associate Professor, Department of Statistics
	University of California, Berkeley.
1960–	Professor, Department of Statistics, University of
	California, Berkeley
1961-65	Chairman, Department of Statistics, University of
	California, Berkeley
1957-58	Fellow of the Alfred P. Sloan Foundation
Summers of	
1958, 1959	
1971-72	Miller Professor, Department of Statistics, University
	of California, Berkeley
1972-73	Director, Centre de Recherches Mathématiques,
	Université de Montréal
1973–	Professor of Mathematics and Statistics, University
	of California, Berkeley

### **Professional Activities**

1965	Editor (with J. Neyman) of Bernoulli-Bayes-Laplace
	Anniversary Volume, Springer, 1965
1967	Editor (with J. Neyman) of Proceedings of the Fifth

	Berkeley Symposium on Mathematical Statistics and
	Probability, University of California Press, Berkeley,
	Vols. 1-V, (1967), 3365 pages
1968–	Associate Editor, Zeitschrift für Wahrscheinlichkeits-
	theorie u.v. Gebiete
1968-70	Member of Council, Institute of Mathematical Statistics
1970-72	Editor (with J. Neyman and E.L. Scott) of Proceedings
	of the Sixth Berkeley Symposium on Mathematical
	Statistics and Probability, University of California
	Press, Berkeley
1973	President, Institute of Mathematical Statistics
1973	Member of Council, I.A.S.P.S.
1974–	Member comité aviseur du Centre de Recherches
	Mathématiques, Université de Montreal, Montreal,
	Canada
1974	Founder, Publications de la Chaire Aisenstadt, Les
	Presses de l'Universit de Montreal, 1974
1976	Elected to American Academy of Arts and Sciences
1977	Elected Fellow of the American Association for the
	Advancement of Science
1979–	Associate Editor, Polish Journal of Probability and
	Mathematical Statistics
1981	Associate Director, Statistical Laboratory, University
	of California, Berkeley
1982	Member, New York Academy of Science

**Member of Professional Societies** 

International Statistical Institute Institute of Mathematical Statistics American Mathematical Society American Statistical Association International Chinese Statistical Association

## 2. Publications of Lucien Le Cam

- (1) 'Un instrument d'étude des fonctions aléatoires, la fonctionelle caractéristique", *Comptes rendus des séances de l'Academie des Sciences*, Paris, 224 (1947), pp. 710-711.
- [2] 'Sur certaines classes de fonctions aléatoires", *Comptes rendus des séances de l'Academie des Sciences*, Paris, **227** (1948), pp. 1206-1208 (with J. Bass).

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- [3] ''Les lois des débits des riviéres francaises", *Houille Blanche*, Numéro Special B (1949), pp. 733-740, (with G. Morlat).
- [4] 'On some asymptotic properties of maximum likelihood estimates and related Bayes' estimates", *Univ. Calif. Publ. in Stat.*,**1**, No.11 (1953), pp. 277-329.
- [5] ' 'Note on a theorem of Lionel Weiss", *Annals of Mathematical Statistics*, **25** (1954), pp. 791-794.
- [6] 'An extension of Wald's theory of statistical decision functions", Annals of Mathematical Statistics, 26, No. 1 (1955), pp. 69-81.
- [7] 'On the asymptotic theory of estimation and testing hypotheses", Proc. Third Berkeley Symposium on Mathematical Statistics and Probability, University of California Press, I (1956), pp. 129-156.
- [8] 'A remark on the roots of the maximum likelihood equation", *Annals of Mathematical Statistics*, **27**, No. 4 (1956), pp. 1174-1177, (with C. Kraft).
- [9] ' 'Convergence in distribution of stochastic processes", *Univ.Calif. Publ. in Stat.*, 2, No. 11 (1957), pp. 207-236.
- (10) 'Remarques sur les variables aléatoires dans les espaces vectoriels non séparables", *Publications de l'Institut de Statistique de l'Université de Paris*, VII, Pts. 1-2 (1958), pp. 39-53.
- (11) 'Une théorme sur la division d'un intervalle par des points pris au hasard", *Publications de l'Institut de Statistique de l'Université de Paris*, VII, Pts. 3-4 (1958), pp. 7-16.
- [12] 'Les propriétés asymptotiques des solutions de Bayes", Publications de l'Institut de Statistique de l'Université de Paris, VII, Pts. 3-4 (1958), pp. 17-35.
- [13] 'Locally asymptotically normal families of distributions", Univ. Calif. Publ. in Stat., 3, No. 2 (1960), pp. 37-98.
- [14] 'A necessary and sufficient condition for the existence of consistent estimates", *Annals of Mathematical Statistics*, **31** (1960), pp. 140-150. (with L. Schwartz).
- [15] 'The Poisson approximation to the Poisson binomial distribution", Annals of Mathematical Statistics, 31 (1960), pp. 737-740 (with J.L. Hodges, Jr.).
- [16] ' 'An approximation theorem for the Poisson binomial distribution", *Pacific Journal of Math.*, **10**, No. 4 (1960), pp. 1181-1197.
- [17] 'A stochastic description of precipitation", Proceedings of the Fourth Berkeley Symposium on Mathematical Statistics and Probability, Vol. III, pp. 165-186, Univ. of Calif. Press, Berkeley, 1961.
- [18] 'A note on the distribution of sums of independent random variables", Proc. of Nat'l Acad. Sci., Vol. 50, No. 4 (1963), pp. 601-603.
- [19] 'Sufficiency and approximate sufficiency", (Special invited address Inst. Math. Stat., Dec. 1959.) Annals of Mathematical Statistics, Vol. 35, No. 4 (1964), pp. 1419-1455.
- (20) 'Consistent estimates and zero-one sets", *Annals of Mathematical Statistics*, Vol. 35, No. 1 (1964), pp. 157-161 (with L. Breiman and L. Schwartz).
- [21] 'On the distribution of sums of independent random variables", *Proc. of the Bernoulli-Bayes-Laplace Seminar*, Springer-Verlag 1965, pp. 179-202.
- [22] ' 'A remark on the central limit theorem", *Proc. Nat. Acad. Science*, August 1965, pp. 354-359.

- [23] *Bernoulli Bayes, Laplace*, (Ed. J. Neyman and L. Le Cam), Springer-Verlag, Berlin, October, 1965.
- [24] 'Generalizations of Chernoff-Savage theorems on asymptotic normality on nonparametric test statistics", *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*, Univ. of Calif. Press, Berkeley. (with M. Raghavachari and Z. Govindarajulu), Vol. I (1967), pp. 609-638.
- [25] Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability, Univ. of Calif. Press, Berkeley and Los Angeles (ed. J. Neyman and L. Le Cam) (1967), Vol. I Statistics, pp. 1-666, Vol. II, Probability Part I, pp. 1-447, Part II, pp. 1-483, Vol. III, Physical Sciences, pp. 1-324, Vol. IV, Biology and Problems of Health, pp. 1-934, Vol. V, Weather Modification Experiments, pp. 1-451.
- [26] 'Likelihood functions for large numbers of independent observations", *Research Papers in Statistics* (ed. F.N. David), John Wiley and Sons, New York (1966), pp. 167-187.
- [27] 'Panel discussion on statistical inference", in *The Future of Statistics* (ed. D. Watts), Academic Press, New York (1968), pp. 139-160.
- [28] ' 'Théorie asymptotique de la décision statistique', Séminaire de Mathématiques Supérieures-Été 1968, University of Montreal Press, Montreal, Canada (1969), pp. 7-143.
- [29] ' 'Remarques sur le théorme limite central dans les espaces localement convexes", Colloques internationaux de Centre National de la Recherche Scientifique No. 186, June 1969, Lés probabilités sur les structures algébriques. Editions du C.N.R.S., Paris, (1970), pp. 233-249.
- [30] 'On the assumptions used to prove asymptotic normality of maximum likelihood estimates", *Annals of Mathematical Statistics*, Vol. 41, No. 3 (1970), pp. 802-828.
- [31] 'On the weak convergence of probability measures", *Annals of Mathematical Statistics*, Vol. 41, No. 2 (1970), pp. 621-625.
- [32] 'On semi-norms and probabilities, and abstract Wiener spaces", *Ann. Math.*, Vol. 93, No. 2 (1971), pp. 390-408 (with R.M. Dudley and Jacob Feldman).
- [33] 'Limits of experiments", Proceedings of the Sixth Berkeley Symposium on Mathematical Statistics and Probability, Vol. 1 (1971) Univ. of Calif. Press, Berkeley, pp. 245-261.
- [34] 'Paul Lévy 1886-1971", Proceedings of the Sixth Symposium on Mathematical Statistics and Probability, University of California Press, Berkeley, Vol. III (1972), pp. xv-xx.
- [35] Proceedings of the Sixth Berkeley Symposium on Mathematical Statistics and Probability, Univ. of Calif. Press, Berkeley Los Angeles (Ed. Le Cam, Neyman & Scott): (1973)
  - Vol. 1: Theory of Statistics, 760 pp.
  - Vol. 2: Probability Theory, 605 pp.
  - Vol. 3: 711 pp.
  - Vol. 4: Biology and Health, 353 pp.
  - Vol. 5: Darwinian, Neo-Darwinian, and Non-Darwinian Evolution, 369 pp.
  - Vol. 6: Effects of Pollution on Health, 599 pp.

- [36] 'Convergence of estimates under dimensionality restrictions", *Annals of Statistics*, Vol. 1, No. 1 (1973), pp. 38-53.
- [37] ' 'On the information contained in additional observations", *Annals of Statistics*, Vol. 2 (1974), pp. 630-649.
- [38] 'Sur la lois des grands nombres pour des variables aléatoires de Bernoulli attacheés un arbre dyadique", (with A. Joffe and J. Neveu), C.R. Acad. Sciences, Paris, Vol. 277 (1973), pp. 963-964.
- [39] ' 'Sur les contraintes imposées par les passages la limite usuels en statistique', Bulletin of the *International Statistical Institute* (1973), Vienna, pp. 169-180.
- [40] 'Asymptotic methods in statistical decision theory, Chapter 1: Basic Structures", xvi + 270 pages, *Publications du C.R.M.*, University of Montreal, Canada (1974).
- [41] 'J. Neyman: on the occasion of his 80th birthday" (with E.L. Lehmann), Annals of Statistics, Vol. 2, No. 3 (1974), pp. vii-xiii.
- [42] 'Distances between experiments", A Survey of Statistical Design and Linear Models, J.N. Srivastava ed., North Holland, (1975), pp. 383-396.
- [43] 'Construction of asymptotically sufficient estimates in some non-Gaussian situations", Proceedings of the IASPS Satellite Symposium on Asymptotic Methods in Statistics, Prague (1975) Ed. J. Hájek, Universita Karlova Praga.
- [44] ' 'On local and global properties in the theory of asymptotic normality of experiments", *Stochastic Processes and Related Topics*, Vol. 1 (1975) Academic Press, pp. 13-53.
- [45] C omment on Brad Efron's paper on "Defining the curvature of a statistical problem", *Annals of Statistics*, Vol. 3, No. 6 (1975), pp. 1223-1224.
- [46] 'Circadian rhythm of stimulated lymphocyte blastogenesis" (with M. Kaplan, *et al) Journal of Allergy and Clinical Immunology*, Vol. 58, No. 1, Part 2 (1976), pp. 181-189.
- [47] 'An unusual metastatic lesion in a patient with osteosarcoma receiving tumor specific transfer factor' (with A.S. Levin, V.S. Byers, J.O. Johnson, *Transfer Factor*, Academic Press, N.Y. (1976), eds. Ascher, Gottlieb & Kirkpatrick, pp. 537-542.
- [48] 'Tumor specific transfer factor therapy in osteogenic sarcoma" (with V.S. Byers, A.S. Levin, J.O. Johnston and A.J. Hackett) Annals of the New York Academy of Sciences, Vol. 277 (1976), pp. 621-627.
- [49] 'A reduction theorem for certain sequential experiments", *Statistical Decision Theory and Related Topics*, Academic Press, N.Y. (1977) ed. S. Gupta and D. Moore.
- [50] 'On the asymptotic normality of estimates", *Proceedings of the IASPS Symposium* (to honor Jerzy Neyman), Polish Scientific Publishers, Warsaw (1977).
- [51] ' 'Identification of human populations with a high incidence of immunity against breast carcinoma", *Cancer Immunology and Immunotherapy*, Vol. 2 (1977), pp. 163-172 (with V.S. Byers, A.S. Levin, W.H. Stone, A.J. Hackett.)
- [52] 'A note on metastatistics or, An essay towards stating a problem in the doctrine of chances", *Synthese*, Vol. 36 (1977), pp. 133-160.
- [53] 'On the asymptotic behavior of mixtures of Poisson distributions" (with R. Traxler), *Zeitschrift fur Wahrscheinlichkeitstheorie*, Vol. 44, (1978), pp. 1-45.

- [54] ' 'A reduction theorem for certain sequential experiments, II'' *Annals of Statistics*, Vol. 7 (1979), pp. 847-859.
- [55] ' 'On a theorem of J. Hájek", *Contributions to Statistics* (Jaroslav Hájek Memorial Volume), Academia, Prague (1979), pp. 119-135.
- [56] 'Immunotherapy of Osteogenic Sarcoma with Transfer Factor, Long-Term Follow-up", *Cancer Immunology and Immunotherapy*, Vol. 6 (1979), pp. 243-253 (with V.S. Byers, A.S. Levin, J.O. Johnson, A.J. Hackett).
- [57] Jerzy Neyman Biographical supplement to the International Encyclopedia of the Social Sciences. (1979)
- [58] ' 'Minimum chi-square not maximum likelihood. Discussion of J. Berkson's paper", *Annals of Statistics*, Vol. 8 (1980), pp. 473-478.
- [59] 'Limit theorems for empirical measures and Poissonization". In *Statistics and Probability*, Essays in the honor of C.R. Rao, North-Holland (1982), pp. 455-463.
- [60] 'On the risk of Bayes estimates". In *Statistical Decision Theory and Related Topics*. Academic Press (1982), pp. 121-137.
- [61] 'On some stochastic models of tumor growth and metastasis", In *Probability Models and Cancer*. North-Holland (1982), pp. 265-286.
- [62] Probability Models and Cancer, L. Le Cam and J. Neyman editors, North-Holland (1982), 301 pages.
- [63] 'A remark on empirical measures", *Festschrift in the honor of E.L. Lehmann*, Wadsworth (1982), pp. 305-327.
- [64] 'Extension of a theorem of Chernoff and Lehmann", (with C. Mahan and A. Singh), *Recent Advances in Statistics*, Academic Press (1983), pp. 303-337.
- [65] R eview of *Statistical estimation; asymptotic theory*, by Ibragimov and Has'minskii and *Contributions to a general asymptotic statistical theory* by Pfanzagl and Wefelmeyer, *Bull. Amer. Math. Soc.*, Vol. 11, No. 2, October 1984, pp. 392-400.
- [66] *Proceedings of the Berkeley Conference in honor of Jerzy Neyman and Jack Kiefer*, L. Le Cam and R.A. Olshen, eds., Vol. 1 and 2, Wadsworth 1985.
- [67] 'Sur l'approximation de familles de mesures par des familles gaussiennes", Ann. Inst. Henri Poincaré, Vol. 21, No. 3 (1985) pp. 255-287.
- [68] 'On Lévy's martingale central limit theorem", (with P. Jeganathan) Sankhya, Vol. 47, Series A, Part 2 (1985), pp. 141-155.
- [69] ' 'The central limit theorem around 1935", *Statistical Science*, Vol. 1, No. 1, (1986), pp. 78-96.
- [70] Asymptotic Methods in Statistical Decision Theory . Springer- Verlag, July 1986 (xxvi + 735 pages).
- [71] D iscussion of D.A. Freedman and P. Diaconis, "Consistency of Bayes Estimates", *Annals of Statistics* Vol. 14, No. 1 (1986) pp. 59-60.
- (72) 'Distinguished statistics, loss of information and a theorem of Robert B. Davies".
  (with Grace Lo Yang). *Statistical decision theory and related topics IV*, Vol. 2, pp. 163-75, Springer Verlag 1988.
- [73] ' 'On the preservation of local asymptotic normality under information loss''. (with Grace Lo Yang) *Annals of Statistics*, Vol. 16, No. 2, pp. 483-520, (1988).
- [74] 'Convergence of stochastic empirical measures". (with R.J. Beran and P.W. Millar). J. Multivariate Analysis. Vol. 23 pp. 159-168 (1987).

- [75] 'Statistical asymptotics. Some basic theorems". (with Grace Yang). Springer-Verlag Series in Statistics 1990. Chinese version to be published by Science Press, Beijing, Spring 1991.
- [76] 'Maximum likelihood an introduction", Pub. University of Maryland. Lecture Notes #18. ISI Review Vol 58 #2 pp. 153-171. (1990)
- (77) 'On the standard asymptotic confidence ellipsoids of Wald". ISI Review Vol 58 #2 pp. 129-152 (1990).
- [78] 'Some recent results in the asymptotic theory of statistical estimation" Invited paper, International Congress of Mathe- maticians, Kyoto, August 21-29, 1990.
  Published Proceedings of the International Congress of Mathematicians pp. 1083-1090. Springer Verlag 1991.

#### **Publications to Appear**

- [79] 'Stochastic models of lesion induction and repair in yeast". Accepted *Mathematical Biosciences*.
- [80] ' 'On some stochastic models of the effects of radiation on cell survival". To be submitted.
- [81] 'On the Prokhorov distance between the empirical process and the associated Gaussian bridge". Technical Report #170, Statistics, U.C. Berkeley.
- [82] ' 'On measurability and convergence in distribution''. Technical Report #211, Statistics, U.C. Berkeley.
- [83] 'Some special results of measure theory" Technical Report, U.C. Berkeley, August 1990. 39 pages.
- [84] 'An Infinite Dimensional Convolution Theorem" Technical Report #269, September 1990, Statistics, U.C. Berkeley.

#### **In Preparation**

- [85] 'Stochastic models for sodium channels in nerve cells". To be submitted (with Grace Lo Yang).
- [86] 'A non-Markovian model of temporal and spatial propagation of epidemics". Proc. Conference on Stochastic Processes in Epidemic Theory. Marseille-Lumigny Oct. 1988.

#### 3. Students of Lucien Le Cam

JULIUS RUBIN BLUM, Strong consistency of stochastic approximation methods, 1953. CHARLES HALL KRAFT, On the problem of consistent and uniformly consistent statistical procedures, 1954. BAYARD RANKIN, The concept of sets enchained by a stochastic process and its use in cascade shower theory, 1955. GEORGES POWELL STECK, Limit theorems for conditional distributions, 1955. THOMAS SHELBURNE FERGUSON,

I. On the existence of linear regression in linear structural relations. II. A method of generating best asymptotically normal estimates with application to the estimation of bacterial densities, 1956. ISRAEL JACOB ABRAMS, Contributions to the stochastic theory of inventory, 1957. ESARY, JAMES D., A stochastic theory of accident survival and fatality, 1957. CHARLOTTE T. STRIEBEL, Efficient estimation of regression parameters for certain second order stationary processes, 1960. LORRAINE SCHWARTZ, Consistency of Bayes' procedures, 1960. HELEN WITTENBERG, Limiting distributions of random sums of independent random variables, 1963. GIAN DOMENICO MAJONE, Asymptotic behavior of Bayes' estimates in Borel sets, 1966. NORA SNOECK SMIRIGA, Stochastic processes with independent pieces, 1966. GRACE LO YANG, Contagion in stochastic models for epidemics, 1966. DAVID GOMBERG, Estimation of asymptotes, 1967. STEPHEN MACK STIGLER, Linear functions of order statistics, 1967. MIN-TE CHAO, Nonsequential optimal solutions of sequential decision problems, 1967. ERIK NIKOLAI TORGERSEN, Comparison of experiments when the parameter space is finite, 1968. ALEJANDRO DANIEL DEACOSTA, Existence and convergence of probability measures in Banach spaces, 1969. PEDRO JESUS FERNANDEZ, On the weak convergence of random sums of independent random elements, 1970. ARNOLDO GUEVARA DE HOYOS, Continuity of some Gaussian processes parametrized by the compact convex sets in R<sup>s</sup>, 1970. Detlev Lindae, Distributions of likelihood ratios and convergence of experiments, 1972. Mohd Nawaz Goria, Estimation of the location of discontinuities, 1972. Aloisio Pessoa deAraujo, On the central limit theorem in C(0, 1), 1974. ROBERT HENRY TRAXLER, On tests for trend in renewal processes, 1974 (Biostatistics).

ODD OLAI AALEN, Statistical Inference for a Family of Counting Processes, 1975. ERIK JAN BALDER, An Extension of Duality-Stability Relations to Nonconvex Optimization Problems, 1976. ERROL CHURCHILL CABY, Convergence of Measures on Uniform Spaces, 1976. MOHAMED WALID MOUSSATAT, On the Asymptotic Theory of Statistical Experiments and Some of Its Applications, 1976. NENG HSIN CHEN, On the Construction of a Non-Parametric Efficient Location Estimator, 1980. ANDERS SWENSEN, Asymptotic Inference for a Class of Stochastic Processes, 1980. Shaw Hwa Lo, Locally Asymptotically Minimax Estimation for Symetric Distribution Functions and Shift Parameters, 1981. JANE LING WANG, Asymptotically Minimax Estimators for Distributions With Increasing Failure Rate, 1982. YANNIS YATRACOS, Uniformly Consistent Estimates and Rates of Convergence via Minimum Distance Methods, 1983. IMKE JANSSEN, Stochastic Models for the Effects of Radiation on Cells in Culture, 1984. BIN YU, Some results on empirical processes and stochastic complexity, 1990 (Jointly with Professor Terence Speed). YU-LIN CHANG, Local behavior of mixtures of normal distributions, 1991. YU-LI GU, Minimax estimation for Poisson experiments, 1992. JAMES SCHMIDT, A computer simulation of the effect of radiation on a coil of DNA, 1993 (Jointly with

A computer simulation of the effect of radiation on a coil of DNA, 1993 (Jointly with Professor Cornelius Tobias, Biophysics).