The Jackson Laboratory
Leading the search for tomorrow's cures

Vivek Kumar

Curriculum Vitae (April 2015)

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Research Appointment

The Jackson Laboratory, Bar Harbor, 2015-present
Assistant Professor, Mammalian Genetics.

University of Texas Southwestern Medical Center 2009-2014
2011-2014 Instructor, Dept. of Neuroscience.
2009-2011 - Post doctoral fellow, Dept. of Neuroscience, **Joseph S. Takahashi** Lab.

Northwestern University 2004-2009
Post Doctoral fellow, Dept. of Neuroscience, **Joseph S. Takahashi** Lab.

Education

University of California, San Diego, La Jolla, CA 1997-2003.
Ph.D, Department of Biology, Section of Cell and Developmental Biology.
Functional and Structural Characterization of the Transcriptional Corepressor *C-terminal Binding Protein (CtBP).*
Advisor: **Michael G. Rosenfeld, Ph.D.**

University of Chicago, Chicago, IL 1991-1995.
A.B. Biology
Studied the molecular genetics of the photosynthetic bacterium *Rhodobacter capsulatus.*
Advisor: **Robert Haselkorn, Ph.D.**

Research Summary

The Kumar Lab uses functional genomics approaches in mice to dissect motivational reward pathways whose misregulation leads to addiction, attention deficit and hyperactivity disorder, and depression. We use two approaches in mice - forward genetic ethylnitrosourea (ENU) mutagenesis screens and quantitative genetics (QTL analysis) - to identify genes and pathways that regulate these behaviors. Powerful and unbiased, forward genetic approaches make no *a priori* assumptions and only require a clear well-defined assay for gene discovery. We have established a high throughput screening pipeline to discover mutants for acute cocaine response and open field behavior. The recorded behavioral data is rich and can be analyzed for many phenotypes. We have a collection of cocaine response and open field behavioral mutants that we are mapping and cloning. Each one of these mutants identifies a novel gene or allele that regulates reward behaviors and may serve as future therapeutic targets. This forward genetic approach is highly flexible and can be applied towards many neurological phenotypes. In a paper published in *Science*, we used QTL analysis of two closely related mouse substrains to identify a novel gene, *Cyfip2*, that regulates cocaine response. This work has implications for the 17,000 mouse strains developed by the international mouse knockout project, QTL community, and addiction researchers. Our goal is to establish a leading research group using genetics as its foundation, and a combination of biochemistry, physiology, and imaging techniques to dissect complex reward behavior in mammals.

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Publications

Plikus MV, Van Spyk EN, Pham K, Geyfman M, **Kumar V**, Takahashi JS, Andersen B. The Circadian Clock in Skin: Implications for Adult Stem Cells, Tissue Regeneration, Cancer, Aging, and Immunity. ***Journal of Biological Rhythms*** Jan 2015. *In Press*.

Stringari C, Wang H, Geyfman M, Crosignani V, **Kumar V**, Takahashi JS, Andersen, B, Gratton E. *In Vivo* single-cell detection of metabolic oscillations in stem cells. ***Cell Reports*** 10: 1-7 2015.

Takahashi JS, **Kumar V,** Nakashe P, Koike N, Huang HC, Green CB, Kim TK. ChIP-seq and RNA-seq methods to study circaidan control of transcription in mammals. ***Methods in Enzymology***, December 2014, in press. doi:10.1016/bs.mie.2014.10.059

Kumar V, Kim K, Joseph C, Kourrich S, Yoo SH, Huang HC, Vitaterna MH, Pardo-Manuel de Villena F, Churchill G, Bonci A, Takahashi JS. C57BL/6N mutation in *Cytoplasmic FMRP interacting protein 2 (Cyfip2)* regulates cocaine response. ***Science*** 342: 1508-1512. 2013.

News Coverage
https://www.sciencenews.org/blog/scicurious/all-mice-are-same-until-theyre-not
http://www.utsouthwestern.edu/newsroom/news-releases/year-2013/dec/takahashi-gene.html
http://www.jax.org/news/archives/2013/addiction-research.html

Kumar V, Andersen B, Takahashi JS. Epidermal stem cells ride the circadian wave. ***Genome Biology*** 14: 140-143. 2013.

Shimomura K, **Kumar V**, Koike N, Kim TK, Chong J, Buhr ED, Whiteley AR, Low SS, Omura C, Fenner D, Owens JR, Richards M, Yoo SH, Hong HK, Vitaterna MH, Bass J, Pletcher MT, Wiltshire T, Hogenesch JB, Lowrey PL, Takahashi JS. *Usf1*, a suppressor of the circadian clock mutant, reveals the nature of the DNA-binding of the CLOCK:BMAL1 complex in mice. ***E-Life*** 2:e00426. 2013.

Yoo SH, Mohawk JA, Siepka SM, Shan Y, Huh SK, Hong HK, Kornblum I, **Kumar V**, Koike N, Xu M, Nussbaum J, Liu X, Chen Z, Chen ZJ, Green CB, and Takahashi JS. Competing E3 Ubiquitin Ligases Govern Circadian Periodicity by Degradation of CRY in Nucleus and Cytoplasm. ***Cell*** 152(5): 1091-1105. 2013.

Koike N, Yoo SH, Huang HC, **Kumar V**, Lee C, Kim TK, Takahashi JS. Transcriptional Architecture and Chromatin Landscape of the Core Circadian Clock in Mammals. ***Science*** 338(6105): 349-354. 2012.

Geyfman M, **Kumar V**, Liu Q, Ruiz R, Gordon W, Espitia F, Cam E, Millar SE, Smyth P, Ihler A, Takahashi JS, Andersen B. Brain and muscle Arnt-like protein-1 (BMAL1) controls circadian cell proliferation and susceptibility to UVB-induced DNA damage in the epidermis. ***PNAS*** 109(29):11758-63, 2012.

Kumar V, Kim K, Joseph C, Thomas LC, Hong HK, and Takahashi JS. A Second Generation High Throughput Forward Genetic Screen in Mice to Isolate Subtle Behavioral Mutants. ***PNAS*** 108: Sup 3 15557-15564. 2011.

Kumar V and Takahashi JS. PARP around the Clock. ***Cell*** 142(6): 841-843. 2010.

Shimomura K, Lowrey PL, Vitaterna MH, Buhr ED, **Kumar V**, Hanna P, Omura C, Izumo M, Low SS, Barrett, RK, LaRue SI, Green CB, Takahashi JS. Genetic suppression of the circadian Clock mutation by the melatonin biosynthesis pathway. ***PNAS*** 107(18): 8399-8403. 2010.

Chen R, Schirmer A, Lee Y, Lee H, **Kumar V**, Yoo SH, Takahashi JS, Lee C. Rhythmic PER

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abundance defines a critical nodal point for negative feedback within the circadian clock mechanism. ***Molecular Cell*** 36(3):417-30. 2009.

Lin KK, **Kumar V**, Geyfman M, Chudova D, Ihler AT, Smyth P, Paus R, Takahashi JS, Andersen B. Circadian clock genes contribute to the regulation of hair follicle cycling. ***PLoS Genetics*** Jul;5(7):e1000573. 2009.

Takahashi J.S., Shimomura K., **Kumar V**. Searching for genes underlying behavior: lessons from circadian rhythms. ***Science*** 322(5903):909-12. 2008.

Siepka SM, Yoo, SH, Park J, Song W, **Kumar V**, Hu Y, Lee C, Takahashi JS. Circadian mutant Overtime reveals F-box protein FBXL3 regulation of Cryptochrome and Period gene expression. ***Cell*** 129(5): 1011-1023. 2007.

Kumar V, Carlson JE, Ohgi KA, Edwards TA, Rose DW, Escalante CR, Rosenfeld MG, Aggarwal AK. Transcriptional corepressor CtBP is an NAD(+)-regulated dehydrogenase. ***Molecular Cell*** 10(4):857-69. 2002.

Sugihara TM, Kudryavtseva EL, **Kumar V**, Horridge JJ, Andersen B. The POU domain factor Skin-1a represses the keratin 14 promoter independent of DNA binding. A possible role for interactions between Skn-1a and CREB-binding protein/p300. ***Journal of Biological Chemistry*** 276(35): 33036-44. 2001.

Jepsen K, Hermanson O, Onami TM, Gleiberman AS, Lunyak V, McEvilly RJ, Kurokawa R, **Kumar V**, Liu F, Seto E, Hedrick SM, Mandel G, Glass CK, Rowe DW, Rosenfeld MG. Combinatorial roles of the nuclear receptor corepressor in transcription and development. ***Cell*** 102(6):653-63. 2000.

Fonstein M, Koshy EG, **Kumar V**, Mourachov P, Nikolskaya T, Tsifansky M, Zheng S, Haselkorn R. Rhodobacter capsulatus SB1003. In ***Bacterial Genomes***: Physical Structure and Analysis, de Bruijn, Lupski, and Weinstock (eds) 1998.

Kumar V, Fonstein M, Haselkorn R. Bacterium genome sequence. ***Nature*** 381:653-4. 1996.

Talks

Winter Conference on Brain Research, Jan. 2015, Big Sky, MO. ***Oral Presentation***. CYFIP2 is a key regulator of cocaine response. In session: Genomic and neurobiological studies of RNA binding proteins in complex traits relevant to psychiatric disorders.

Society for Neuroscience, Nov. 2014, Washington DC. CYFIP2 is a key regulator of cocaine response. Session 387: Cocaine: New Findings on Neural Mechanisms.

Complex Trait Consortium Meeting. 2013 Madison, WI. 'QTL analysis utilizing closely related mouse substrains identifies Cytoplasmic FMRP Interacting Protein 2 (CYFIP2) as a regulator of cocaine response.'

Automated Imaging and High-Throughput Phenotyping. Cold Spring Harbor Laboratory Conferences. April 2012. 'A Second Generation High Throughput Forward Genetic Screen in Mice to Isolate Subtle Behavioral Mutants'.

Sackler Symposium on Quantification of Behavior. 2010, Washington, DC. Organized by Donald Pfaff and Alan Leshner. 'Circadian biology'.

Complex Trait Consortium Meeting. 2008 Montreal Canada. 'ENU screen identifies Mice with Altered response to Psychostimulants'.

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Argonne National Laboratory. Postdoctoral Symposium. Sept. 2008. 'A high Throughput, Forward Genetics Behavioral Screen Identifies Mice with Altered Response to Psychostimulants'.

Ad hoc Reviewer

Genes Brain and Behavior, PlosOne, Mammalian Genome

Courses Attended

Leadership in Bioscience. Cold Spring Harbor Laboratory, NY. March 13-16, 2015. Taught by Carl M. Cohen and Dannielle Kennedy.

Statistical Learning and Data Mining. Stanford University,Palo Alto, CA. March 16-18 2009. Taught by Trevor Hastie and Robert Tibshirani.

Summer Institute in Statistical Genetics. University of Washington, Seattle, 2009. June 22 to July 1. Attended three modules on quantitative genetics, QTL mapping I and QTL mapping II. Taught by Bill Muir, Bruce Walsh, Rebecca Doerge, Zhao-Bang Zeng, and Brian Yandell .

Complex Trait Analysis Course. The Jackson Laboratory, Bar Harbor Maine. 2006. Organized by Gary Churchill.

Meetings and Conferences

Winter Conference on Brain Research, Jan. 2015, Big Sky, MO. ***Oral Presentation***. CYFIP2 is a key regulator of cocaine response. In session: Genomic and neurobiological studies of RNA binding proteins in complex traits relevant to psychiatric disorders.

Society for Neuroscience, Nov. 2014, Washington DC. ***Oral Presentation***. CYFIP2 is a key regulator of cocaine response. Session 387: Cocaine: New Findings on Neural Mechanisms.

Society for Research on Biological Rhythms Annual Meeting, 2014, Big Sky, MT. Poster Presentation.

79th Cold Spring Harbor Symposium on Quantitative Biology: Cognition, 2014, Cold Spring Harbor, NY, Poster Presentation.

Americal College of Neuropsychopharmachology (ACNP), Dec. 2013, Hollywood, FL.

Society for Neuroscience, Nov. 2013, San Deigo, CA.

Cell Symposia on Genes, Circuits and Behavior, June 2013, Toronto, CA. Poster Presentation.

Complex Trait Community 12th Annual Meeting. May, 2013. Madison, WI. ***Oral Presentation***.

Mouse Molecular Genetics Meeting, Oct. 2012, Asilomar, CA. Poster Presentation.

Society for Research on Biological Rhythms Annual Meeting 2012, San Destin, FL. Poster Presentation.

Automated Imaging and High-Throughput Phenotyping. Cold Spring Harbor Laboratory Conferences. April 2012. Selected for ***oral presentation***.

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CO-ORGANIZER – **Complex Trait Consortium Meeting** Chicago, 2010. www.ctc2010.org. One of four co-organizer for meeting with 200 participants.

Society for Neuroscience 2008. Poster presentation.

Chicago Mouse Genetics Annual Meeting 2008. Poster Presentation:

Keystone Symposia: Neurobiology of Addiction 2007. Santa Fe, NM.

Complex Trait Consortium Meeting 2006. Chapel Hill, NC. Poster Presentation.

Mechanisms and Regulation of Eukaryotic Transcription, FASEB Summer Conference 2002. Saxton River, VT. Poster Presentation.

Mechanisms of Eukaryotic Transcription, Keystone Symposia 2001, Santa Fe, NM. Poster Presentation.

European Developmental Biology Conference 1999, Oslo, Norway. Poster Presentation.

International Society of Plant Microbe Interaction 1992, Seattle, WA. Poster Presentation.

Teaching

Drug Abuse and Society (RX462) Husson Univeristy, Guest Lecturer, The genetics of addiction, March 2015, course organizer Dr. Brian J. Piper.

Developmental Neurobiology (BIPN 144). Teaching Assistant, UCSD, Spring 2002. Taught by Dr. Ethan Bier.

Endocrinology. Teaching Assistant, UCSD, Fall 2001. Taught by Dr. Chris Armour.

Microbiology Laboratory (BIMM 121). Teaching Assistant, UCSD, Summer 1994. Taught by Drs. Willie Brown and Stuart Brody.

Experimental Molecular Biology Lab (BioSci 321). Lab Assistant, University of Chicago, Summer 1994. Taught by Dr. Malcolm Casadaban.

Research Support

NRSA postdoctoral fellowship from NIDA. 1F32 DA024556, 2008 to 2011. Characterization & Cloning of the Response Psychostimulant Mutant *Gridlock'd*.

R01 AR056439 subcontract with Bogi Andersen, UC Irvine, 2008-present. Official UTSW PI is J. Takahashi, but I co-wrote the grant and conducted the work done at UTSW. Role of Clock Genes in the Hair Cycle .

HHMI Associate 2006-2008.