

SUDHIR KUMAR

ADDRESS: The Biodesign Institute
EFG Center (BDA-240A)
1001 S. McAllister Avenue
Arizona State University
Tempe, AZ 85287-5301

PHONE: (480) 727-6949 (Office)
(480) 965-2091 (Laboratory)
FAX: (480) 727-6947
E-MAIL: s.kumar@asu.edu

INTERNET: www.kumarlab.net
www.biodesign.org/efg

CITIZENSHIP: United States

EDUCATION

	DEGREE	YEAR	DISCIPLINE
Birla Institute of Tech. & Sci. (India)	B.Engg.	1990	Electrical/Electronics Engineering*
Birla Institute of Tech. & Sci. (India)	M.Sc.	1990	Biological Sciences*
Pennsylvania State University (USA)	Ph.D.	1996	Genetics

*Concurrent degrees

DOCTORAL AND POSTDOCTORAL RESEARCH MENTOR

Dr. Masatoshi Nei, Institute of Molecular Evolutionary Genetics,
Penn State University, University Park, PA 16802

PROFESSIONAL APPOINTMENTS

2003 – Present	Director, Center for Evolutionary Functional Genomics, The Biodesign Institute, Arizona State University (ASU)
2003 – 2004	Faculty Leader, Genomics, Evolution, and Bioinformatics, School of Life Sciences (SoLS), ASU
2002 – Present	Associate Professor, SoLS, ASU
1998 – 2002	Assistant Professor, Department of Biology, ASU
1996 – 1998	Postdoctoral Fellow, Department of Biology, Penn State University
1991 – 1996	Research Assistant, Department of Biology, Penn State University

AWARDS & HONORS

2004 – 2005	Top-10 Most-Cited Author for papers classified as Computer Science by Science Citation Index (ISI), PA
2004	Hot Paper in Biology, <i>Bioinformatics</i> [2001] 17: 1244-1245, ISI, PA
2002 – 2005	EARS-Faculty Designation, ASU (selection based on size and complexity of extramurally-funded research projects)
2000	Innovation award in Functional Genomics, Burroughs-Wellcome Fund, USA ¹ .
2000	Hot Paper in Biology, <i>Nature</i> [1998] 392: 917-920, ISI, PA

PROFESSIONAL AFFILIATIONS

2004 – Present	Adjunct Senior Investigator, Translational Genomics Research Institute (TGen), Phoenix, Arizona
2002 – Present	Affiliate Professor, Computer Science & Engineering, ASU
2000 – Present	Member, NASA Astrobiology/Evolutionary Genomics Focus Group
1998 – Present	Associate Member, Penn State Astrobiology Research Center
1998 – Present	Member, Genetics Program, ASU

PROFESSIONAL SOCIETY ACTIVITIES

2004 – 2006	Secretary (Elected), <i>Society for Molecular Biology and Evolution</i>
2004 – Present	Webmaster, <i>Society for Molecular Biology and Evolution</i> (www.smbe.org)
1999 – Present	Webmaster, <i>American Genetic Association</i> (www.theaga.org)

¹ See www.bwfund.org/programs/interfaces/previous_programs_genomics_grant_recipients.html for other awardees

JOURNAL EDITORIAL SERVICE

- 2005 – Present *Associate Editor*, Molecular Biology & Evolution
2005 – Present *Associate Editor*, Evolutionary Bioinformatics Online
2005 – Present *Board of Editors*, Gene: Functional Genomics
1999 – Present *Associate Editor*, Journal of Heredity
2005 – Present *Editorial Board*, Genome Research
2004 – Present *Editorial Board*, Molecular and Developmental Evolution (J Exp Zool)
Ad hoc Reviewer
Bioinformatics, Evolution, Gene, Genetics, Journal of Molecular Evolution, Nature, Nucleic Acids Research, Proceedings of the National Academy of Sciences (USA), Proceedings of the Royal Society (UK), Science, Trends in Ecology & Evolution

EXTERNAL REVIEWER FOR INSTITUTES/DEPARTMENTS

- 2005 Five-year review of *Institute for Genomics and Bioinformatics* (IGB) @ University of California, Irvine (Upcoming in October)

MEMBERSHIP IN SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

- American Association for the Advancement of Science
Arizona Arts, Sciences, and Technology Academy (founding fellow)
American Genetic Association
Society for Molecular Biology and Evolution
Society for the Study of Evolution
The Genetics Society of America

CONFERENCE/SYMPOSIA ORGANIZED

- 2006 Host, Annual meeting of the *Society for Molecular Biology and Evolution*, Arizona State University, Tempe, Arizona (Upcoming: May 25 – 28).
2005 Organizer, Genome Database Workshop @ *National Evolutionary Synthesis Center*, Wilmington Beach, North Carolina, (May 31 – Jun 3)
2004 Symposium on Evolutionary and Population Genomics in the *Future of Statistics Conference* at *Indian School of Business*, Hyderabad, India (Dec. 29 – Jan. 1)

SCIENTIFIC AND PROFESSIONAL COMMITTEES

- 2003 Tucson *Drosophila* Committee for Generating a White Paper for Fruit Fly Genome Sequencing Projects
2003 Committee on Membership Enhancement; *Society for Molecular Biology and Evolution*

WORKSHOPS ATTENDED FOR PROFESSIONAL ENHANCEMENT

- 2001 National Human Genome Research Institute Grantees Workshop on Minority Participation, Bethesda, Maryland
1999 Attended workshop in Teaching Excellence sponsored by the Howard Hughes Medical Institute Undergraduate Research Program at Arizona State University

MAJOR UNIVERSITY COMMITTEES (all at ASU)

- 2005 – Present *Member*, Steering Committee, NIH-funded Post-Baccalaureate Research Education Program in Biomedical Sciences (PREP) program
2004 – Present *Member*, Taskforce on Biomedical Informatics.
Taskforce is charged with the planning, design, and development of a new Department of Biomedical Informatics
2004 – Present *Member*, Executive Committee, Biodesign Institute
2003 – 2004 *Member*, Executive Committee, School of Life Sciences
2001 Representative from ASU in 3 formation meetings of the International Genomics Consortium: Johns Hopkins Univ, Baltimore, MD; M. D. Anderson Cancer Center, Houston, TX; Sun HealthCare, Scottsdale, AZ

2000 – Present *Member, Executive Committee, Computational Biosciences Program*
2000 – 2001 *Member, Information Technology Hot Team, Prop 301*
2000 *Member, Planning Committee, Academic degree program in Comp. Biosci.*

FACULTY SEARCH COMMITTEES (*all at ASU*)

2005 – Present *Member, Biomedical Informatics Department Chair Search*
2004 – 2005 *Member, Insect Neurogenomics Search (open rank)*
2003 – 2004 *Member, SoLS Founding Director*
2000 – 2001 *Member, Joint Bioengineering & Computer Science (open rank)*
1999 *Member, Molecular Genetics (Asst. Prof.)*

REVIEWER FOR GRANTING AGENCIES

2005 *BioData Management and Analysis (NIH, ad hoc member)*
2004 *Software Development and Maintenance (NIH; twice; ad hoc member)*
2004 *Population Genetic Analysis Program (NIH; ad hoc member)*
2004 *Development; DEV- (NIH; phone-in member)*
2004 *Systematic Biology (NSF; mail-in reviewer)*
2003 *Information Technology Research-Medium (NSF)*
2002 *Information Technology Research-Small (NSF)*

CURRENT RESEARCH GRANT SUPPORT (*Competitive Renewal)

2004 – 2007* *Comparative molecular sequence analysis*
Principal Investigator (R01; \$763,673)
National Human Genome Research Institute (NIH/NHGRI)
2003 – 2006 *Computational analysis of gene expression pattern images*
Principal Investigator (R01; \$1,806,148)
National Human Genome Research Institute (NIH/NHGRI)
2003 – 2006 *Computational genomic analysis to identify and dissect functionally*
important mutations in protein sequences
Principal Investigator (\$200,000)
Burroughs-Wellcome Fund, USA
2003 – 2006* *Emerging wildlife diseases: Threats to amphibian biodiversity*
Co-Principal Investigator (\$23,000 from \$3 million; PI: J. Collins)
National Science Foundation (NSF/IRCEB)

COMPLETED RESEARCH GRANT SUPPORT

2001 – 2004 *Development of an evolutionary timescale database*
Co-Principal Investigator (\$102,450 from \$300,000; PI: S. B. Hedges)
National Science Foundation (NSF/DBI)
2000 – 2004 *Design of a bioinformatic database for functional evolutionary footprints in*
multigene families
Principal Investigator (\$677,398)
National Science Foundation (NSF/DBI)
2000 – 2002 *Host-pathogen biology and the global decline of amphibians*
Co-Principal Investigator (\$90,000 from \$3 Million; PI: J. Collins)
National Science Foundation (NSF/IRCEB)
1999 – 2003 *Comparative molecular sequence analysis*
Principal Investigator (R01; \$709,262)
Human Genome Research Institute (NHGRI/NIH)

INSTRUCTION/TRAINING GRANT PARTICIPATION

2004 – 2006 *LSAMP Biodesigned Bridges to the Doctorate*
Co-Principal Investigator (\$878,422; 16%; PI: Antonio Garcia)
National Science Foundation (NSF/EHR)

- 2002 – 2005 *IGERT: Evolutionary, Computational, and Molecular Approaches to Genome Structure and Function*
Participating Scientist (PI: Michael Nachman, Univ of Arizona)
National Science Foundation (NSF)
- 2001 – 2003 *A Computational Biosciences Professional Master's Program*
Participating Investigator (PI: Rosie Renaut)
Sloan Foundation

UNIVERSITY COURSES TAUGHT (Average rating in parentheses; SCALE: 1: BEST - 4: WORST)

- 2005 BIO 345 [1.6] Organic Evolution, 3 credits, 150 students (Jan–May)
2004 BIO 494 (1.3) Intro to Comparative Genomics, 3 credits, 11 students (Jan–May)
2003 BIO 345 (1.4) Organic Evolution, 3 credits, 185 students (Jan–May)
2003 BIO 494 (1.2) Intro to Comparative Genomics, 3 credits, 12 students (Jan–May)
2001 BIO 445 (1.4) Organic Evolution, 3 credits, 179 students (Jan–May)
2001 BIO 494 (1.3) Computational Genomics, 3 credits, 7 students (Aug–Dec)
2000 BIO 445 (1.7) Organic Evolution, 3 credits, 106 students (Jan–May)
2000 BIO 594 (1.3) Molecular Evolutionary Genetics, 3 credits, 7 students (Aug–Dec)
1999 BIO 594 (1.5) Molecular Evolutionary Genetics, 3 credits, 10 students (Jan–May)
1999 BIO 494 (1.2) Advanced Evolution, 3 credits, 14 students (Aug–Dec)

POSTDOCTORAL FELLOWS MENTORED

- 2005 – Present Anup Som, Ph.D., Bioinformatics, Javadpur Univ., India
Project: Bayesian Inference of Evolutionary Timescales
Current Position: Postdoctoral researcher (starts in August, 2005)
- 2003 – Present Christine Kuslich, Ph.D., Biomedical Sciences—Genetics, Univ. of Hawaii
Project: Evolutionary Anatomy of Disease Mutations
Current Position: Assistant Professor Research, ASU
- 2001 – Present Alan Filipinski, Ph.D., Formal Language Theory, Michigan State
Project: Molecular Evolutionary Timescales
Current Position: Faculty Research Associate, ASU
- 2000 – Present Sankar Subramanian, Ph.D., Microbiology, IARI, India
Project: Animal Evolutionary Genomics
Current Position: Assistant Professor Research, ASU
- 2003 – 2004 Araxi Urrutia, Ph.D., Evolutionary Genomics, Univ. of Bath, UK
Project: Evolution of Transcriptome
Current Position: Visiting Research Scholar, ASU.
- 2000 – 2003 Michael S. Rosenberg, Ph.D., Ecology & Evolution, SUNY--Stony Brook
Project: Computer Simulation in Molecular Phylogenetics
Current Position: Assistant Professor, ASU
- 2000 – 2002 Mark P. Miller, Ph.D., Evol & Conservation Genetics—Comp. Biol., NAU
Project: Evolutionary Properties of Disease Mutations
Current Position: Assistant Research Professor, Utah State University
- 1998 – 2003 Sudhindra R. Gadagkar, Ph.D., Biology (Aquaculture Genetics), Canada
Project: Molecular Phylogenetic Analysis
Current Position: Assistant Professor, University of Dayton, Ohio

CHAIR/CO-CHAIR OF GRADUATE STUDENT COMMITTEES

- 2005 – Present Vinod Swarna, Doctoral, Biology (Chair)
2005 – Present HoJoon Lee, Doctoral, Biology (Chair)
2005 – Present Stephanie Rogers, Doctoral, Biology (Co-Chair)
2002 – Present Jian Yang, Doctoral, Biology (Chair)
2002 – Present Madhusudana Gargasha, Doctoral, Electrical Engg (Co-Chair)
2002 – Present Rajalakshmi Gurunathan, Doctoral, Computer Science (Chair)
2003 – 2005 Stephanie Rogers, Professional MS in Computational Biosciences (Chair)

2003 – 2005 Vinod Swarna, Professional MS in Computational Biosciences (Chair)
 2003 – 2005 Hojoon Lee, Professional MS in Computational Biosciences (Chair)
 2003 – 2005 Xiaofen Liu, Professional MS in Computational Biosciences (Chair)
 2003 – 2004 Shubhra Gupta, Professional MS in Computational Biosciences (Chair)
 2002 – 2004 Sandhya Durvasaua, MS, Computer Science & Engg (Co-Chair)
 2001 – 2003 Patrick Kolb, MNS, Biology (Chair)
 2000 – 2002 Rekha Iyer, MS, Molecular & Cell Biology (Chair)
 1999 – 2001 Karthik Jayaraman, MS, Electrical Engineering (Co-Chair)

MEMBER OF GRADUATE STUDENT COMMITTEES

2003 – Present Hugo F. Gante, Doctoral, Biology
 2001 – Present Michael Schwemm, M.S., Biology
 1998 – 2005 Peter Unmack, Doctoral, Biology
 1998 – 2005 Evan Carson, Doctoral, Biology
 1999 – 2005 Carla Hurt, Doctoral, Biology
 1999 – 2003 Daniel Garrigan, Doctoral, Biology

OTHER RESEARCH/DEVELOPMENT LAB PERSONNEL

2005 – Present Vesna Djinovic, Programming Assistant
 2005 – Present Ashley Ruttman, Programming Assistant
 2004 – Present Bernard Van Emden, Faculty Research Associate
 2003 – Present Wayne Parkhurst, Multimedia Specialist
 2003 – Present Quan Nguyen, Computer Data Base Specialist
 2001 – Present Joel Dudley, Faculty Research Associate
 1999 – Present Graziela Valente, Lab Manager & Research Technician
 2002 – 2004 Renee Grothe, Graphic Artist
 2001 – 2002 Ben Timmerick, Graphics & Multimedia
 2000 – 2004 David Schwartz, Programmer

UNDERGRADUATE ASSISTANTS

Heather Wiemann (1998–2000), Candice White (1998), Roman Johnson (1999), Veena Ganeshan (2000–2001), Emily Davenport (2000), Diana Tlougan (2000), Jacob Reidhead (2001–2003)

VISITING SCHOLARS SPONSORED

2005 Xuhua Xia, Ottawa University, Canada
 Koichiro Tamura, Tokyo Metropolitan University, Japan
 2004 Stephen Schaeffer, Pennsylvania State University, PA
 S. Blair Hedges, Pennsylvania State University, PA
 Koichiro Tamura, Tokyo Metropolitan University, Japan
 2003 Koichiro Tamura, Tokyo Metropolitan University, Japan
 2002 Ms. Prachi Shroff, Penn State University, University Park, PA
 Ziheng Yang, University College, London
 Tom Brody, National Institute of Health, Bethesda, MD
 Sherry Church, Indiana University, Bloomington, IN
 Koichiro Tamura, Tokyo Metropolitan University, Japan
 Paul Purdom, Indiana University, IN
 S. Blair Hedges, Penn State University, PA
 2001 Koichiro Tamura, Tokyo Metropolitan University, Japan
 2000 S. Blair Hedges, Penn State University, University Park, PA
 Joaquin Dopazo, Glaxo-Wellcome, Madrid, Spain
 Koichiro Tamura, Tokyo Metropolitan University, Japan
 1998 Paul Purdom, Indiana University, IN

RESEARCH VISITS TO OTHER INSTITUTIONS

- 2005 Penn State University (Dr. S. Blair Hedges)
- 2003 University College London, Biology (Dr. Ziheng Yang)
- 2001 Hong Kong University, Biology (Dr. Xuhua Xia)
- 2000 Tokyo Metropolitan University, Biology (Dr. Koichiro Tamura)

INVITED PRESENTATIONS (Titles included for symposia, workshop and special presentations)

- 2005 Symposium on *Molecular Evolution @ Moscow Conference on Computational Molecular Biology*, Moscow State University, Russia
Title: Placing Confidence Limits on the Molecular Age of the Human-Chimpanzee Divergence
- 2005 Symposium on *Systems Biology @ Moscow Conference on Computational Molecular Biology*, Moscow State University, Russia
Title: Automating Discovery of Gene Interactions by *in silico* Analysis of *in situ* Gene Expression Patterns in Fruit Fly Embryos
- 2005 Special presentation to the *Panel on Chemical Imaging*, National Academies (USA), Washington DC
Title: *In silico* Analysis and Management of Fruit Fly Gene Expression Pattern Images
- 2004 Symposium on *Evolutionary and Population Genomics @ Future of Statistics Conference*, Hyderabad, India.
Title: Genomic Bounds on the Timing of the Evolutionary Divergence of Humans and Chimpanzees.
- 2004 Symposium on *Advances in Methods for Estimating Species Divergence Dates Using Molecular Data @ International Congress of Zoology*, Beijing, China.
Title: Genomic Timescales: Precision & Robustness
- 2004 Workshop on *Molecular Evolution and Systematics*, Chinese Academy of Sciences, Beijing, China
Title: Distance and Parsimony Methods
- 2004 Symposium on *Molecular Phylogeny and Molecular Clocks @ Annual Meeting of the Society for Molecular Biology & Evolution*, Penn State University, University Park, PA
Title: Genomic Timescales: Precision & Robustness
- 2004 Hexapodium, Center for Insect Research, University of Arizona.
- 2003 Techniques Workshop @ 44th Annual *Drosophila Research Conference*, Chicago, IL
Title: Basic Expression Search Tool (BEST): Computational Framework for *in silico* Analysis of *in situ* Hybridization Data
- 2003 *Comparative and Functional Genomics* Workshop, Sponsored by the *Wellcome Trust and Department of Energy*, Hinxton, Cambridgeshire, UK
Title: Patterns of Point Mutation and Protein Substitution Rates Revealed by Comparative Mammalian Genomics
- 2003 Annual Meeting of the *Society for Molecular Biology & Evolution*, Newport Beach, CA
- 2003 Department of Biology, Duke University, Durham, NC
- 2003 Bioinformatics Research Center, North Carolina State University, Raleigh, NC
- 2002 Symposium on *Evolutionary Genetics @ Annual meeting of the American Genetic Association*, Arizona State University, Tempe, Arizona.
Title: Rates of Point Mutation in Mammals
- 2002 The 12th International Workshop on *Beyond the Identification of Transcribed Sequences: Functional, Evolutionary, and Expression Analysis* sponsored by *Department of Energy*, Washington DC
Title: Building Fruit Fly Developmental Networks: *in silico* Approaches for Analyzing *in situ* Gene Expression Patterns
- 2002 The 18th *International Symposium in Conjunction with Award of the International Prize for Biology*, Tokyo, Japan
Title: Building Fruit Fly Developmental Networks: *in silico* approaches for Analyzing *in situ* Gene Expression Patterns

- 2002 Department of Biology, Indiana University, Bloomington, Indiana.
- 2002 Department of Computer Science, Arizona State University, Tempe, AZ.
- 2002 Department of Biology, University of Michigan, Ann Arbor, MI.
- 2001 International Workshop on *Population Genetics @ University of Montreal*, Montreal, Canada
Title: Estimating Neutral Evolutionary Rates in Mammals
- 2001 ASU President's Community Enrichment Program, Phoenix, Arizona
- 2001 Department of Biology, Ohio State University, Columbus, Ohio
- 2001 Department of Biology, Hong Kong University, Hong Kong, China (2 lectures)
- 2001 Department of Biology, Syracuse University, Syracuse, New York
- 2001 Program in Ecology and Evolutionary Biology, University of Illinois, Urbana Champaign, Illinois
- 2001 Department of Biology, Grand Canyon University, Phoenix, Arizona.
- 2001 Ecology & Evolutionary Biology Program/IGERT, Indiana University, Bloomington, Indiana.
- 2001 Department of Biology, Tokyo Metropolitan University, Tokyo, Japan.
- 2001 Biomedical Engineering, Indian Institute of Science, Bangalore, India.
- 2000 Department of Biology, Tokyo Metropolitan University, Tokyo, Japan
- 2000 Graduate University for Advanced Studies, Hayama, Japan
- 2000 Genetics Program, University of Arizona, Tucson, Arizona
- 2000 Birla Institute of Technology & Sciences, Pilani, India
- 2000 University of South Carolina, Columbia, South Carolina
- 1999 Symposium on *Genomic Diversity @ Annual meeting of the American Genetic Association*, Pennsylvania State University, University Park, PA
Title: Genomic Divergence between Species in terms of the Number of Chromosomal Rearrangements
- 1999 Department of Biology, Arizona State University-West, Phoenix, Arizona
- 1998 Department of Zoology and Genetics, Iowa State University, Ames, Iowa.
- 1997 Symposium on *Large Phylogenies @ Annual meeting of the Society for the Study of Systematic Biology*, University of Colorado, Boulder, Colorado
Title: Inferring Large Phylogenies
- 1997 National Cancer Institute, Frederick, Maryland.
- 1997 Department of Biology, Arizona State University, Tempe, Arizona.

CONFERENCE & POSTER PRESENTATIONS (*Presenter underlined*)

- 2005 Kumar S, Tamura K & Nei M @ Annual meetings of the *Society for Molecular Biology and Evolution*, Auckland, New Zealand.
Title: MEGA3: An Integrated Software for Molecular Evolutionary Genetics Analysis and Sequence Alignment.
- 2005 Kumar S @ Annual meetings of the *Society for Molecular Biology and Evolution*, Auckland, New Zealand.
Title: Launch of the FlyExpress Resource: The Drosophila in situ Gene Expression Pattern Database and Search Tool.
- 2005 Hedges B, Dudley J, Pisani D, Swarna V, Valente G & Kumar S @ Annual meetings of the *Society for Molecular Biology and Evolution*, Auckland, New Zealand.
Title: Time Tree: A Database of Species Divergence Times.
- 2005 Gargesha M, Yang J, Van Emden B, Panchanathan S & Kumar S @ 46th Annual *Drosophila Research Conference*
Title: Computational Annotation of View, Orientation and Stage of Fruit Fly Gene Expression Pattern Images from Early Developmental Stages
- 2004 Kumar S, Tamura K & Nei M @ Annual meetings of the *Society for Integrative and Comparative Biology*, New Orleans. LA.
Title: MEGA3: An Integrated Platform for Molecular Evolutionary Genetics Analysis and Sequence Alignment.
- 2004 Kumar S @ International Meeting on *Evolutionary Genomics*, Tucson, AZ (IGERT).

- Title: Molecular Evolutionary Genetics Analysis Software*
- 2004 Kumar S, Van Emden B, Gurunathan R, Panchanathan S & Newfeld S @ 45th Annual *Drosophila Research Conference*, San Diego, CA.
Title: FlyExpress: The Drosophila Gene Expression Pattern Search and Analysis Tool.
- 2004 Subramanian S & Kumar S @ Annual Meetings of the *Society for Molecular Biology & Evolution*, Penn State Univ, PA.
Title: Gene Expression Intensity Shapes Evolutionary Rates of the Proteins Encoded by the Vertebrate Genome.
- 2004 Urrutia AO, Kalyanamaran V & Kumar S @ Annual Meeting of the *Society for Molecular Biology & Evolution*, Penn State PA
Title: Codon Bias in Human: Beyond GC Content and Context Mutations
- 2004 Jancovich J, Bremont M, Touchman J, Kumar S, Valente G, Collins J & Jacobs B @ *XVth International Poxvirus and Iridovirus Symposium*, Keble College, Oxford, UK.
Title: Genomic Sequence of Epizootic Haematopoietic Necrosis Virus [EHNV]: An Evolutionary Link between Frog and Salamander Ranaviruses?
- 2003 Kumar S, Tamura K & Nei M @ Annual meeting of the *Society for Molecular Biology and Evolution*, University of California at Irvine, Newport Beach
Title: MEGA3: An Integrated Platform for Molecular Evolutionary Genetics Analysis and Sequence Alignment
- 2003 Kumar S, Tamura K & Nei M @ *Evolutionary Genomics Conference* sponsored by the National Science Foundation and Integrative Graduate Education and Research Traineeship (IGERT) Program
Title: MEGA3: An Integrated Platform for Molecular Evolutionary Genetics Analysis and Sequence Alignment
- 2002 Kumar S, Newfeld SJ, Marti-Subirana A, Jayaraman K, Gurunathan R & Panchanathan S @ 43rd Annual *Drosophila Research Conference*.
Title: Computational analysis of Embryonic Gene Expression Patterns
- 2002 Iyer R & Kumar S @ Annual meeting of the *American Genetic Association*, Tempe, AZ
Title: A Comparative Study of Secondary Structural Attributes of Enzyme Classes
- 2002 Filipski A & Kumar S. *American Genetic Association*, Tempe, AZ
Title: The Effect of Substitution Process Heterogeneity on Inferred Rates of Mutation
- 2002 Gadagkar SR, Tamura K & Kumar S. *American Genetic Association*, Tempe, AZ
Title: Quantifying Substitution Pattern Differences in Sister Lineages by Pairwise Sequence Analysis
- 2001 Kumar S. International Workshop on Population Genetics, Univ. of Montreal, Montreal, Canada
Title: Estimating Neutral Substitution Rate in Mammals
- 2001 Rosenberg MS & Kumar S. *Society for the Study of Evolution*, University of Tennessee, Knoxville, Tennessee.
Title: Taxon Sampling is Not a Problem for Phylogenetic Inference
- 2001 Jayaraman K, Panchanathan S, & Kumar S. *Society of Photo-Optical Instrumentation Engineers*, San Diego, California.
Title: Classification and Indexing of Gene Expression Images
- 2000 Kumar S, Jakobsen IB, Tamura K & Nei M @ Annual meeting of the *Society for Molecular Biology & Evolution*. Yale University, New Haven, Connecticut.
Title: Molecular Evolutionary Genetics Analysis Software
- 2000 Kumar S & Gadagkar S @ Annual meeting of *Society for Molecular Biology & Evolution*, Yale University, New Haven, Connecticut.
Title: Reconstructing Large Phylogenies using Molecular Data
- 2000 Kumar S, Jakobsen IB, Tamura K & Nei M @ Annual meeting of the *Genetics Society of America*, University of British Columbia, Vancouver, Canada
Title: Molecular Evolutionary Genetics Analysis Software version 2
- 2000 Filipski A & Kumar S @ Annual meeting of the *Genetics Society of America*, University of British Columbia, Vancouver, Canada

- Title: Estimating Genomic Distance between species based on the number of conserved chromosomal segments*
- 1999 Kumar S @ Annual meeting of the *American Genetic Association*, Penn State, University Park, Pennsylvania.
Title: Estimating Genomic Divergence between Species in terms of the Number of Conserved Chromosomal Segments in Nuclear Genomes
- 1998 Kumar S & Hedges SB @ Annual meeting of the *Society for Molecular Biology & Evolution*, University of British Columbia, Vancouver, Canada.
Title: Constructing a Molecular Timescale for Vertebrate Evolution
- 1997 Kumar S @ Annual meeting of the *Society for the Study of Systematic Biology*, University of Colorado, Boulder, Colorado.
Title: Inference and Reliability of the Large Phylogenies under the Minimum Evolution Criterion
- 1995 Kumar S @ Annual meeting of the *Society of Molecular Biology & Evolution*, Shonan International Village, Hayama, Japan
Title: Evolution of the Hedgehog Gene Family
- 1994 Kumar S @ Annual meeting of the *Society for Molecular Biology & Evolution*. University of Georgia, Atlanta, Georgia
Title: A New Algorithm for Finding Minimum Evolution Trees
- 1993 Kumar S, Tamura K & Nei M @ Annual meeting of the *Society for Molecular Biology & Evolution*. University of California, Irvine, California
Title: MEGA: Molecular Evolutionary Genetics Analysis software

PUBLICATIONS

Major Review Articles, Books, Monographs

1. Kumar S, Tamura K & Nei M (1993) ***A Guide to Molecular Evolutionary Genetics Analysis Program for Microcomputers***, Institute of Molecular Evolutionary Genetics, Pennsylvania State University, University Park, PA (140 pp; >2500 printed manuals distributed).
2. ²Nei M & Kumar S (2000) ***Molecular Evolution and Phylogenetics***. Oxford University Press, New York. (333 pp)
3. Gerber AS, Loggins R, Kumar S & Dowling TE (2001) Does non-neutral evolution shape observed patterns of DNA variation in animal mitochondrial genomes? ***Annual Review of Genetics***. 35:539-566.
4. Hedges SB & Kumar S (2002) Vertebrate genomes compared. ***Science*** 297:1283-1285.
5. Hedges SB & Kumar S (2003) Genomic clocks and evolutionary timescales. ***Trends in Genetics*** 19:200-206.
6. Hedges SB & Kumar S (2004) Precision of molecular time estimates. ***Trends in Genetics*** 20:242-247.
7. Kumar S (2005) Molecular clocks: four decades of evolution. ***Nature Reviews Genetics*** 6:654-662.

Original Research Articles

8. Hedges SB, Kumar S, Tamura K & Stoneking M (1992) Human origins and analysis of mitochondrial DNA sequences. ***Science*** 255:737-739.
9. Kumar S, Tamura K & Nei M (1994) MEGA: Molecular Evolutionary Genetics Analysis software for microcomputers. ***Computer Applications in Biosciences*** 10:189-191.
10. Yang Z, Kumar S & Nei M (1995) A new method of inference of ancestral nucleotide and amino acid sequences. ***Genetics*** 141:1641-1650.

² Translated in Chinese, Japanese, and Russian; currently in the 9th printing in English.

11. Rzhetsky A, Kumar S & Nei M (1995) Four-cluster analysis: a simple method to test phylogenetic hypotheses. *Molecular Biology & Evolution* 12:163-167.
12. Winnepenninckx W, Backeljau T, Mackey LY, Brooks JM, De-Wachter R, Kumar S & Garey JR (1995) 18S rRNA data indicate that Aschelminthes are polyphyletic in origin and consist of at least three distinct clades. *Molecular Biology & Evolution* 12:1132-1137.
13. Hedges SB, Parker PH, Sibley CG & Kumar S (1996) Continental breakup and the ordinal diversification of birds and mammals. *Nature* 381:226-229.
14. Kumar S (1996) A stepwise algorithm for finding minimum evolution trees. *Molecular Biology & Evolution* 13:584-593.
15. Kumar S (1996) Patterns of nucleotide substitution in mitochondrial protein coding genes of vertebrates. *Genetics* 143:537-548.
16. Kumar S, Balczarek KA & Lai Z-C (1996) Evolution of the *hedgehog* gene family. *Genetics* 142:965-972.
17. Kumar S & Rzhetsky A (1996) Evolutionary relationships of eukaryotic kingdoms. *Journal of Molecular Evolution* 42:183-193.
18. Yang Z & Kumar S (1996) Approximate methods for estimating the pattern of nucleotide substitution and the variation of substitution rates among sites. *Molecular Biology & Evolution* 13:650-659.
19. Balczarek KA, Lai Z-C & Kumar S (1997) Evolution and functional diversification of the Paired-box (*Pax*) DNA-binding domains. *Molecular Biology & Evolution* 14:829-842.
20. Zhang J & Kumar S (1997) Detection of convergent and parallel evolution at the amino acid sequence level. *Molecular Biology & Evolution* 14:527-536.
21. Zhang J, Kumar S & Nei M (1997) Small-sample tests of episodic adaptive evolution: A case study of primate lysozymes. *Molecular Biology & Evolution* 14:1335-1338.
22. Yeager M, Kumar S & Hughes AL (1997) Sequence convergence in the peptide-binding region of primate and rodent MHC class *Ib* molecules. *Molecular Biology & Evolution* 14:1035-1041.
23. Leitner TL, Kumar S & Albert J (1997) Tempo and mode of nucleotide substitutions in *gag* and *env* gene fragments in Human Immunodeficiency Virus Type 1 populations with a known transmission history. *Journal of Virology* 71:4761-4770.
24. Kumar S & Hedges SB (1998) A molecular timescale for vertebrate evolution. *Nature* 392:917-920.
25. Nei M, Kumar S & Takahashi K (1998) The optimization principle in phylogenetic analysis tends to give incorrect topologies when the number of nucleotides or amino acids used is small. *Proceedings of the National Academy of Sciences (USA)* 95:12390-12397.
26. Hedges SB & Kumar S (1999) Divergence times of eutherian mammals. *Science* 285:2031.
27. Newfeld SJ, Wisotzkey RG & Kumar S (1999) Molecular evolution of a development pathway: Phylogenetic analyses of transforming growth factor- β family ligands, receptors, and Smad signal transducers. *Genetics* 152:783-795.
28. Wang Y-C, Kumar S & Hedges SB (1999) Divergence time estimates for the early history of animal phyla and the origin of plants, animals, and fungi. *Proceedings of the Royal Society, London. B* 266:163-171.
29. Kumar S, Mitnik C, Valente G & Floyd-Smith G (2000) Expansion and molecular evolution of the interferon-induced 2'-5' oligoadenylate synthetase gene family. *Molecular Biology & Evolution* 17:738-750.

30. Kumar S, Hedrick P, Dowling T, & Stoneking M (2000) Questioning evidence for recombination in human mitochondrial DNA. **Science** 288:1931a.
31. Kumar S & Gadagkar SR (2000) Efficiency of the Neighbor-Joining method in reconstructing deep and shallow evolutionary relationships in large phylogenies. **Journal of Molecular Evolution** 51:544-553.
32. Purdom PW, Bradford PG, Tamura K & Kumar S (2000) Single column discrepancy and dynamic max-mini optimizations for quickly finding the most parsimonious evolutionary trees. **Bioinformatics** 16:140-151.
33. Kumar S, Gadagkar SR, Filipowski A, & Gu X (2001) Determination of the number of conserved chromosomal segments between species. **Genetics** 157:1387-1395.
34. Kumar S and Gadagkar SR (2001) Disparity Index: A simple statistic to measure and test the homogeneity of substitution pattern between molecular sequences. **Genetics** 158:1321-1327.
35. Rosenberg MS & Kumar S (2001) Traditional phylogenetic reconstruction methods reconstruct shallow and deep evolutionary relationships equally well. **Molecular Biology & Evolution** 18:1823-1827.
36. Rosenberg MS & Kumar S (2001) Incomplete taxon sampling is not a problem for phylogenetic inference. **Proceedings of the National Academy of Sciences (USA)** 98:10751-10756.
37. Kumar S, Tamura K, Jakobsen IB, & Nei M (2001) MEGA2: Molecular Evolutionary Genetics Analysis software. **Bioinformatics** 17:1244-1245.
38. Miller MP & Kumar S (2001) Understanding human disease mutations through the use of interspecific genetic variation. **Human Molecular Genetics** 10: 2319-2328.
39. Hedrick P & Kumar S (2001) Mutation and linkage disequilibrium in human mtDNA. **European Journal of Human Genetics** 9:969-972.
40. Hedges SB, Chen H, Kumar S, Wang DY-C, Thompson AS, & Watanabe H (2001) A genomic timescale for the origin of eukaryotes. **BMC Evolutionary Biology** 1:4 (10 pp).
41. Kumar S & Subramanian S (2002) Mutation rates in mammalian genomes. **Proceedings of the National Academy of Sciences (USA)** 99:803-808.
42. Kumar S, Jayaraman K, Panchanathan S, Gurunathan R, Marti-Subirana A & Newfield SJ (2002) BEST: A novel computational approach for comparing gene expression patterns from early stages of *Drosophila melanogaster* development. **Genetics** 162:2037-2047.
43. Tamura K & Kumar S (2002) Evolutionary distance estimation under heterogeneous substitution pattern among lineages. **Molecular Biology Evolution** 19:1727-1736.
44. Jiang Z, Melville JS, Cao H, Kumar S, Filipowski A & Verrinder Gibbins AM (2002) Measuring conservation of contiguous sets of autosomal markers on bovine and porcine genomes in relation to the human genome map. **Genome** 45:769-776.
45. Subramanian S & Kumar S (2003) Neutral substitutions occur as a faster rate in exons than in noncoding DNA in primate genomes. **Genome Research** 13:838-844.
46. Rosenberg MS & Kumar S (2003) Taxon sampling, bioinformatics, and phylogenomics. **Systematic Biology** 52:119-124.
47. Rosenberg MS & Kumar S (2003) Patterns of transitional mutation biases within and among mammalian genomes. **Molecular Biology and Evolution** 20:988-993.
48. Rosenberg MS & Kumar S (2003) Heterogeneity of nucleotide frequencies among evolutionary lineages and phylogenetic inference. **Molecular Biology and Evolution** 20:610-621.

49. Miller MP, Parker JD, Rissing SW, & Kumar S (2003) Quantifying the intragenic distribution of disease mutations. ***Annals of Human Genetics*** 67:567-579.
50. Jancovich J, Mao J, Chinchar VG, Wyatt C, Case S, Kumar S, Valente G, Subramanian S, Davidson EW, Collins JP & Jacobs BL (2003) Genomic sequence of a ranavirus (family Iridoviridae) associated with salamander mortalities in North America. ***Virology*** 316:90-103.
51. Kumar S, Tamura K & Nei M (2004) MEGA3: Integrated software for Molecular Evolutionary Genetics Analysis and Sequence Alignment. ***Briefings in Bioinformatics***. 5:150-163.
52. Tamura K, Subramanian S & Kumar S (2004) Temporal patterns of fruit fly evolution revealed by mutation clocks. ***Molecular Biology and Evolution*** 21:36-44.
53. Briscoe A, Gaur C & Kumar S (2004) The spectrum of human rhodopsin disease mutations through the lens of interspecific variation. ***Gene*** 332:107-118.
54. Tamura K, Masatoshi Nei, & Kumar S (2004) Prospects for inferring very large phylogenies using the Neighbor-Joining method. ***Proceedings of the National Academy of Sciences (USA)*** 101:11030-11035.
55. Subramanian S & Kumar S (2004) Gene expression intensity shapes evolutionary rates of the proteins encoded by the vertebrate genome. ***Genetics*** 168:373-381.
56. Gurunathan R, Van Emden B, Panchanathan S & Kumar S (2004) Identifying spatially similar gene expression patterns in early stage fruit fly embryo images: binary feature versus invariant moment digital representations. ***BMC Bioinformatics*** 5:202 (13 pp).
57. Gadagkar SR, Rosenberg MS & Kumar S (2005) Inferring species phylogenies from multiple genes: concatenated sequence tree versus consensus gene tree. ***Journal of Experimental Zoology (Molecular & Developmental Evolution)***. 304B:64-74.
58. Gadagkar SR & Kumar S (2005) Maximum likelihood method outperforms maximum parsimony in inferring correct phylogeny even when evolutionary rates are heterotachous. ***Molecular Biology and Evolution*** (In press).

Conference proceedings (original, peer-reviewed work)³

59. Kumar S & Panchanathan S (2001) Elucidating gene interaction networks based on gene expression pattern image analysis. ***Proceedings of the International Conference on Biomedical Engineering*** 5A:232-234.
60. Jayaraman K, Panchanathan S, & Kumar S (2001) Classification and indexing of gene expression images. ***Proceedings of Society of Photo-optical Instrumentation Engineers*** 4472:471-481.
61. Gargsha M, Antin P, Van Emden B, Panchanathan S & Kumar S (2004) Image registration and similarity computation for chicken gene expression patterns. Workshop on ***Genomic Signal Processing and Statistics*** (GENSIPS), IEEE Signal Processing Society (4 pp).
62. Gargsha M, Yang J, Van Emden B, Panchanathan S & Kumar S (2005) Automatic Annotation Techniques for Gene Expression Images of the Fruit Fly. ***Proceedings of Visual Communications and Image Processing Conference***, SPIE (8 pp).

Original Research Articles submitted or in final stages of preparations

63. Kumar S, Filipski A, Swarna V, Walker A & Hedges SB (2005) Placing confidence limits on the molecular age of the human-chimpanzee divergence.
64. Subramanian S & Kumar S (2005) Evolutionary rates of amino acid positions modulate the proteome-wide trends of disease-associated mutations and nonsynonymous variations in humans.

³ IEEE and SPIE conferences papers are peer-reviewed and have a 50% acceptance rate.

65. Elser JJ, Fagan WF, Subramanian S & Kumar S (2005) Signatures of environmental resource availability in the animal and plant proteomes.
66. Kuslich CD, Valente G, Moturu ST & Kumar S (2005) Contrasting features of disease-associated and benign missense mutations in mitochondrial proteins through evolutionary measures.

Book chapters/Dictionaries/Encyclopedia/Minor reviews

67. O'Brien S, Eisenberg JF, Miyamoto M, Hedges SB, Kumar S, & Wilson DE (1999) Comparative Genomics: Mammalian radiation. *Genome Maps 10* (phylogenetic tree). **Science** 286:463-478.
68. Kumar S & Filipski A (2001) Molecular Phylogeny Reconstruction. **Encyclopedia of Life Sciences** Macmillan Reference Ltd, Oxford, UK. (www.els.net).
69. Kumar S & Filipski A (2001) Molecular Clock Testing. **Encyclopedia of Life Sciences**, Macmillan Reference Ltd, Oxford, UK. (www.els.net).
70. Kumar S & Filipski A (2004) Phylogenetic Analysis. **Dictionary of Bioinformatics and Computational Biology** edited by Hancock J & Zvelebil M, Wiley-Liss, New York.
71. Kumar S & Filipski A (2005) Reconstructing Vertebrate Phylogeny. **Encyclopedia of Genetics, Genomics, Proteomics, and Bioinformatics** edited by Subramaniam S. John Wiley & Sons, New York.
72. Filipski A & Kumar S (2005) Comparative Genomics in Eukaryotes. In **The Evolution of the Genome** edited by Ryan TG. Elsevier, San Diego, 521-583.

Book reviews

73. Kumar S (2000) A review of the book Genomes by TA Brown. **The Quarterly Review of Biology** 75:316-317.
74. Kumar S (2002) *MacTrees made easy*, a review of the book Phylogenetic trees made easy: a how-to-manual for molecular biologists by Hall BG. **Molecular Evolution and Phylogenetics** 27:165-167.
75. Kumar S & Newfeld SJ (2002) A review of the book Molecular Genetic Analysis: Integrating Genes and Genomes (second edition) by Griffiths AJF, Gelbart WM, Lewontin RC & Miller JH. **The Quarterly Review of Biology** 77:456-457.
76. Rawls A & Kumar S (2002) A review of the book Genomic Regulatory Systems: Development and Evolution by E. H. Davidson. **The Quarterly Review of Biology** 77:456.
77. Lorson C & Kumar S (2003) A review of the book Genomes (second edition) by T.A. Brown. **The Quarterly Review of Biology** 78:225.

Software Packages (available at www.kumarlab.net/publications)

78. Kumar S (1996) *PHYLTEST: Phylogenetic Hypothesis Testing Software*. Version 2.0. Pennsylvania State University, University Park, Pennsylvania.
79. Kumar S (2000) *LDA: Linkage Disequilibrium Analysis of Bi-allelic Sites in Molecular Sequence Data*. Version 1.0. Arizona State University, Tempe, Arizona.

Web-based resources

80. www.megasoftware.net: Molecular Evolutionary Genetics Analysis (MEGA) software package. Version 3.0.
81. www.timetree.net: A web-accessible database containing published times of tetrapod species divergence inferred using molecular data. Version 1.0.
82. www.flyexpress.net: A database of spatial gene expression patterns in the fruit fly embryos, with an ability to find the overlapping patterns of gene expression by means of image-analysis. Version 1.0 (currently in test phase).