

Shmuel Weinberger

Curriculum Vita

Born 2.20.63

Married, two children

Education.

1982 Ph.D. Courant Institute of the Mathematical Sciences
1981 B.A. New York University

Professional Experience:

2015-present, Andrew MacLeish Distinguished Service Professor of Mathematics,
University of Chicago
2012-present, Chairman, Department of Mathematics, University of Chicago
1997-2015 Professor, University of Chicago
1994-1996 Thomas A. Scott Professor of Mathematics, University of
Pennsylvania
1987-1994 Professor, University of Chicago
1985-1987 Associate Professor, University of Chicago
1984-1985 Assistant Professor, University of Chicago
1982-1984 Instructor, Princeton University

Longer visiting positions

2015 Aug-Dec. Visiting Professor, Hebrew University
2011 Aug-Dec. Simons Visiting Professor, MSRI
2006 Aug-Oct. Visiting Research Professor, MSRI
2004 Sept-Dec. Magnus Visiting Professor, Courant Institute
2000-2001 Forshemer Visiting Professor, Hebrew University
1989-1992 Visiting Professor, Courant Institute of the Mathematical Sciences

Awards

2013 Fellow American Association for the Advancement of Science
2013 Fellow American Mathematical Society
1985 Sloan Foundation Fellowship
1985 Presidential Young Investigator Award
1983 NSF Postdoctoral Fellowship
1982 Friedrichs Prize (of Courant Institute)
1979 NSF Graduate Fellowship

1977 Westinghouse Science Talent Search (4th Place)

Major Addresses

2017 Mathematical Congress of the Americas, invited lecture
2017 Plenary lecture, FoCM Triennial meeting (Barcelona)
2017 Minerva distinguished lectures, Princeton University
2015 MINT distinguished lectures, Tel Aviv University
2014 Simons Science Series Lecture
2013 Distinguished lecture series, Indiana University, Bloomington
2013 Frontiers of Mathematics Lectures, Texas A&M
2012 Clifford Lectures, Tulane University
2010 William Benter Lecture, Hong Kong City University
2008 Invited Speaker, at Mini-symposium (Applied algebraic topology) of European Congress of Mathematicians, Amsterdam
2008 Hardy Lecture Series, London Mathematical Society
2006 Plenary Lecturer, Winter meeting of Canadian Mathematical Society in Toronto
2005 Blumenthal Lectures, Tel Aviv University
2005 Special Lecture Series, Technion (Haifa)
2004 Plenary lecturer, Conference in honor of 40th Anniversary of F.I.M. Zurich
2004 Lewis Lectures, Rutgers University
2003 Marker Lectures, Penn State University.
2002 Cairns lectures, University of Illinois at Urbana-Champaign
2001 Plenary Speaker, Association of Symbolic Logic-American Mathematical Society Joint Annual Meeting
2001 Zabrodsky Lecture, Hebrew University
2000 Jankowski Memorial Lecture, Gdansk section of the Polish Academy of Sciences
2000 Porter Lecture Series, Rice University
1994 Invited Speaker, International Congress of Mathematicians, Zurich
1989 Plenary lecturer at Spring meeting of American Mathematical Society in Chicago

Current Editorships and Board Memberships

Geometriae Dedicata,
Journal of Homotopy and Related Structures.
Journal of Foundations of Computational Mathematics
Founding Editor, Journal of Topology and Analysis
Founding Editor in Chief, Journal of Applied and Computational Topology

Governing board, FoCM (Foundations of Computational Mathematics)
Academic Advisory board Stevanovich Center of Financial Mathematics at University of Chicago
External Scientific Board, CRG in applied, algebraic, and geometric topology (2014-18) at PIMS (Vancouver).

Scientific Advisory Board, Math and Physical Sciences Simons Foundation (2018-22)

Recent Service

AMS-AAAS Liaison Committee 2010-11
Chair of AMS Fellows Committee 2015
Chair of AMS Veblen Prize Committee 2015
Smale Prize Committee 2017
ICM Topology Committee (1998 and) 2018

Books:

1. The Topological Classification of Stratified Spaces, University of Chicago Press 1994
2. Computers, Rigidity, and Moduli: The Large Scale Geometry of Riemannian Moduli Space, Princeton University Press 2005
3. Variations on a theme of Borel, Cambridge University Press (to be published in 2018)
4. A course in surgery theory, Princeton University Press (to be published in 2019)

Published Articles and Preprints:

1. Homotopy equivalent manifolds by pasting. Current trends in algebraic topology, Part 2 (London, Ont., 1981), pp. 423-433, CMS Conf. Proc., 2, Amer. Math. Soc., Providence, R.I.
2. There exist finitely presented groups with infinite ooze. Duke Math. J. 49 (1982), no. 4, 1129-1133.
3. Constructions of group actions a survey of some recent developments, Group actions on manifolds (Boulder, Colo., 1983), 269--298, Contemp. Math. 36
4. Oliver's formula and Minkowski's theorem. Algebraic and geometric topology (New Brunswick, N.J., 1983), 420-421, Lecture Notes in Math., 1126
5. Some nilpotent complexes. in Algebraic and geometric topology (New Brunswick, N.J., 1983), 422-423, Lecture Notes in Math., 1126
6. The Novikov conjecture and low-dimensional topology. Comment. Math. Helv. 58 (1983), no. 3, 355-364.
7. Constructing homotopy equivalences. Topology 23 (1984), no. 3, 347-379.
8. Caractéristiques d'Euler et groupes fondamentaux des variétés de dimension 4. Comment. Math. Helv. 60 (1985), no. 1, 139-144. (with Hausmann)
9. Improving homological triviality. Comm. Pure Appl. Math. 38 (1985), no. 6, 911-917.
10. A geometric interpretation of Siebenmann's periodicity phenomenon Geometry and topology (Athens, Ga., 1985), 47-52, Lecture Notes in Pure and Appl. Math., 105, Dekker, New York. (with Cappell)
11. Continuous versus discrete symmetry. in Geometry and topology (Athens, Ga., 1985), 319-323, Lecture Notes in Pure and Appl. Math., 105, Dekker, New York,
12. Group actions and higher signatures. Proc. Nat. Acad. Sci. U.S.A. 82 (1985), no. 5, 1297-1298.
13. Parallelizability of finite H-spaces. Comment. Math. Helv. 60 (1985), no. 4, 628-629. (with Cappell)

14. Group actions on homology spheres. *Invent. Math* 86 (1986), no. 2, 209-231. (with Davis)
15. Homologically trivial group actions. I. Simply connected manifolds. *Amer. J. Math.* 108 (1986), no. 5, 1005-1021.
16. Homologically trivial group actions. II. Nonsimply connected manifolds. *Amer. J. Math.* 108 (1986), no. 6, 1259-1275.
17. Group actions and higher signatures. II. *Comm. Pure Appl. Math.* 40 (1987), no. 2, 179-187.
18. Homology propagation of group actions, *Comm. Pure Appl. Math* 40 (1987), no. 6, 723-744. (with Cappell)
19. Free Q/Z actions. *Comment. Math. Helv.* 62 (1987), no. 3, 450-464.
20. On fibering four- and five-manifolds. *Israel J. Math* 59 (1987), no. 1, 1-7.
21. Group actions and equivariant Lipschitz analysis. (with Rothenberg) *Bull. Amer. Math. Soc. (N.S.)* 17 (1987), no. 1, 109-112.
22. The Lipschitz rationality of linear representations. *Comm. Pure Appl. Math.* 40 (1987), no. 5, 609-610.
23. Aspects of the Novikov conjecture. Geometric and topological invariants of elliptic operators (Brunswick, ME, 1988), 281-297, *Contemp. Math.*, 105.
24. Which H-spaces are manifolds? I. (with Cappell) *Topology* 27 (1988), no. 4, 377-386.
25. Higher G-indices and applications. (with Rosenberg) *Ann. Sci. Ecole Norm. Sup. (4)* 21 (1988), no. 4, 479-495.
26. Class numbers, the Novikov conjecture, and transformation groups. *Topology* 27 (1988), no. 3, 353-365.
27. Homotopy invariance of Eta-invariants. *Proc. Nat. Acad. Sci. U.S.A.* 85 (1988), no. 15, 5362-5363.
28. Phenomenes de rigidite topologique equivariante. *C. R. Acad. Sci. Paris Ser. I Math.* 306 (1988), no. 19, 777-782. (with Ferry and Rosenberg)
29. Semifree locally linear PL actions on the sphere. *Israel J. Math.* 66 (1989), no. 1-3, 351-363.
30. Finite detection of compact actions. I. *Comm. Pure Appl. Math.* 42 (1989), no. 3, 299-307. Erratum: *Comm. Pure Appl. Math.* 42 (1989), no. 5, 709.
31. G-signatures and cyclotomic units, Proceedings of the 1987 Georgia Topology Conference (Athens, GA, 1987). *Topology Appl.* 32 (1989), no. 2, 183-196.
32. On smooth surgery. *Comm. Pure Appl. Math.* 43 (1990), no. 5, 695-696.
33. All finite groups act on fake complex projective spaces. *Proc. Amer. Math. Soc.* 110 (1990), no. 1, 259-261.
34. An equivariant Novikov conjecture. With an appendix by J. P. May. *K-Theory* 4 (1990), no. 1, 29-53. (with Rosenberg)
35. The classification of nonlinear similarities over Z_2 . *Bull. Amer. Math. Soc. (N.S.)* 22 (1990), no. 1, 51-57. (with Cappell, Shaneson, Steinberger and West)
36. Curvature, tangentiality, and controlled topology. *Invent. Math* 105 (1991), no. 2, 401-414. (with Ferry)
37. Classes topologiques caracteristiques pour les actions de groupes sur les espaces singuliers. *C. R. Acad. Sci. Paris Ser. I Math.* 313 (1991), no. 5, 293-295. (with Cappell and Shaneson)
38. Classification de certains espaces stratifies. *C. R. Acad. Sci. Paris Ser. I Math.* 313 (1991), no. 6, 399-401. (with Cappell)
39. A simple construction of Atiyah-Singer classes and piecewise linear transformation groups. *J. Differential Geom.* 33 (1991), no. 3, 731-742. (with Cappell)
40. Aperiodic tilings, positive scalar curvature and amenability of spaces. *J. Amer. Math. Soc.* 5

- (1992), no. 4, 907-918. (with Block)
41. Characteristic classes and distortion of diffeomorphisms. *J. Amer. Math. Soc.* 5 (1992), no. 4, 919-921. (with Attie and Block)
 42. Higher G-signatures for Lipschitz manifolds *K-Theory* 7 (1993), no. 2, 101-132. (with Rosenberg)
 43. Topology of homology manifolds. *Bull. Amer. Math. Soc. (N.S.)* 28 (1993), no. 2, 324-328. (with Bryant, Ferry and Mio)
 44. Homotopy invariance of Novikov-Shubin invariants and $\mathbb{Z}/2$ Betti numbers. *Proc. Amer. Math. Soc.*, 125 (1997), no. 12, 3757-3762. (with Block and Mathai)
 45. Large scale homology and geometry, *AMS/IP Studies in Advanced Mathematics*, 2(1997) 522-569 (with Block)
 46. Topology of homology manifolds. *Ann. of Math. (2)* 143 (1996), no. 3, 435 - 467 (with J.Bryant, S.Ferry and W.Mio)
 47. Replacement of fixed sets and of their normal representations in transformation groups of manifolds. *Prospects in topology* (Princeton, NJ, 1994), 67-109, *Ann. of Math. Stud.*, 138, Princeton Univ. Press, Princeton, NJ, 1995 (with Cappell)
 48. Obstructions to propagation of group actions. *Bol. Soc. Mat. Mexicana (3)* 2 (1996), no. 1, 1-14. (with Davis)
 49. Characteristic fixed point sets for group actions on the sphere, *Comm Pure and Applied Math* 52 (1999), no. 8, 935-947. (with Davis)
 50. Rationality of ρ -invariants. appendix to *Jumps of the eta- invariant*. by Farber and Levine, *Math. Z.* 223 (1996), no. 2, 197-246
 51. A coarse approach to the Novikov conjecture. (with Ferry) *Novikov conjectures, index theorems and rigidity*, Vol. 1 (Oberwolfach, 1993), 147-163, *London Math. Soc. Lecture Note Ser.*, 226, Cambridge Univ. Press, Cambridge, 1995.
 52. Discrete circle actions: a note using non-standard analysis. *Israel J. Math.* 94 (1996), 147-155. (with Manevitz) Erratum.
 53. Algorithmic unsolvability of the triviality problem for multidimensional knots. *Comment. Math. Helv.* 71 (1996), no. 3, 426 - 434. (with Nabutovsky)
 54. On the homotopy invariance of the boundedly controlled analytic signature of a manifold over an open cone. (with Pederson and Roe) *Novikov conjectures, index theorems and rigidity*, Vol. 2 (Oberwolfach, 1993), 285-300, *London Math. Soc. Lecture Note Ser.*, 227, Cambridge Univ. Press, Cambridge, 1995.
 55. Surgery and stratified spaces, (with Hughes) *Surveys on surgery theory*, Vol. 2, 319-352, *Ann. of Math. Stud.*, 149, Princeton Univ. Press, Princeton, NJ, 2001
 56. Review of "Algebraic L-theory and topological manifolds", by A.Ranicki, *Bull AMS* 33(1996) 93-99
 57. $SL_n(\mathbb{Z})$ does not act on small tori, *AMS/IP Stud. Adv.Math.*, 2.1 (1997) 406-408.
 58. Microsurgery on stratified spaces, *AMS/IP Studies in Advanced Mathematics*, 2(1997) 509-521
 59. Algorithmic aspects on homeomorphism problems (with A.Nabutovsky) *Contemp Math* 231 (1999) 245-250
 60. Higher Rho Invariants, *Contemp Math* 231 (1999) 315-320
 61. Large Riemannian Manifolds which are Flexible (*Ann. of Math. (2)* 157 (2003), no. 3, 919-938., with Dranishnikov and Ferry)
 62. Equivariant Periodicity for Abelian Group Actions (with Yan) *Adv. Geom.* 1 (2001) 49-70.

63. Arithmetic manifolds of positive scalar curvature (with Block) *JDG* 52 (1999), no. 2, 375-406.
64. Neighborhoods in stratified spaces with two strata (with Hughes, Taylor, and Williams) *Topology* 39 (2000) 873-919.
65. On smooth surgery II (preprint)
66. Critical points of Riemannian functionals and arithmetic groups (with A. Nabutovsky) *Math Publ d'IHES*, 92 (2000) 5-62.
67. Nonlinear averaging of embeddings and group actions, *Contemp Math* 231 (1999) 307-314.
68. The fractal geometry of Riem/Diff I (with Nabutovsky) *Geometriae Dedicata* 101 (2003) 1-54.
69. Surgery theoretic methods in group actions. (with Cappell) *Surveys on surgery theory*, Vol. 2, 285-317, *Ann. of Math. Stud.*, 149, Princeton Univ. Press, Princeton, NJ, 2001
70. On the zero-in-the-spectrum conjecture (with M. Farber) *Ann of Math* 154 (2001) 139-154.
71. On invariants of Hirzebruch and Cheeger-Gromov. (with Chang) *Geometry and Topology* 7 (2003) 311-319.
72. The Topological Social Choice Problem, Revisited *Journal of Economic Theory* 115 (2005) 377-384.
73. Relative hyperbolization and aspherical bordism (with M.Davis and T.Januszkiewicz.) *JDG* 58 (2001) 535-541.
74. Isovariant periodicity for compact group actions, (with M.Yan.) *Adv. Geo* 5 (2005) 363-376
75. The signature operator at 2 (with J.Rosenberg.) *Topology* 45 (2006) 47-63
76. The Novikov conjecture for linear groups (with E.Guentner, and N.Higson.) *Math Publ. d'IHES* 101 (2005) 243-268
77. On Novikov-type conjectures, (with S.S.Chang.) *Clay Institute Monograph on Noncommutative Geometry*, 6(2006) 43-70.
78. Hidden symmetries and arithmetic manifolds (with B. Farb) *Proceedings of Robert Brooks Memorial Conference*, *Contemp. Math.* 387, (2005) 111-119.
79. Isometries, rigidity, and universal covers, (with B. Farb) *Ann of Math* 168 (2008) 915-940.
80. Higher Todd classes and holomorphic group actions, (with J. Block) *Pure and Applied Math Q.* 2(2006) 1237-1253.
81. On the generalized Nielsen realization problem (with J. Block) *Comm Math Helv* 83 (2008) 21-33
82. An etale approach to the Novikov conjecture (with A.N.Dranishnikov and S.Ferry) *Comm. Pure and Applied Math* 61 (2008) 139-155
83. Desingularizing homology manifolds (with J.Bryant, S.Ferry, and W.Mio) *Geometry and Topology* 11 (2007) 1289-1314.
84. Examples of exotic stratifications (with B.Hughes, L.Taylor, and B.Williams, *Geometry and Topology* 11(2007) 1477-1505.
85. Homology manifolds (for the *Handbook of geometric topology*, R. Davermann, editor, Elsevier)
86. Topological non-rigidity of non-uniform lattices (with S.S. Chang) *CPAM* 60(2007) 282-290.
87. Betti numbers of finitely presented groups and very rapidly growing functions (with A.Nabutovsky) *Topology* 46(2007)211-223
88. Final values of functors, (Issue of *L'Enseign. Math* in honor of Guido Mislin)
89. E_7 , Wirtinger inequalities, Cayley 4-form, and Homotopy, (with V.Bangert, M.Katz, and

- S.Shnider) Duke Math. J. Volume 146, Number 1 (2009), 35-70.
90. Replacement theorems for compact group actions: the 2 rho theorem, (with S.Cappell and M.Yan) Pure and Applied Math Quarterly 8 (2012) 53-78.
 91. Some Remarks inspired by the C^0 Zimmer program. Geometry, Rigidity, and Group Actions, University of Chicago press (2011) 262-282.
 92. Finding the homology of submanifolds with high confidence from random samples, (with P.Niyogi, and S.Smale.) Combinatorial and Discrete Geometry 39 (2008) 419-441.
 93. A topological view of unsupervised learning from noisy data, (with P.Niyogi and S.Smale) SIAM J. of Computing 20(2011) 646-663.
 94. The intrinsic asymmetry and inhomogeneity of Teichmuller space, (with B.Farb) Duke Math. J, 155(2010) 91-103
 95. Fixed point theories on noncompact manifolds Journal of Fixed Point Theory and its Applications 6(2009) 15-25.
 96. Aspherical manifolds with hyperbolic fundamental group (with A.Barthels and W. Lueck) JDG 86(2010) 1-16.
 97. Taming three manifolds using scalar curvature. (with S.Chang and G.Yu) Geom. Ded, 148 (2010) 3-14
 98. Multiaxial $U(n)$ -manifolds (with S.Cappell and M.Yan) to appear in JEMS
 99. Persistent Homology for Random Fields and Complexess (with R.Adler, O.Bobrowski, M.Borman, and E.Sabag) IMS Collections 6 (2010) 124-143.
 100. What is...Persistent Homology? Notices AMS January 2011 pp.36-39.
 101. Relative Systoles of relative-essential 2-complexes (with M.Katz, S.Shnider, S.Soubarau, and K.Usadi-Katz) AGT 11(2011) 197-217.
 102. Closed aspherical manifolds with center (with S.Cappell and M.Yan) Journal of Topology 6(2013) 1009-1018 .
 103. The complexity of some topological inference problems. J of FOCM, 14 (2014) 1277-1285.
 104. Quantitative algebraic topology and Lipschitz homotopy. (with Steve Ferry) PNAS 100 (2013) 19246-19250.
 105. Modular symbols and the topological non-rigidity of arithmetic manifolds. (with Stanley Chang) CPAM 68(2015) 2022-2051.
 106. Crackle: the homology of noise. (with Robert Adler and Omer Bobrowski) Discrete and Combinatorial Geometry, to appear
 107. Finite part of K-theory for groups finitely embeddable into Hilbert Space and the degree of non-rigidity of manifolds. (with Guoliang Yu) G&T, to appear.
 108. Review of "Large Scale Geometry by Nowak and Yu" Bull AMS 52 (2015) 141-150.
 109. An infinite dimensional phenomenon in finite dimensional topology. (With A.N.Dranishnikov and S.Ferry, submitted)
 110. A trichotomy theorem for transformation groups of locally symmetric manifolds (with S.Cappell and A.Lubotzky, submitted).
 111. On the vanishing of homology in random Cech complexes (with Bobrowski, to appear in Random Structures and Algorithms)
 112. The reach of random manifolds (with Adler, Krishnan, and Taylor, to appear in PTRF)
 113. Additivity of higher rho invariants and nonrigidity of topological manifolds (with Xie and Yu, submitted)
 115. The Stabilized Cannon Conjecture (with S. Ferry and W. Lueck, submitted)

116. Quantitative nullcobordism (with G.Chambers, D.Dotterer, F.Manin, and S.Weinberger, to appear in JAMS)
117. The Gromov-Guth-Whitney embedding theorem (appendix to [116], with F. Manin, to appear in JAMS)
118. Quantitative homotopy (with G.Chamber and F.Manin, GAFA to appear).
119. Integral and rational mapping classes (with F.Manin, preprint)
120. Interpolation, the rudimentary geometry of Lipschitz function spaces, and geometric complexity (FOCM 2017 Barcelona talk, preprint)