

# Karen Vogtmann

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## Education

Ph.D. Mathematics, University of California, Berkeley 1977

B.A. Mathematics, University of California, Berkeley 1971

## Principal fields of interest

Geometric group theory, low-dimensional topology, cohomology of groups

## Academic positions

Professor, Cornell University, January 1994 to present

Associate Professor, Cornell University, July 1997 to December 1993

Assistant Professor, Cornell University, July 1985 to June 1987

Visiting Assistant Professor, Cornell University, September 1984 to June 1985

Assistant Professor, Columbia University, July 1979 to June 1986

Visiting Assistant Professor, Brandeis University, September 1978 to December 1978

Visiting Assistant Professor, University of Michigan, September 1977 to June 1978 and January 1979 to June 1979

## Research and sabbatical positions

Mathematical Sciences Research Institute, Berkeley, CA, 8/07-12/07

I.H.E.S., Bures-sur-Yvette, France 3/04

Professeur Invité, Marseilles, France, 3/00

Mathematical Sciences Research Institute, Berkeley, 1/95 to 7/95

I.H.E.S., Bures-sur-Yvette, France, 1/92-8/93

Chercheur, C.N.R.S., E.N.S. de Lyon, France, 9/92-12/92

Mathematical Sciences Research Institute, Berkeley, 1/89 to 6/89

University of Illinois at Chicago, 1/88 to 6/88

Institute for Advanced Study, Princeton, 9/80 to 8/81

## Research grants

National Science Foundation grants for summer research in mathematics 1978-79, 1983-present

National Science Foundation Visiting Professorship for Women grant, 1984-85

National Science Foundation Career Advancement Award, 1989

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## Ph.D. students

Thomas Brady (1988)	G. Christopher Hruska (2002)
Martin Bridson (1991)	F. Gerlits (2002)
Debra Boutin (1998)	Matt Horak (2003)
Craig Jensen (1998)	Brad Forrest (2007)
Lisa Orlandi-Korner (1998)	

## Professional Service

Board of Trustees, American Mathematical Society (2008-2013)

External review committee, Mathematics Department, University of Utah (chairman 2007)

National Research Council Committee to evaluate the VIGRE program (2007-2008)

Editorial Board, Algebraic and Geometric Topology, (2006- )

Scientific Advisory Committee of the Mathematical Sciences Research Institute (2006-2010)

National Academy of Sciences Delegation to the International Mathematical Union (August 2006)

Vice President, American Mathematical Society, (2003 - 2006)

AMS Committee on Education (2003 - 2006)

Vietnam Education Foundation graduate fellowship panel (2005)

Scientific Research Board of the American Institute of Mathematics (1998 - 2005)

ArXiv Advisory Board (2004 - )

External Review panel, University of Texas at Austin, 2004

Executive Committee, American Mathematical Society (1999 - 2003)

AMS Committee on Meetings and Conferences (1997 - 2003), chairman (2000 - 2003)

Member-at-Large, Council of the AMS (1997-2000)

Selection committee, AWM postdoc workshop

Associate Editor, Research/Expository surveys, Bulletin of the A.M.S. (1998-2000)

Selection committee, NSF graduate fellowships in Mathematics, 1994, 1996-99 (chairman 1999)

External Review panel, Rutgers University Newark, 1997

Selection committee, Gehman lectures, Seaway section of the MAA, 1997

AMS Fellowship Committee 1989-90 (chairman 1990)

AWM Noether Lecturer selection committee 1991-1993 (chairman 1993)

Reviewer, Math Reviews 1977-1990

Served on ten panels at the National Science Foundation

Referee for numerous professional journals

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### Conferences Organized

- (with Cornell topologists) Topology Festival, Cornell University, 1986-present.
- (with M. Bestvina, J. McCammond, and M. Sageev) Special semester in Geometric Group Theory, M.S.R.I., Berkeley, Fall 2007
- (with R. Charney and I. Chatterji) Connections for Women Workshop: Classics of Geometric Group theory, M.S.R.I., Berkeley, August 2007
- (with M. Bestvina, J. McCammond, and M. Sageev) Introductory Workshop in Geometric Group Theory, M.S.R.I., Berkeley, August 2007
- (with R. Charney) Special session on Geometric Group Theory at annual meeting of the AMS, New Orleans, January 2007
- (with M. Bridson and P. Kropholler) Topological and Geometric Methods in Group Theory, Oberwolfach, Germany, April 2006
- (with R. Charney, A. Grassi, C-L. Terng, and K. Uhlenbeck) The Geometry of Groups, Program for Women in Mathematics, Institute for Advanced Study and Princeton University, May 2005
- (with S. Holmes and L. Billera) AIM workshop on Geometric models of biological phenomena, Palo Alto, CA, June 2003
- (with G. Levitt) Special session at joint meeting of AMS and French Mathematical Society, Lyon, France, July 2001
- (with H. Abels and P. Kropholler) Conference on Topological and Geometric Methods in Group Theory, Oberwolfach, Germany, January 2001
- (with R. Alperin) A.M.S. Special Session on Geometric Methods in Combinatorial Group Theory, November 1989.
- (with A. Borel and J. Harer) M.S.R.I. Workshop on Buildings and Arithmetic Groups, Berkeley, CA, May 1989

### Selected Invited addresses

- 45-minute address, International Congress of Mathematicians, Madrid, Spain, August 2006
- Groups of Diffeomorphisms 2006, Conference in honor of S. Morita's 60th birthday, Tokyo, Japan, September 2006
- Minicourse, 20th Birthday Celebration of Outer Space, Luminy, France, February 2007
- Geometry and the Imagination, conference in honor of William P. Thurston's 60th birthday, Princeton, NJ, June 2007
- AWM Noether Lecture, New Orleans, LA, January 2007
- Alaoglu Lecture, California Institute of Technology, Pasadena, CA, May 2008

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## All invited addresses 2001-present

### 2001

Special Session on Geometric Group Theory, Annual AMS meeting, New Orleans, LA, January 2001  
Topology Seminar, Columbia University, New York, NY, February 2001  
Conference on non-positive curvature and analysis, Penn State University, State College, PA, March 2001  
Georgia Topology Conference, Athens, GA, May 2001  
Graphs and Patterns in Mathematics and Theoretical Physics, A conference to celebrate Dennis Sullivan's 60th birthday, Stony Brook, NY June 2001  
Workshop on Moduli Spaces, Stanford University, Stanford, CA, August 2001  
Colloquium, Northwestern University, Evanston, IL, November 2001  
Colloquium, University of Chicago, Chicago, IL, November 2001  
Topology Seminar, Duke University, Durham, NC, December 2001  
Algebraic Geometry Seminar, Duke University, Durham, NC, December 2001

### 2002

Group Theory Seminar, Graduate Center of CUNY, New York, NY February 2002  
Topology Seminar, Binghamton University, Binghamton, NY April 2002  
Colloquium, U. of Neuchatel, Neuchatel, Switzerland, June 2002  
Minicourse on outer space, U. of Neuchatel, Neuchatel, Switzerland, June 2002  
Topology seminar, U. of Geneva, Geneva, Switzerland, June 2002  
AMS Special session in Geometric Group Theory, Boston, MA October 2002  
Topology seminar, S.U.N.Y., Stonybrook, NY, November 2002  
Colloquium, S. U. N.Y., Stonybrook, NY, November 2002

### 2003

Colloquium, University of Pennsylvania, Philadelphia, PA, February 2003  
Topology Seminar, Yale University, New Haven, CT, February 2003  
AMS special session on Rigidity in topology and dynamics (double time slot), New York, NY April 2003.  
Topology Festival, Cornell University, Ithaca, NY, May 2003  
Durham Symposium, Durham, England, July 2003  
Stony Brook String Theory conference, Stony Brook, N.Y., August 2003  
Oberwolfach Topologie, Oberwolfach, Germany, September 2003  
Institut Henri Poincare, Paris, France, September 2003  
AMS special session, Binghamton, NY, October 2003  
Albany Group Theory Conference, Rensaleerville, NY, October 2003  
Seminar, R.I.M.S., Kyoto, Japan, December 2003

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### 2004

- Topology Seminar, Max Planck Institute, Bonn, Germany, March 2004
- AMS special session on Group Cohomology and related topics (in honor of William Browder's 70th birthday), Lawrenceville, NJ, April 2004
- Colloquium, University of Illinois at Champaign-Urbana, April 2004
- Workshop on Classifying Spaces for Families, Munster, Germany, June 2004
- AMS special session on Topological and geometric methods in group theory, Nashville, TN, October 2004
- CMS special session on Combinatorial and Geometric Group Theory, Montreal, Quebec, December 2004

### 2005

- Colloquium, University of Tennessee, Knoxville, TN, January 2005
- Topology Seminar, Columbia University, New York, NY, February 2005
- Algebra Seminar, University of Glasgow, Glasgow, Scotland, March 2005
- Colloquium, Brandeis University, Waltham, MA, March 2005
- Midwest Topology Seminar, University of Chicago, Chicago, IL, April 2005
- Course in geometric group theory (4 lectures), Program for Women in Mathematics, IAS, Princeton, NJ, May 2005
- Colloquium, University of Education, Hanoi, Vietnam, June 2005
- Colloquium, VAST Institute of Mathematics, Hanoi, Vietnam, June 2005
- Barcelona conference on Geometric Group Theory, Barcelona, Spain, June 2005
- Topology meeting, B.I.R.S., Banff, Canada, August 2005
- Geometric and Probabilistic Methods in Group Theory and Dynamical Systems, Texas A&M, College Station, TX, October 2005
- Flavors of Groups meeting, B.I.R.S., Banff, Canada, November 2005
- Wasatch Topology Conference, Park City, UT, December 2005
- Colloquium, Penn State University, State College, PA, March 2005

### 2006

- University of Arkansas Spring Lecture Series, Fayetteville, AR, April 2006
- Combinatorial and Geometric Group Theory, Nashville, TN, May 2006
- Conference sur la theorie geometrique des groupes, Montreal, Canada, July 2006
- International Congress of Mathematicians, Madrid, Spain, August 2006
- Groups in Geometry and Topology, Malaga, Spain, September 2006
- Groups of Diffeomorphisms 2006, Tokyo, Japan, September 2006
- Oberwolfach Topologie, Oberwolfach, Germany, September 2006
- Geometry Seminar, ETH Zurich, Switzerland, December 2006

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### 2007

- AWM Noether Lecture, New Orleans, LA, January 2007
- Conference on the Topology and Geometry of Moduli Spaces, Stanford, CA, January 2007
- Minicourse, 20th Birthday Celebration of Outer Space, Luminy, France, February 2007
- Topology meeting, B.I.R.S., Banff, Canada, February 2007
- Colloquium, University of Michigan, Ann Arbor, MI, March 2007
- Topology/Geometry seminar, University of Chicago, Chicago, IL, May 2007
- Geometry and the Imagination, conference in honor of William P. Thurston's 60th birthday, Princeton, NJ, June 2007
- MSRI/Evans lecture, University of California, Berkeley, CA, September 2007
- Topology seminar, University of California, Berkeley, October 2007
- Topics in Geometric Group Theory, M. S. R. I., Berkeley, CA, November 2007
- UCSB Distinguished Lecturer (2 lectures), University of California, Santa Barbara, CA, November 2007
- Winterschool in Geometric Group Theory (4 lectures), Goettingen, Germany, December 2007

### 2008

- Colloquium, McMaster University, Hamilton, Ontario, Canada, January 2008
- Colloquium, Stanford University, Stanford, CA, February 2008
- Colloquium, University of Texas, Austin, TX, March 2008
- Alaoglu Lecture, Cal Tech, Pasadena, CA, May 2008
- Workshop on Discrete Groups and Geometric Structures, Kortrijk, Belgium, May 2008

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### Publications

1. *Homology Stability for  $O_{n,n}$* , *Comm. Alg.*, **7** (1979), no.1., 9-38.
2. *Spherical Posets and homology stability for  $O_{n,n}$* , *Topology* **20** (1981), 119-132.
3. *A Stieffel complex for the orthogonal group of a field*, *Comment. Math. Helv.* **57** (1982), no.1, 11-21.
4. *The integral homology of  $SL_2$  and  $PSL_2$  over Euclidean imaginary quadratic integers*, (with J. Schwermer) *Comment. Math. Helv.* **58** (1983) no.4, 573-598.
5. *Rational homology of Bianchi groups*, *Math. Ann.* **272** (1985), 399-419.
6. *Moduli of graphs and automorphisms of free groups*, (with M. Culler) *Inventiones* **84** (1986), 91-119.
7. *A generating function for the Euler characteristic of  $Out(F_n)$* , (with J. Smillie) *J. Pure and Appl. Algebra* **44** (1987), 329-348.
8. *Automorphisms of graphs,  $p$ -subgroups of  $Out(F_n)$  and the Euler characteristic of  $Out(F_n)$* , (with J. Smillie) *J. Pure and Appl. Algebra* **49** (1987), 187-200.
9. *Local structure of some  $Out(F_n)$ -complexes*, *Proc. Edinburgh Math Soc.* **33** (1990), 367-379.
10. *The boundary of outer space in rank two*, (with M. Culler) in *Arboreal Group Theory* (R. Alperin, ed) New York: Springer-Verlag (1991) 189-229.
11. *Automorphisms of  $SL_2$  of imaginary quadratic integers*, (with J. Smillie) *Proc. A.M.S.* **112** (1991) no. 3
12. *Equivariant Outer space and automorphisms of free-by-finite groups* (with S. Krstic), *Comment. Math. Helvetici* **68** (1993) 216-262.
13. *Length functions and outer space* (with J. Smillie), *Michigan Math J.* **39** (1992) 485-493.
14. *End invariants of the group of outer automorphisms of a free group*, *Topology* **14** (1995) no. 3, 533-545..
15. *Isoperimetric inequalities for automorphism groups of free groups* (with A. Hatcher), *Pacific J. Math.* **173** (1996), no. 2, 425-441.
16. *On the geometry of the group of automorphisms of a free group* (with M. Bridson), *Bull. London Math. Soc.* **27** (1995), 544-552.
17. *A group-theoretic criterion for property FA* (with M. Culler), *Proc. Amer. Math. Soc.* **124** (1996), no. 3, 677-683
18. *Cerf theory for graphs* (with A. Hatcher), *J. London Math. Soc.*, **58**, part 3 (1998), 633-655.
19. *The complex of free factors of a free group* (with A. Hatcher), *Quart. J. Math. Oxford Ser. (2)* **49** (1998), no. 196, 459-468.
20. *Rational homology of  $Aut(F_n)$*  (with A. Hatcher), *Mathematical Research Letters* **5** (1998), 759-780.
21. *An Equivariant Whitehead algorithm and conjugacy for roots of Dehn twists* (with S. Krstic and M. Lustig), *Proceedings of the Edinburgh Math Society* **44** (2001), 117-141.
22. *A Whitehead algorithm for surface groups* (with G. Levitt), *Topology* **39** (2000), no. 6, 1239-1251.
23. *The symmetries of Outer space* (with M. R. Bridson), *Duke Math Journal* **106** (2001), 391-409.
24. *Automorphisms of automorphism groups of free groups* (with M. R. Bridson), *J. Algebra* **229** (2000), no. 2, 785-792.
25. *Geometry of the space of phylogenetic trees* (with L. Billera and S. Holmes), *Advances in Applied Math* **27** (2001), 733-767.
26. *Automorphisms of free groups and outer space*, *Proceedings of the Conference on Geometric and Combinatorial Group Theory, Part I* (Haifa, 2000). *Geom. Dedicata* **94** (2002), 1-31.

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27. *Homomorphisms from automorphism groups of free groups*, (with Martin R. Bridson), Bull. London Math. Soc. 35 (2003), no. 6, 785–792.
28. *Infinitesimal operations on graph complexes*, (with James Conant), Math. Ann. 327 (2003), 545–573.
29. *On a theorem of Kontsevich*, (with Jim Conant), Algebr. Geom. Topol. 3 (2003) 1167-1224.
30. *Cut vertices in commutative graphs*, (with James Conant and Ferenc Gerlits), Quart. J. Math 56(3) (2005), 321-336.
31. *Morita classes in the homology of automorphism groups of free groups*, (with Jim Conant), Geom. Topol. 8 (2004), 1471-1499.
32. *Homology stability for outer automorphism groups of free groups*, (with Allen Hatcher), Algebr. Geom. Topol. 4 (2004), 1253-1272.
33. *Automorphisms of free groups, surface groups and free abelian groups*, (with Martin Bridson), in Problems on Mapping Class Groups and Related Topics, ed. by B. Farb, Proc. Symp. Pure Math. 74, Amer. Math. Soc., Providence RI, (2006).
34. *Erratum to: Homology stability for outer automorphism groups of free groups*, (with A. Hatcher and N. Wahl), Algebr. Geom. Topol. 6 (2006), 573–579.
35. *The cohomology of automorphism groups of free groups*, Proceedings of the International Congress of Mathematicians, Madrid 2006, European Mathematical Society Publishing House, Zurich, 2006.
36. *Morita classes in the homology of  $Aut(F_n)$  vanish after one stabilization*, (with Jim Conant), Groups, Geometry and Dynamics 2 (1) (2008) 121-138.
37. *Automorphisms of two-dimensional right-angled Artin groups*, (with Ruth Charney and John Crisp), Geometry & Topology 11 (2007) 2227-2264.
38. *Automorphism groups of right-angled Artin groups*, (with Ruth Charney), to appear in L'Enseignement Mathématique, special edition dedicated to Guido's book of conjectures.
39. *A presentation for  $Aut(F_n)$* , (with H. Armstrong and B. Forrest), J. of Group Theory 11 (2008), 267-276.
40. *Automorphisms of higher-dimensional right-angled Artin groups*, (with Ruth Charney), submitted, available on arXiv.
41. *Actions of automorphism groups of free groups on spheres and acyclic manifolds*, (with Martin Bridson), submitted, available on arXiv
42. *Automorphisms of two-dimensional RAAGs and partially symmetric automorphisms of free groups*, (with K.-U. Bux and R. Charney), to appear in Groups, Geometry and Dynamics.
43. *What is Outer space?*, to appear in Notices of the AMS.