Shai Carmi

Born: December 1981, Ramat-Gan, Israel

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Current occupation

- Post-doctoral scientist, Department of Computer Science, Columbia University
  - Started: November 2011
  - Mentor: Prof. Itsik Pe'er
  - Topics: Sharing of long genetic segments in isolated populations: models and applications; Population and medical Jewish genetics

Education

- B.Sc., Bar-Ilan University, Israel, 2005
  - Physics and Computer Science, summa cum laude
- M.Sc., Bar-Ilan University, Israel, 2006
  - Physics, accelerated track, magna cum laude
  - Advisor: Prof. Shlomo Havlin
  - Thesis title: Statistical physics of complex networks
- Ph.D., Bar-Ilan University, Israel, 2010
  - Physics, with distinction
  - Advisor: Prof. Shlomo Havlin
  - Thesis title: Complex systems from communication networks to proteins: statistical analysis and modeling
  - 2007-2008: Visiting graduate student in the group of Prof. H. Eugene Stanley at the Department of Physics, Boston University

Past academic positions

- Teaching assistant, Department of Physics, Bar-Ilan University (2005-2010)
  - Courses taught: Introductory physics laboratory for engineering; Physics for life sciences; Thermodynamics and statistical mechanics
- Post-doctoral fellow, The faculty of Life Sciences, Bar-Ilan University (2010-2011)
  - Mentor: Dr. Erez Levanon
  - Topic: RNA and DNA editing in mammalian genomes

Fellowships and Awards

- Undergraduate:
  - The Open University president's list (as a non-degree student) (2001,2002)
  - Bar-Ilan University dean's list (2003, 2004, 2005)
  - Department of Physics award (2004, 2005)
  - Wolf Foundation award (national) (2005)
- Graduate:
  - Bar-Ilan University rector's award (2005), president's fellowship (2007), dean's award (2008), and Department of Physics award (2008)
  - Adams fellowship of The Israel Academy of Sciences and Humanities (2007)
  - 'Interdisciplinary Technologies' fellowship of The Council for Higher Education in Israel (declined) (2007)
  - Wolf Foundation award (national) (2009)
- Post graduate:
  - Human Frontiers Science Program Cross Disciplinary Fellowship (2011)

Publications

1. **S. Carmi**, E. Y. Levanon, S. Havlin, and E. Eisenberg. Connectivity and expression in protein networks: Proteins in a complex are uniformly expressed. Phys. Rev. E **73**, 031909 (2006).
2. **S. Carmi**, R. Cohen, and D. Dolev. Searching complex networks efficiently with minimal information. Europhys. Lett. **74**, 1102 (2006).
3. E. Lopez, **S. Carmi**, S. Havlin, S. Buldyrev, and H. E. Stanley. Anomalous electrical and frictionless flow conductance in complex networks. Physica D **224**, 69-76 (2006).
4. **S. Carmi**, Z. Wu, E. Lopez, S. Havlin, and H. E. Stanley. Transport between multiple users in complex networks. Eur. Phys. J. B **57**, 165-174 (2007).
5. **S. Carmi**, S. Havlin, S. Kirkpatrick, Y. Shavitt, and E. Shir. A Model of Internet topology using *k*-shell decomposition, P. Natl. Acad. Sci. USA **104**, 11150-11154 (2007).
6. E. Lopez, R. Parshani, R. Cohen, **S. Carmi**, and S. Havlin. Limited path percolation in complex networks. Phys. Rev. Lett. **99**, 188701-188704 (2007).
7. M. Maragakis, **S. Carmi**, D. ben-Avraham, S. Havlin, and P. Argyrakis. Priority diffusion model in lattices and complex networks. Phys. Rev. E (Rapid Communication) **77**, 020103-020106 (2008).
8. **S. Carmi**, Z. Wu, S. Havlin, and H. E. Stanley. Transport in networks with multiple sources and sinks. EPL **84**, 28005 (2008).
9. A. Kittas, **S. Carmi**, S. Havlin, and Panos Argyrakis. Trapping in complex networks. EPL **84**, 40008 (2008).

10. **S. Carmi**, P. L. Krapivsky, and D. ben-Avraham, Partition of networks into basins of attraction. Phys. Rev. E **78** 066111 (2008).
11. **S. Carmi**, E. Y. Levanon, and E. Eisenberg. Efficiency of complex production in changing environment. BMC Sys. Biol. **3**:3 (2009).
12. **S. Carmi**, S. Havlin, C. Song, K. Wang, and H. Makse. Energy-landscape network approach to the glass transition. J. Phys. A: Math. Theor. **42**, 105101 (2009).
13. **S. Carmi**, S. Carter, J. Sun, and D. ben-Avraham. Asymptotic behavior of the Kleinberg model. Phys. Rev. Lett. **102**, 238702 (2009).
14. L. Turgeman, **S. Carmi**, and E. Barkai. Fractional Feynman-Kac equation for non-Brownian functionals. Phys. Rev. Lett. **103**, 190201 (2009).
15. H. Goldshmidt, D. Matas, A. Kabi, **S. Carmi**, R. Hope, and S. Michaeli. Persistent ER stress induces the Spliced Leader RNA Silencing pathway (SLS), leading to programmed cell death in *Trypanosoma brucei*. PLoS Pathog. **6**, e1000731 (2010).
16. R. Parshani, **S. Carmi**, and S. Havlin. Epidemic threshold for the Susceptible-Infectious-Susceptible model on random networks. Phys. Rev. Lett. **104**, 258701 (2010).
17. N. G. Kolev, J. B. Franklin, **S. Carmi**, H. Shi, S. Michaeli, and C. Tschudi. The transcriptome of the human pathogen *Trypanosoma brucei* at single-nucleotide resolution. PLoS Pathog. **6**, e1001090 (2010).
18. **S. Carmi**, L. Turgeman, and E. Barkai. On distributions of functionals of anomalous diffusion paths. J. Stat. Phys. **141**, 1071 (2010).
19. **S. Carmi**, I. Borukhov, and E. Y. Levanon. Identification of widespread ultra-edited human RNA. PLoS Genet. **7**, e1002317 (2011).
20. **S. Carmi**, G. M. Chruch, and E. Y. Levanon. Large scale DNA editing of retrotransposons accelerates mammalian genome evolution. Nat. Commun. **2**, 519 (2011).
21. **S. Carmi** and E. Barkai. Fractional Feynman-Kac equation for weak ergodicity breaking. Phys. Rev. E **84**, 061104 (2011).
22. S. K. Gupta, **S. Carmi**, H. Waldman Ben-Asher, I. D. Tkacz, I. Naboishchikov, and S. Michaeli. Basal splicing factors regulate the stability of mature mRNAs in Trypanosomes J. Biol. Chem. **7**, 4991 (2013).
23. **S. Carmi**, P. F. Palamara, V. Vacic, T. Lencz, A. Darvasi, and I. Pe'er. The variance of identity-by-descent sharing in the Wright-Fisher model. Genetics **193**, 911 (2013).
24. S. K. Gupta, I. Kosti, G. Plaut, A. Pivko, D. Biswas, C. Wachtel, H. Waldman Ben-Asher, **S. Carmi**, F. Glaser, Y. Mandel-Gutfreund, and S. Michaeli. The hnRNP F/H homologue of *Trypanosoma brucei* is differentially expressed in the two life cycle stages of the parasite and regulates splicing and mRNA stability. Nucleic Acids Res. **41**, 6577 (2013).

25. N. Bastas, M. Maragakis, P. Argyrakis, D. ben-Avraham, S. Havlin, and **S. Carmi**. Random walk with priorities in communication-like networks. Phys. Rev. E **88**, 022803 (2013).
26. S. K. Gupta, V. Chikne, D. Eliaz, I. D. Tkacz, I. Naboishchikov, **S. Carmi**, H. Waldman Ben-Asher, and S. Michaeli. Two splicing factors carrying serine-arginine motifs, TSR1 and TSR1IP, regulate splicing, mRNA stability and rRNA processing in *Trypanosoma brucei*. RNA Biology, in press (2014).

Submitted manuscripts

- **S. Carmi**, K. Y. Hui, E. Kochav, … (27 authors), I. Pe'er. Whole genome sequencing of an Ashkenazi Jewish reference panel supports population-targeted personal genomics and illuminates Jewish and European origins. Submitted (2013).
- K. Y. Hui, S. M. E. Ng, W. Zhang, … (8 authors), **S. Carmi**, … (24 authors), I. Peter, J. Cho. Genetic architecture of coding variation associated with Crohn's disease in Ashkenazi Jews. Submitted (2014).
- H. T. Porath, **S. Carmi**, and E. Y. Levanon. A genome-wide map of hyper-edited RNA reveals the main targets of ADAR activity. Submitted (2014).
- **S. Carmi**, P. Wilton, J. Wakeley, and I. Pe'er. A renewal theory approach to IBD sharing. Submitted (2014).
- J. Zidan, D. Ben-Avraham, **S. Carmi**, T. Maray, E. Friedman, and G. Atzmon. Population genetic of the Druze. Submitted (2014).

Manuscripts in preparation

- **S. Carmi** and I. Pe'er. The distribution of ancestry fractions in admixed populations.

Book chapters

- **S. Carmi** and E. Barkai. Fractional Feynman-Kac equation for anomalous diffusion functionals. Chapter 8 in Fractional Dynamics: Recent Advances, Eds. J. Klafter, S. C. Lim, and R. Metzler (World Scientific, 2011).

Media coverage

- A model of Internet topology using k-shell decomposition: Articles in MIT Technology Review, Science News, IEEE Spectrum, PopSci, Scientific American, and over 15 articles in other magazines
- Limited path percolation in complex networks: a story in Physical Review Focus
- Large scale DNA editing of retrotransposons accelerates mammalian genome evolution: an article in Haaretz online science channel (Hebrew)

Conferences

- Science of Complex Networks: from Biology to the Internet and WWW, Aveiro, Portugal, 2004 (poster)
- Katzir Conference on Molecuar Perspectives on Protein-Protein Interactions, Eilat, Israel, 2005 (poster)
- Complex Networks: from Biology to Information Technology, Pula, Italy, 2007 (talk)
- The Israel Physical Society annual meeting, Tel Aviv, Israel, 2010 (talk)
- Weak Chaos, Infinite Ergodic Theory, and Anomalous Dynamics, Dresden, Germany, 2011 (talk)
- The American Society of Human Genetics annual meeting, San Francisco, CA, USA, 2012 (poster)
- Personal Genomes and Medical Genomics, Cold Spring Harbor Laboratory, NY, USA, 2012 (talk)
- The American Society of Human Genetics annual meeting, Boston, MA, USA, 2013 (talk)
- Human Evolution in the Genomic Era: Origins, Populations, and Phenotypes, Leicester, UK, 2014 (talk)
- The Biology of Genomes, Cold Spring Harbor Laboratory, NY, USA, 2014 (poster)

Workshops

- Workshop on Networks and Complexity, Tel Aviv, Israel, 2006 (talk)
- The Science of Complexity, Eilat, Israel, 2008 (talk)
- Adams fellowship meeting, Jerusalem, Israel, 2008, 2010 (posters)
- Bar-Ilan's Institute for Nanotechnology and Advanced Materials meeting, Kinneret, Israel, 2009 (talk)

Seminar talks

- The Center for Polymer Studies, Boston University, 2007
- The Center for Complex Network Research seminar, Northeastern University, 2008, 2009
- IBM research center, Tel Aviv, Israel, 2010
- Applied math seminar, Bar-Ilan University, Israel, 2011
- Condensed matter seminar, Department of Physics, Tel Aviv University, Israel, 2011
- Computational genetics seminar, Tel-Aviv University, Israel, 2012, 2013
- Computational biology seminar, Bar-Ilan University, Israel, 2012

- Computational genetics seminar, Broad Institute and Harvard Medical School, 2013
- Statistical genetics seminar, Columbia University, 2013
- Division of Psychiatric Genomics seminar, Icahn School of Medicine at Mount Sinai, 2014
- Department of Organismic and Evolutionary Biology, Harvard University, 2014

Peer review

Wrote over 60 referee reports for Nature, Nature Physics, PNAS, Physical Review Letters, PLoS Computational Biology, PLoS One, Molecular Biology and Evolution, Physical Review E, Europhysics Letters, New Journal of Physics, Journal of Statistical Mechanics, Molecular Biotechnology, BMC Bioinformatics, Physics Letters A, Journal of Physics A, Physica A, ESAIM: Mathematical Modelling and Numerical Analysis, Scientific Reports, and Canadian Journal of Physics.

Selected as a Europhysics Letters distinguished referee for 2008.

Student projects supervised

- Undergraduate computational biology research projects at Bar-Ilan University
  - Structural motifs in transcripts regulated under splicing factors depletion in *Trypanosoma brucei*, 2010
  - DNA editing in polymorphic human retrotransposons, 2011
  - A comprehensive screen for DNA editing in mammalian genomes, 2011
- NCI-ICBP summer program at Columbia University
  - Quality control and variant statistics in the genomes of Ashkenazi Jews, 2012
- Undergraduate/masters research projects at Columbia University
  - Imputation of Ashkenazi Jewish genomes using whole genome sequencing panels, 2012
  - Evaluating methods of local ancestry inference in closely related populations, 2013
  - Imputation of Ashkenazi Jewish genomes using long segmental sharing with a large reference panel, 2013
  - Extracting IBD segments efficiently from genealogical trees, 2014