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Peter Calabrese

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Education

National Science Foundation Mathematics Postdoctoral Fellow (Simon Tavaré sponsoring scientist), University of Southern California. 2001 – 2003
Ph.D. in Applied Mathematics, Cornell University (Rick Durrett advisor). 2001
B.S. in Mathematics, University of Maryland, College Park. 1996

Positions

Associate Professor (Teaching) of Quantitative and Computational Biology, University of Southern California. 2021 – present
Director of Undergraduate Studies, Quantitative Biology, University of Southern California. 2018 – present
Assistant Professor (Teaching) of Biological Sciences, University of Southern California. 2018 – 2021
Assistant Professor (Research) of Biological Sciences, University of Southern California. 2005 – 2018
Senior Research Associate, Molecular and Computational Biology, University of Southern California. 2003 – 2005

Courses taught at USC

1. QBIO 401, Introduction to Computational Analysis of Biological Data. Fall 2021, Summer 2020, Spring 2020, Spring 2019 (I designed this course)
2. QBIO 310, Statistical Thinking for Quantitative Biology. Spring 2022, Spring 2021 (I co-designed this course)
3. BISC 305, Statistics for Biological Sciences. Summer 2022, Spring 2022, Fall 2021, Summer 2021, Spring 2021, Summer 2020, Spring 2020, Fall 2019, Summer 2019, Spring 2019, Fall 2018, Spring 2018
4. BISC 478, Computational Genome Analysis. Spring 2021
5. QBIO 105, Introduction to Quantitative Biology Seminar. Spring 2022, Spring 2021, Spring 2020
6. BISC 542, Seminar in Computational Biology. Spring 2021
7. BISC 593, Practicum in Teaching the Biological Sciences. Spring 2020, Fall 2019, Spring 2019, Fall 2018

8. QBIO 493, Quantitative Biology Honors Seminar. Fall 2019
9. BISC 321, Multidisciplinary Seminar: Science, Technology, and Society. Spring 2019
10. MATH 407, Probability Theory. Fall 2003
11. MATH 408, Mathematical Statistics. Spring 2002
12. MATH 116, Mathematics for the Social Sciences. Fall 2001

Faculty Committees

1. QBIO Curriculum Committee. 2018 – present
2. BISC Student Awards Committee. 2020
3. Wattis-Dumke Fellowship Awards Committee. 2020
4. BISC Undergraduate Review Committee. 2019/2018
5. CBB Graduate Student Admission Committee. 2018/2017
6. MCB Annual Faculty Evaluation Committee. 2015, 2014, 2012
7. BISC Chair Selection Committee. 2013/2012

Supervised Undergraduate Students' Research

1. Brian Tinsley (Spring 2022)
2. Sydney Rashid (Fall 2021 and Spring 2022)
3. Emily Yang (Spring 2021)

Graduated Students Ph.D. Committees

1. Saket Choudhary (Andrew Smith advisor), graduated 2020
2. Sara Keeble (Mathew Dean advisor), graduated 2019
3. Ben Decato (Andrew Smith advisor), graduated 2018
4. Jordan Eboreime (Norman Arnheim advisor), graduated 2016

Current Students Ph.D. Committees

1. Oanh Huynh (Matthew Michael advisor)
2. Makayla Morton (Lin Chen advisor)
3. Amal Thomas (Andrew Smith advisor)
4. Guilherme De Sena Brandine (Andrew Smith advisor)
5. Meghan Petrie (Oscar Aparicio advisor)
6. Lisa Welter (Peter Kuhn advisor)
7. Zifan Zhu (Fengzhu Sun advisor)

Invited Lectures

Frontiers in Aging and Regeneration Research, NIH Sponsored Advanced Training Course for Promising Undergraduates from Predominately Underrepresented Communities: New Orleans, Louisiana, May 2016; Atlanta, Georgia, May 2014; and New Orleans, Louisiana, May 2013

Awards

National Science Foundation Mathematics Postdoctoral Fellow
University of Maryland:

Graduated magna cum laude with high honors in mathematics
Phi Beta Kappa: elected junior year, won Outstanding Junior Award
Mathematics Department: Strauss Fellowship, Senior Award
Maryland Distinguished Scholar, Honors program, Dean's list all four years

Education Publication

P. Calabrese. Quantitative Biology Undergraduate Major at the University of Southern California. Journal of Computational Biology, 2022. 29(7): p. 616-618.

Refereed Publications

(* indicates the authors contributed equally to this publication.)

1. Eboreime, J., S.K. Choi, S.R. Yoon, A. Sadybekov, V. Katritch, **P. Calabrese,** and N. Arnheim. Germline selection of PTPN11 variants make a major contribution to both Noonan syndrome's high birth rate and the transmission of sporadic cancer variants resulting in fetal abnormality. Human Mutation. Accepted 2022.
2. Kim, K., **P. Calabrese**, S. Wang, C. Qin, Y. Rao, P. Feng, and X. S. Chen. The Roles of APOBEC-mediated RNA Editing in SARS-CoV-2 Mutations, Replication and Fitness. Scientific Reports, 2022. 12: 14972.
3. Qu, T., **P. Calabrese**, P. Singhavi, and J. Tower. Incorporating antagonistic pleiotropy into models for molecular replicators. Biosystems, 2021. 201: 104333
4. Deng, C., T. Daley, **P. Calabrese**, J. Ren, and A. Smith. Predicting the Number of Bases to Attain Sufficient Coverage in High-Throughput Sequencing Experiments. J Comput Biol, 2020. 27(7): p. 1130-1143.
5. Pham, P., S. Malik, C. Mak, **P. Calabrese**, R. Roeder, and M. Goodman. *AID-RNA polymerase II transcription-dependent deamination of IgV DNA*. Nucleic Acids Res, 2019. 47(20): p. 10815-10829.
6. Fischer, J.M., **P.P. Calabrese**, A.J. Miller, N.M. Munoz, W.M. Grady, D. Shibata, and R.M. Liskay. *Single cell lineage tracing reveals a role for Tgfβ R2 in intestinal stem cell dynamics and differentiation.* Proc Natl Acad Sci U S A, 2016. 113(43): p. 12192-12197.
7. Arnheim, N. and **P. Calabrese**. *Germline stem cell competition, mutation hot spots, genetic disorders, and older fathers*. Annu Rev Genomics Hum Genet, 2016. 17: p. 219-243.
8. Eboreime, J., S.K. Choi, S.R. Yoon, N. Arnheim*, and **P. Calabrese***. *Estimating exceptionally rare germline and somatic mutation frequencies via next generation sequencing.* PLoS One, 2016. 11(6): p. e0158340.
9. Shinde, D.N., D.P. Elmer, **P. Calabrese**, J. Boulanger, N. Arnheim, and I. Tiemann-Boege. *New evidence for positive selection helps explain the paternal age effect observed in achondroplasia*. Hum Mol Genet, 2013. 22(20): p. 4117-26.

10. Yoon, S.R., S.K. Choi, J. Eboreime, B.D. Gelb, **P. Calabrese***, and N. Arnheim*, *Age-dependent germline mosaicism of the most common Noonan syndrome mutation shows the signature of germline selection*. Am J Hum Genet, 2013. 92(6): p. 917-926.
8. Choi, S.K., S.R. Yoon, **P. Calabrese***, and N. Arnheim*, *Positive Selection for New Disease Mutations in the Human Germline: Evidence from the Heritable Cancer Syndrome Multiple Endocrine Neoplasia Type 2B.* PLoS Genetics, 2012. 8(2): p. e1002420.
9. Pham, P., **P. Calabrese**, S.J. Park, and M.F. Goodman, *Analysis of a single-stranded DNA-scanning process in which activation-induced deoxycytidine deaminase (AID) deaminates C to U haphazardly and inefficiently to ensure mutational diversity.* J Biol Chem, 2011. 286(28): p. 24931-42.
10. **Calabrese, P.** and D. Shibata, *A simple algebraic cancer equation: calculating how cancers may arise with normal mutation rates.* BMC Cancer, 2010. 10: p. 3.
11. Yoon, S.R., J. Qin, R.L. Glaser, E.W. Jabs, N.S. Wexler, R. Sokol, N. Arnehim, and **P. Calabrese**, *The ups and downs of mutation frequencies during aging can account for the apert syndrome paternal age effect.* PLoS Genet, 2009. 5(7): p. e1000558.
12. Main, B.J., R.D. Bickel, L.M. McIntyre, R.M. Graze, **P.P. Calabrese**, and S.V. Nuzhdin, *Allele-specific expression assays using Solexa.* BMC Genomics, 2009. 10: p. 422.
13. Arnheim, N. and **P. Calabrese**, *Understanding what determines the frequency and pattern of human germline mutations.* Nat Rev Genet, 2009. 10(7): p. 478-88.
14. Pham, P., M.B. Smolka, **P. Calabrese**, A. Landolph, K. Zhang, H. Zhou, and M.F. Goodman, *Impact of phosphorylation and phosphorylation-null mutants on the activity and deamination specificity of activation-induced cytidine deaminase.* J Biol Chem, 2008. 283(25): p. 17428-39.
15. Choi, S.K., S.R. Yoon, **P. Calabrese***, and N. Arnheim*, *A germ-line-selective advantage rather than an increased mutation rate can explain some unexpectedly common human disease mutations.* Proc Natl Acad Sci U S A, 2008. 105(29): p. 10143-8.
16. Qin, J.*, **P. Calabrese***, I. Tiemann-Boege, D.N. Shinde, S.R. Yoon, D. Gelfand, K. Bauer, and N. Arnheim, *The molecular anatomy of spontaneous germline mutations in human testes.* PLoS Biol, 2007. 5(9): p. e224.
17. **Calabrese, P.**, *A population genetics model with recombination hotspots that are heterogeneous across the population.* Proc Natl Acad Sci U S A, 2007. 104(11): p. 4748-52.
18. Arnheim, N., **P. Calabrese**, and I. Tiemann-Boege, *Mammalian meiotic recombination hot spots.* Annu Rev Genet, 2007. 41: p. 369-99.
19. Toomajian, C., T.T. Hu, M.J. Aranzana, C. Lister, C. Tang, H. Zheng, K. Zhao, **P. Calabrese**, C. Dean, and M. Nordborg, *A nonparametric test reveals selection for rapid flowering in the Arabidopsis genome.* PLoS Biol, 2006. 4(5): p. e137.
20. Tiemann-Boege, I., **P. Calabrese**, D.M. Cochran, R. Sokol, and N. Arnheim, *High-resolution recombination patterns in a region of human chromosome 21 measured by sperm typing.* PLoS Genet, 2006. 2(5): p. e70.
21. Chelico, L., P. Pham, **P. Calabrese**, and M.F. Goodman, *APOBEC3G DNA deaminase acts processively 3' --> 5' on single-stranded DNA.* Nat Struct Mol Biol, 2006. 13(5): p. 392-9.
22. Nordborg, M., T.T. Hu, Y. Ishino, J. Jhaveri, C. Toomajian, H. Zheng, E. Bakker, **P. Calabrese**, J. Gladstone, R. Goyal, M. Jakobsson, S. Kim, Y. Morozov, B. Padhukasahasram, V. Plagnol, N.A. Rosenberg, C. Shah, J.D. Wall, K. Zhao, T. Kalbfleisch, V. Schulz, M. Kretiman, and J. Bergelson, *The pattern of polymorphism in Arabidopsis thaliana.* PLoS Biol, 2005. 3(7): p. e196.
23. **Calabrese, P.**, J.P. Mecklin, H.J. Jarvinen, L.A. Aaltonen, S. Tavaré, and D. Shibata, *Numbers of mutations to different types of colorectal cancer.* BMC Cancer, 2005. 5: p. 126.

24. Rosenberg, N.A. and **P.P. Calabrese**, *Polyploid and multilocus extensions of the Wahlund inequality.* Theor Popul Biol, 2004. 66(4): p. 381-91.
25. Kim, K.M., **P. Calabrese**, S. Tavaré, and D. Shibata, *Enhanced stem cell survival in familial adenomatous polyposis.* Am J Pathol, 2004. 164(4): p. 1369-77.
26. DuMont, V.B., J.C. Fay, **P.P. Calabrese**, and C.F. Aquadro, *DNA variability and divergence at the notch locus in Drosophila melanogaster and D. simulans: a case of accelerated synonymous site divergence.* Genetics, 2004. 167(1): p. 171-85.
27. **Calabrese, P.**, J.L. Tsao, Y. Yatabe, R. Salovaara, J.P. Mecklin, H.J. Jarvinen, L.A. Aaltonen, S. Tavaré, and D. Shibata, *Colorectal pretumor progression before and after loss of DNA mismatch repair.* Am J Pathol, 2004. 164(4): p. 1447-53.
28. **Calabrese, P.**, S. Tavaré, and D. Shibata, *Pretumor progression: clonal evolution of human stem cell populations.* Am J Pathol, 2004. 164(4): p. 1337-46.
29. Bransteitter, R., P. Pham, **P. Calabrese**, and M.F. Goodman, et al., *Biochemical analysis of hypermutational targeting by wild type and mutant activation-induced cytidine deaminase.* J Biol Chem, 2004. 279(49): p. 51612-21.
30. Ahmed, A.A., B.D. Tom, and **P. Calabrese**, *Ectopic pregnancy diagnosis and the pseudo-sac.* Fertil Steril, 2004. 81(5): p. 1225-8.
31. **Calabrese, P.P.**, S. Chakravarty, and T.J. Vision, *Fast identification and statistical evaluation of segmental homologies in comparative maps.* Bioinformatics, 2003. 19 Suppl 1: p. i74-80.
32. **Calabrese, P.** and R. Durrett, *Dinucleotide repeats in the Drosophila and human genomes have complex, length-dependent mutation processes.* Mol Biol Evol, 2003. 20(5): p. 715-25.
33. Arnheim, N., **P. Calabrese**, and M. Nordborg, *Hot and cold spots of recombination in the human genome: the reason we should find them and how this can be achieved.* Am J Hum Genet, 2003. 73(1): p. 5-16.
34. Zhang, K., **P. Calabrese**, M. Nordborg, and F. Sun, *Haplotype block structure and its applications to association studies: power and study designs.* Am J Hum Genet, 2002. 71(6): p. 1386-94.
35. **Calabrese, P.P.**, R.T. Durrett, and C.F. Aquadro, *Dynamics of microsatellite divergence under stepwise mutation and proportional slippage/point mutation models.* Genetics, 2001. 159(2): p. 839-52.

Contributed Book Chapters

1. Arnheim, N. and **P. Calabrese**, *Frequency of Human Disease Mutations and Spermatogonial Stem Cell Function*, in The Biology of Mammalian Spermatogonia, J. Oatley and M. Griswald, Editors. 2017, Springer: New York, NY. p. 181-204.
2. Arnheim, N. and **P. Calabrese**, *Recurrent Germline Mutations in the FGFR2/3 Genes, High Mutation Frequency, Paternal Skewing and Age-Dependence*, in Craniosynostoses: Molecular Genetics, Principles of Diagnosis and Treatment (Monographs in Human Genetics v. 19), M. Muenke, W. Kress, H. Collmann, and B. Solomon, Editors. 2011, Karger: Basel. p. 58-66.
3. **Calabrese, P.** and R. Sainudiin, *Models of Microsatellite Evolution*, in Statistical Methods in Molecular Evolution, R. Nielsen, Editor. 2005, Springer. p. 289-306.

Completed Research Support

1. R01 GM03674529 NIH Arnheim/Calabrese/Oatley (co-PI/PDs) 10/1/14 – 9/30/18
   Genetic Analysis Using Sperm Typing
   A continuation of our work on mutation hot spots and germline selection.
   Role: Co-PI/PD Amount: ~$1.8M
2. R01 HG007650 NIH Smith (PI) 12/16/14 – 11/30/17
   Methods to predict molecular complexity in sequencing experiments
   Role: Co-Investigator Amount: ~$1.2M
3. R01 GM03674525 NIH Arnheim/Calabrese (co-PI/PDs) 10/1/10 – 9/30/14
   Genetic Analysis Using Sperm Typing
   A continuation of our work on mutation hot spots and germline selection.
   Role: Co-PI/PD Amount: ~$2.0M
4. R21 CA170814-01 NIH Shibata (PI) 7/1/12 – 6/30/14
   How Do NSAIDs Prevent Colorectal Cancer?
   The major goal of this project is to test the hypothesis that NSAIDs prevent colorectal cancer (CRC) not by directly killing mutant stem cells but by minimizing average stem cell numbers and thereby augmenting normal crypt "anticancer" mechanisms.
   Role: Co-Investigator Amount: ~$400K
5. R01 MH084678 NIH Marjoram (PI) 9/25/08 – 6/30/11
   Statistical Methods for Relating Sequence Data to Phenotype
   We aim to develop a raft of statistical machinery to help develop our understanding of how sequence level data can be related to phenotype.
   Role: Co-Investigator Amount: ~$1.6M
6. R01 GM03674521 NIH Arnheim/Calabrese (co-PI/PDs) 9/1/06 – 8/31/10
   Genetic Analysis Using Sperm Typing
   To study applications of sperm typing in the paternal age effect.
   Role: Co-PI/PD Amount: ~$1.7M
7. P50 HG002790 NIH Waterman (PI) 9/1/03 – 3/31/08
   Implications of Haplotype Structure in the Human Genome
   The specific aim is to study the biological significance of the observed haplotype structure and the practical implications of such haplotype structure for the mapping of genes responsible for disease.
   Role: Co-Investigator Amount: ~$18M
8. DMS-0102008 NSF Calabrese (PI) 9/1/01 – 8/31/03
   National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship
   Role: PI Amount: ~$100K