

Curriculum Vitae: Fred P. Davis, Pharm.D. Ph.D.

Current position

Staff Scientist

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)
National Institutes of Health (NIH)
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Education

1995 - 2001 Doctor of Pharmacy. Purdue University
2001 - 2003 Graduate courses, Mathematical & Computational Biology. Rockefeller University
2003 - 2007 Ph.D., Biophysics. University of California, San Francisco. Advisor: Andrej Sali
2007 - 2013 Postdoctoral training. HHMI Janelia Research Campus. Advisor: Sean Eddy

Research positions

1997 Undergraduate research assistant. Dept. Medicinal Chemistry, Purdue University
1998 Undergrad. research asst. Dept. Industrial & Physical Pharmacy, Purdue
1999 - 2001 Undergrad. research asst. Dept. Medicinal Chem. & Molec. Pharmacology, Purdue
2001 - 2003 Graduate student. Rockefeller University, Laboratory for Molecular Biophysics
2003 - 2007 Graduate student. University of California, San Francisco; Dept. Biophysics
2007 - 2013 Postdoctoral Associate. HHMI Janelia Research Campus
2014 - 2015 Research Specialist. HHMI Janelia Research Campus
2015 - now Staff Scientist. NIH NIAMS

Honors and awards

1998 Purdue Univ. School of Pharmacy Dean's Undergraduate Research Fellowship
1999 - 2000 Merck Research Scholar Program
2000 Pfizer Summer Undergraduate Research Fellowship
2001 Merck Award for Achievement in Medicinal Chemistry and Molecular Pharmacology,
Purdue University School of Pharmacy
2001 - 2002 W.M. Keck Training Grant in Mathematical and Computational Biology
2002 - 2007 Howard Hughes Medical Institute Predoctoral Fellowship
2010 InnoCentive challenge award: Probabilistic modeling of spending habits
2016 NIH Group Merit Award: NIAMS Lymphocyte Regulomes
2019 NIH Summer Mentor Research Award

Primary publications (peer-reviewed)

* co-first author, + co-corresponding author

1. Pieper U, Eswar N, Braberg H, Madhushudhan MS, **Davis FP**, Stuart AC, Mirkovic N, Rossi A, Marti-Renom MA, Fiser A, *et al.* MODBASE, a database of annotated comparative protein structure models, and associated resources. *Nucleic Acids Res* (2004) 32: D217-22.
2. **Davis FP**, Sali A. PIBASE: a comprehensive database of structurally defined protein interactions. *Bioinformatics* (2005) 21(9): 1901-1907.
3. Shen MY, **Davis FP**, Sali A. The optimal size of a globular protein domain: a simple sphere-packing model. *Chemical Physics Letters* (2005) 405: 224-228.
4. Korkin D, **Davis FP**, Sali A. Localization of protein-binding sites within families of proteins. *Protein Science* (2005) 14: 2350-2360.
5. Pieper U, Eswar N, **Davis FP**, Braberg H, Madhusudhan MS, Rossi A, Marti-Renom M, Karchin R, Webb BM, Eramian D, *et al.* MODBASE: a database of annotated comparative protein structure models and associated resources. *Nucleic Acids Research* (2006) 34: D291-D295.
6. **Davis FP**, Braberg H, Shen MY, Pieper U, Madhusudhan MS, Sali A. Protein complex compositions predicted by structural similarity. *Nucleic Acids Research* (2006) 34: 2943-2952.
7. Korkin D, **Davis FP**, Alber F, Luong T, Shen MY, Lucic V, Kennedy MB, Sali A. Structural modeling of protein interactions by analogy: application to PSD-95. *PLoS Computational Biology* (2006) 2(11):e153.
8. Marti-Renom MA, Rossi A, Al-Shahrour F, **Davis FP**, Pieper U, Dopazo J, Sali A. The AnnoLite and AnnoLyze programs for comparative annotation of protein structures. *BMC Bioinformatics* (2007) 8: S4.
9. Marti-Renom MA, Pieper U, Madhusudhan MS, Rossi A, Eswar N, **Davis FP**, Al-Shahrour F, Dopazo J, Sali A. DBAli tools: mining the protein structure space. *Nucleic Acids Research* (2007) 35: W393-7.
10. **Davis FP**, Barkan DT, Narayanan E, McKerrow JH, Sali A. Host-pathogen protein interactions predicted by comparative modeling. *Protein Science* (2007) 16: 2585-2596.
11. Pieper U, Eswar N, Webb BM, Eramian D, Kelly L, Barkan DT, Carter H, Mankoo P, Karchin R, Marti-Renom MA, **Davis FP**, Sali A. MODBASE, a database of annotated comparative protein structure models and associated resources. *Nucleic Acids Research* (2009) 37:D347-54.
12. **Davis FP**, Eddy SR. A tool for the identification of genes expressed in patterns of interest using the Allen Brain Atlas. *Bioinformatics* (2009) 25(13):1647-54.

13. **Davis FP**, Sali A. The overlap of small molecule and protein binding sites within families of protein structures. *PLoS Computational Biology* (2010) 6(2): e1000668.
Designated "Featured research".
14. **Davis FP**. Proteome-wide prediction of overlapping small molecule and protein binding sites using structure. *Molecular Biosystems* (2011) 7(2): 545-547.
Selected for *Virtual Journal of Biological Physics Research* (2011) 21(3).
15. Girard F, Meszar Z, Marti C, **Davis FP**, Celio M. Gene expression analysis in the parvalbumin-immunoreactive PV1 nucleus of the mouse lateral hypothalamus. *Eur. J. Neurosci.* (2011) 34(12): 1934-1943.
16. Henry GL, **Davis FP**, Picard S, Eddy SR. Cell-type specific genomics of Drosophila neurons. *Nucleic Acids Research.* (2012) 40 (19): 9691-9704.
Designated "Featured article".
17. **Davis FP**, Eddy SR. Transcription factors that convert adult cell identity are differentially Polycomb repressed. *PLoS One.* (2013) 8 (5): e63407.
18. Striedter GF, Belgard TG, Chen C, **Davis FP**, Finlay BL, Gunturkun O, Hale ME, Harris J, Hecht EE, Hof PR, *et al.* NSF Workshop Report: Discovering General Principles of Nervous System Organization by Comparing Brain Maps Across Species. *Journal of Comparative Neurology.* (2014) 522 (7): 1445-1453. Note: also published in *Brain, Behavior and Evolution*.
19. Mo A*, Mukamel EA*, **Davis FP***, Luo C*, Henry GL, Picard S, Urich MA, Nery JR, Sejnowski TJ, Lister R, Eddy SR, Ecker JR, Nathans J. Epigenomic Signatures of Neuronal Diversity in the Mammalian Brain. *Neuron.* (2015) 86(6): 1369-1384.
Designated "Issue Highlight", Preview by Steve Henikoff.
20. Mo A, Luo C, **Davis FP**, Mukamel EA, Henry GL, Nery JR, Urich MA, Picard S, Lister R, Eddy SR, Beer MA, Ecker JR, Nathans J. Epigenomic landscapes of retinal rods and cones. *eLife.* (2016) 5:e11613.
21. Shih HY*, Sciume G*, Mikami Y*, Guo L, Sun HW, Brooks SR, Urban Jr JF, **Davis FP**, Kanno Y, O'Shea JJ. Developmental acquisition of regulomes underlies innate lymphoid cell functionality. *Cell.* (2016) 165 (5): 1120-1133.
22. Preger Ben-Noon E, **Davis FP**, Stern DL. Evolved repression overcomes enhancer robustness. *Dev Cell.* (2016) 39(5): 572-584.
23. Afzali B*, Gronholm J*, Vandrocova J*, ... **Davis FP** ... , Cooper N+, Laurence ADJ+. BACH2 immunodeficiency illustrates an association between super-enhancers and haploinsufficiency. *Nature Immunology.* (2017) 18: 813-823.
24. Iwata S*, Mikami Y*, ... , O'Shea JJ+, **Davis FP+**, Kanno Y+. The transcription factor Tbet limits amplification of type I IFN transcriptome and circuitry in T helper 1 cells. *Immunity.* (2017) 46(6): 983-991.e4.

Preview by Lazarevic, Szabo, and Glimcher

25. Villarino AV*, Sciume G*, **Davis FP**, Iwata S, Zitti B, Robinson GW, Hennighausen L, Kanno Y, O'Shea JJ. Subset- and tissue-defined STAT5 thresholds control homeostasis and function of innate lymphoid cells. *J Exp Med.* (2017) 214(10): 2999-3014.
26. Xie L, Torigoe SE, Xiao J, Mai DH, Li L, **Davis FP**, Dong P, Marie-Nelly H, Grimm J, Lavis L, Darzacq X, Cattoglio C, Liu Z, Tjian R. A dynamic interplay of enhancer elements regulates Klf4 expression in naive pluripotency. *Genes Dev.* (2017) 31(17):1795-1808.
27. Bentzur A, Shmueli A, Omesi L, Ryzkin J, Knapp JM, Parnas M, **Davis FP**, Shohat-Ophir G. Odorant binding protein 69a connects social interaction to modulation of social responsiveness in *Drosophila*. *PLoS Genetics.* (2018) 14 (4): e1007328.
28. **Davis FP***, Nern A*, Picard S, Reiser MB, Rubin GM, Eddy SR, Henry GL. A genetic, genomic, and computational resource for exploring neural circuit function. *under review*. bioRxiv preprint 285476.
29. Shih MM*, **Davis FP***, Henry GL+, Dubnau J+. Nuclear transcriptomes of the seven neuronal cell types that constitute the *Drosophila* Mushroom bodies. *G3.* (2019) 9 (1): 81-94. bioRxiv preprint 412569.
30. Schwartz DM, Farley TK, Richoz N, Yao C, Shih HY, Petermann F, Zhang Y, Sun HW, Hayes E, Mikami Y, Jiang K, **Davis FP**, Kanno Y, Milner JD, Siegel R, Laurence A, Meylan F, O'Shea JJ. Retinoic Acid Receptor Alpha Represses a Th9 Transcriptional and Epigenomic Program to Reduce Allergic Pathology. *Immunity.* (2019) 50 (1): 106-120.
31. Nagashima H, Mahlakoiv T, Shih HY, **Davis FP**, Meylan F, Huang Y, Harrison OJ, Yao C, Mikami Y, Urban JF, Caron KM, Belkaid Y, Kanno Y, Artis D, O'Shea JJ. Neuropeptide CGRP limits ILC2 responses and constrains type 2 inflammation. *Immunity.* (2019) online.

Other publications

1. Russell RB, Alber F, **Davis FP**, Aloy P, Korkin D, Pichaud M, Topf M, Sali A. A structural perspective on protein-protein interactions. *Curr Opin Struct Biol* (2004) 14(3): 313-324. (review).
2. **Davis FP**. Phosphorylation at the interface. *Structure.* (2011) 19: 1726-1727. (commentary).
3. **Davis FP**, Kanno Y, O'Shea JJ. A metabolic switch for Th17 pathogenicity. *Cell.* (2015) 163:1308-1310. (commentary).

Presentations

- 2007 Biotechnology High Performance Computing Software Applications Institute, U.S. Army Medical Research and Materiel Command, Fort Detrick, Maryland. (invited)
- 2007 HHMI Predoctoral Fellows Meeting. HHMI. Chevy Chase, MD. (conference)
- 2008 Wellcome Trust Genome Informatics. Sanger Centre. Hinxton, UK. (conference)
- 2010 Allen Brain Atlas Data Mining Workshop. Allen Institute for Brain Science, Seattle, WA (invited)
- 2010 Dept. of Ecology and Evolutionary Biology, Princeton University. (seminar)
- 2011 Dept. of Medicinal Chemistry and Molecular Pharmacology, Purdue University. West Lafayette, IN (invited)
- 2012 National Center for Bioinformation Technology, National Institutes of Health. Bethesda, MD (invited)
- 2013 Annual Symposium, HHMI Janelia. Ashburn, VA (seminar)
- 2014 High-throughput sequencing for neuroscience. HHMI Janelia. Ashburn, VA (invited)
- 2014 Center for Cancer Research, National Institutes of Health. Bethesda, MD (invited)
- 2017 NIH Immunology Interest Group Workshop, National Conference Center. Leesburg, VA

Software packages and databases.

Available at <http://github.com/fredpdavis>

1. YARP: yet another RNA-seq pipeline
2. mdlabbook: a markdown-format lab notebook
3. PIBASE: Database of protein-protein interaction structures.
4. Host-pathogen protein interactions predicted by structure.
5. MODTIE: structure-based prediction of binary and higher-order protein complexes.
6. PIBASE ligands: overlapping small molecule and protein binding sites within families of protein structures.
7. HOMOLOBIND: Proteome-wide prediction of protein and ligand binding sites using structure.
8. ALLENMINER: finding genes expressed in patterns of interest using the Allen Brain Atlas.

Service

- 2003 - now Peer reviewer for *Bioinformatics*, *BMC Bioinformatics*, *BMC Genomics*, *BMC Medical Genomics*, *BMC Systems Biology*, *eLife*, *Genome Research*, *J. Chemical Information and Modeling*, *Nature*, *Neuron*, *Nucleic Acids Res*, *PLoS Comp Biol*, *PLoS One*, *Proc Natl Acad Sci*, *Protein Science*, *Science Immunology*, *Structure*.
- 2013 Invited participant, NSF BRAIN initiative workshop on comparative brain mapping
- 2014 Grant reviewer, Thiel Foundation Breakout Labs
- 2016, 2019 Peer reviewer, NIH Fellows Award for Research Excellence
- 2016 Grant reviewer, National Science Foundation CAREER award

Languages

Fluent: English, Farsi

Intermediate: Spanish