

# Stanford

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## Philippe Murrain

Associate Professor of Psychiatry and Behavioral Sciences (Major Laboratories and Clinical Translational Neurosciences Incubator)

### Bio

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#### BIO

Expertise: Neurobiology, Sleep sciences, Molecular Genetics, Developmental Biology, Gene Silencing/Epigenetics

Methodology: Synapse Imaging (Two photon microscopy, Array Tomography), Calcium Imaging (Light Sheet Microscopy/SPIM, Light Field Microscopy), Optogenetics, CLARITY, Tol2 transgenesis, TALENs, CRISPR/Cas9, Video tracking and behavior computation.

#### ACADEMIC APPOINTMENTS

- Associate Professor, Psychiatry and Behavioral Sciences
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Wu Tsai Neurosciences Institute

#### ADMINISTRATIVE APPOINTMENTS

- Associate Dean for Research, School of Medicine, (2023- present)

#### LINKS

- Murrain Lab: <http://med.stanford.edu/murrainlab/>

### Teaching

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#### COURSES

##### 2023-24

- The Neurobiology of Sleep: BIO 149, BIO 249, HUMBIO 161, PSYC 149, PSYC 261 (Win)

##### 2022-23

- The Neurobiology of Sleep: BIO 149, BIO 249, HUMBIO 161, PSYC 149, PSYC 261 (Win, Spr)

##### 2021-22

- The Neurobiology of Sleep: BIO 149, BIO 249, HUMBIO 161, PSYC 149, PSYC 261 (Win)

#### STANFORD ADVISEES

##### Orals Chair

John Vaughen

Doctoral Dissertation Advisor (AC)

Keri Ngo

## Publications

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### PUBLICATIONS

- **Sleep deficiency as a driver of cellular stress and damage in neurological disorders.** *Sleep medicine reviews*  
Coulson, R. L., Murrain, P., Wang, G. X.  
2022; 63: 101616
- **Hyperexcitable arousal circuits drive sleep instability during aging.** *Science (New York, N.Y.)*  
Li, S. B., Damonte, V. M., Chen, C., Wang, G. X., Kebschull, J. M., Yamaguchi, H., Bian, W. J., Purmann, C., Pattni, R., Urban, A. E., Murrain, P., Kauer, J. A., Scherrer, et al  
2022; 375 (6583): eabh3021
- **Non-REM and REM/paradoxical sleep dynamics across phylogeny.** *Current opinion in neurobiology*  
Jaggard, J. B., Wang, G. X., Murrain, P.  
2021; 71: 44-51
- **William C. Dement (1928-2020).** *Science (New York, N.Y.)*  
Pelayo, R. n., Murrain, P. n.  
2020; 369 (6503): 512
- **Genetic deciphering of the antagonistic activities of the melanin-concentrating hormone and melanocortin pathways in skin pigmentation.** *PLoS genetics*  
Madelaine, R. n., Ngo, K. J., Skariah, G. n., Murrain, P. n.  
2020; 16 (12): e1009244
- **COMPARATIVE FUNCTIONAL GENOMICS ANALYSES OF THE 16P11.2 DELETION AND DUPLICATION CNVS IN A HUMAN IPSC-TO-INDUCED NEURON MODEL**  
Zhang, X., Thomas, W., Leung, L., Zhou, B., Muench, K., Plastini, M., Pattni, R., Ho, S., Ho, M., Huang, Y., Hallmayer, J., Murrain, P., Palmer, et al  
ELSEVIER.2019: S66
- **Sleep: DNA Repair Function for Better Neuronal Aging?** *Current biology : CB*  
Murrain, P., Wang, G. X.  
2019; 29 (12): R585–R588
- **Neuronal Dynamics Regulating Brain and Behavioral State Transitions** *CELL*  
Andalman, A. S., Burns, V. M., Lovett-Barron, M., Broxton, M., Poole, B., Yang, S. J., Grosenick, L., Lerner, T. N., Chen, R., Benster, T., Murrain, P., Levoy, M., Rajan, et al  
2019; 177 (4): 970+
- **Neural signatures of sleep in zebrafish.** *Nature*  
Leung, L. C., Wang, G. X., Madelaine, R. n., Skariah, G. n., Kawakami, K. n., Deisseroth, K. n., Urban, A. E., Murrain, P. n.  
2019; 571 (7764): 198–204
- **Sleep: Short Sleepers Should Keep Count of Their Hypocretin Neurons** *CURRENT BIOLOGY*  
Leung, L. C., Murrain, P.  
2018; 28 (9): R558–R560
- **A screen for deeply conserved non-coding GWAS SNPs uncovers a MIR-9-2 functional mutation associated to retinal vasculature defects in human** *Nucleic Acids Research*  
Madelaine, R., Notwell, J. H., Skariah, G., Halluin, C., Chen, C. C., Bejerano, G., Murrain, P.  
2018; 1
- **The hypothalamic NPVF circuit modulates ventral raphe activity during nociception** *SCIENTIFIC REPORTS*  
Madelaine, R., Lovett-Barron, M., Halluin, C., Andalman, A. S., Liang, J., Skariah, G. M., Leung, L. C., Burns, V. M., Murrain, P.  
2017; 7

- **MicroRNA-9 Couples Brain Neurogenesis and Angiogenesis.** *Cell reports*  
Madelaine, R. n., Sloan, S. A., Huber, N. n., Notwell, J. H., Leung, L. C., Skariah, G. n., Halluin, C. n., Pa#ca, S. P., Bejerano, G. n., Krasnow, M. A., Barres, B. A., Murrain, P. n.  
2017; 20 (7): 1533–42
- **Endogenous retinal neural stem cell reprogramming for neuronal regeneration.** *Neural regeneration research*  
Madelaine, R. n., Murrain, P. n.  
2017; 12 (11): 1765–67
- **Blimp1 induces transient metastatic heterogeneity in pancreatic cancer.** *Cancer discovery*  
Chiou, S. H., Risca, V. I., Wang, G. X., Yang, D. n., Grüner, B. M., Kathiria, A. S., Ma, R. K., Vaka, D. n., Chu, P. n., Kozak, M. n., Castellini, L. n., Graves, E. E., Kim, et al  
2017
- **Sub-synaptic, multiplexed analysis of proteins reveals Fragile X related protein 2 is mislocalized in Fmr1 KO synapses** *ELIFE*  
Wang, G. X., Smith, S. J., Murrain, P.  
2016; 5
- **Sleep-Dependent Structural Synaptic Plasticity of Inhibitory Synapses in the Dendrites of Hypocretin/Orexin Neurons.** *Molecular neurobiology*  
Elbaz, I., Zada, D., Tovin, A., Braun, T., Lerer-Goldshtein, T., Wang, G., Murrain, P., Appelbaum, L.  
2016: -?
- **DRUG DISCOVERY Zebrafish uncover novel antipsychotics** *NATURE CHEMICAL BIOLOGY*  
Leung, L. C., Murrain, P.  
2016; 12 (7): 468-469
- **A Neural Basis for Control of Cichlid Female Reproductive Behavior by Prostaglandin F-2 alpha** *CURRENT BIOLOGY*  
Juntti, S. A., Hilliard, A. T., Kent, K. R., Kumar, A., Andrew Nguyen, A., Jimenez, M. A., Loveland, J. L., Murrain, P., Fernald, R. D.  
2016; 26 (7): 943-949
- **What Lies Sleeping** *The Scientist*  
Philippe, M.  
2016; 30 (3): 22-23
- **Fmr1 KO and Fenobam Treatment Differentially Impact Distinct Synapse Populations of Mouse Neocortex** *NEURON*  
Wang, G. X., Smith, S. J., Murrain, P.  
2014; 84 (6): 1273-1286
- **Prolonged, brain-wide expression of nuclear-localized GCaMP3 for functional circuit mapping** *FRONTIERS IN NEURAL CIRCUITS*  
Kim, C. K., Miri, A., Leung, L. C., Berndt, A., Murrain, P., Tank, D. W., Burdine, R. D.  
2014; 8
- **Orexin A and orexin receptor 1 axonal traffic in dorsal roots at the CNS/PNS interface.** *Frontiers in neuroscience*  
Colas, D., Manca, A., Delcroix, J., Murrain, P.  
2014; 8: 20-?
- **Tracking zebrafish larvae in group - Status and perspectives.** *Methods (San Diego, Calif.)*  
Martineau, P. R., Murrain, P.  
2013; 62 (3): 292-303
- **Imaging zebrafish neural circuitry from whole brain to synapse.** *Frontiers in neural circuits*  
Leung, L. C., Wang, G. X., Murrain, P.  
2013; 7: 76-?
- **Synaptic plasticity in sleep: learning, homeostasis and disease** *TRENDS IN NEUROSCIENCES*  
Wang, G., Grone, B., Colas, D., Appelbaum, L., Murrain, P.  
2011; 34 (9): 452-463
- **Zebrafish: An integrative system for neurogenomics and neurosciences** *PROGRESS IN NEUROBIOLOGY*  
Rinkwitz, S., Murrain, P., Becker, T. S.

2011; 93 (2): 231-243

- **Circadian and Homeostatic Regulation of Structural Synaptic Plasticity in Hypocretin Neurons** *NEURON*  
Appelbaum, L., Wang, G., Yokogawa, T., Skariah, G. M., Smith, S. J., Mourrain, P., Mignot, E.  
2010; 68 (1): 87-98
- **Sleep-wake regulation and hypocretin-melatonin interaction in zebrafish** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Appelbaum, L., Wang, G. X., Maro, G. S., Mori, R., Tovin, A., Marin, W., Yokogawa, T., Kawakami, K., Smith, S. J., Gothilf, Y., Mignot, E., Mourrain, P.  
2009; 106 (51): 21942-21947
- **Characterization of Two Melanin-Concentrating Hormone Genes in Zebrafish Reveals Evolutionary and Physiological Links with the Mammalian MCH System** *JOURNAL OF COMPARATIVE NEUROLOGY*  
Berman, J. R., Skariah, G., Maro, G. S., Mignot, E., Mourrain, P.  
2009; 517 (5): 695-710
- **Live analysis of endodermal layer formation identifies random walk as a novel gastrulation movement** *CURRENT BIOLOGY*  
Pezeron, G., Mourrain, P., Courty, S., Ghislain, J., Becker, T. S., Rosa, F. M., David, N. B.  
2008; 18 (4): 276-281
- **Ras11b Knock Down in Zebrafish Suppresses One-Eyed-Pinhead Mutant Phenotype** *PLOS ONE*  
Pezeron, G., Lambert, G., Dickmeis, T., Straehle, U., Rosa, F. M., Mourrain, P.  
2008; 3 (1)
- **Comparative expression of p2x receptors and ecto-nucleoside triphosphate diphosphohydrolase 3 in hypocretin and sensory neurons in zebrafish** *BRAIN RESEARCH*  
Appelbaum, L., Skariah, G., Mourrain, P., Mignot, E.  
2007; 1174: 66-75
- **Characterization of sleep in zebrafish and insomnia in hypocretin receptor mutants** *PLOS BIOLOGY*  
Yokogawa, T., Marin, W., Faraco, J., Pezeron, G., Appelbaum, L., Zhang, J., Rosa, F., Mourrain, P., Mignot, E.  
2007; 5 (10): 2379-2397
- **Genomic regulatory blocks encompass multiple neighboring genes and maintain conserved synteny in vertebrates** *GENOME RESEARCH*  
Kikuta, H., Laplante, M., Navratilova, P., Komisarczuk, A. Z., Engstrom, P. G., Fredman, D., Akalin, A., Caccamo, M., Sealy, I., Howe, K., Ghislain, J., Pezeron, G., Mourrain, et al  
2007; 17 (5): 545-555
- **A single transgene locus triggers both transcriptional and post-transcriptional silencing through double-stranded RNA production** *PLANTA*  
Mourrain, P., van Blokland, R., Kooter, J. M., Vaucheret, H.  
2007; 225 (2): 365-379
- **Regulation of hypocretin (orexin) expression in embryonic zebrafish** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Faraco, J. H., Appelbaum, L., Marin, W., Gaus, S. E., Mourrain, P., Mignot, E.  
2006; 281 (40): 29753-29761
- **Duplicate sfrp1 genes in zebrafish: sfrp1a is dynamically expressed in the developing central nervous system, gut and lateral line** *GENE EXPRESSION PATTERNS*  
Pezeron, G., Anselme, I., Laplante, M., Ellingsen, S., Becker, T. S., Rosa, F. M., Charnay, P., Schneider-Maunoury, S., Mourrain, P., Ghislain, J.  
2006; 6 (8): 835-842
- **Arabidopsis histone deacetylase HDA6 is required for maintenance of transcriptional gene silencing and determines nuclear organization of rDNA repeats** *PLANT CELL*  
Probst, A. V., Fagard, M., Proux, F., Mourrain, P., Boutet, S., Earley, K., Lawrence, R. J., Pikaard, C. S., Murfett, J., Furner, I., Vaucheret, H., Scheid, O. M.  
2004; 16 (4): 1021-1034
- **Fertile hypomorphic ARGONAUTE (ago1) mutants impaired in post-transcriptional gene silencing and virus resistance** *PLANT CELL*  
Morel, J. B., Godon, C., Mourrain, P., Beclin, C., Boutet, S., Feuerbach, F., Proux, F., Vaucheret, H.  
2002; 14 (3): 629-639
- **Molecular integration of casanova in the Nodal signalling pathway controlling endoderm formation** *DEVELOPMENT*

- Aoki, T. O., David, N. B., Minchiotti, G., Saint-Etienne, L., Dickmeis, T., Persico, G. M., Strahle, U., Mourrain, P., Rosa, F. M.  
2002; 129 (2): 275-286
- **Identification of nodal signaling targets by array analysis of induced complex probes** *DEVELOPMENTAL DYNAMICS*  
Dickmeis, T., Aanstad, P., Clark, M., Fischer, N., Herwig, R., Mourrain, P., Blader, P., ROSA, F., Lehrach, H., Strahle, U.  
2001; 222 (4): 571-580
  - **A crucial component of the endoderm formation pathway, CASANOVA, is encoded by a novel sox-related gene** *GENES & DEVELOPMENT*  
Dickmeis, T., Mourrain, P., Saint-Etienne, L., Fischer, N., Aanstad, P., Clark, M., Strahle, U., ROSA, F.  
2001; 15 (12): 1487-1492
  - **DNA methylation and chromatin structure affect transcriptional and post-transcriptional transgene silencing in Arabidopsis** *CURRENT BIOLOGY*  
Morel, J. B., Mourrain, P., Beclin, C., Vaucheret, H.  
2000; 10 (24): 1591-1594
  - **Arabidopsis SGS2 and SGS3 genes are required for posttranscriptional gene silencing and natural virus resistance** *CELL*  
Mourrain, P., Beclin, C., Elmayan, T., Feuerbach, F., Godon, C., Morel, J. B., Jouette, D., Lacombe, A. M., Nikic, S., Picault, N., Remoue, K., Sanial, M., Vo, et al  
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  - **Plant viral suppressors of post-transcriptional silencing do not suppress transcriptional silencing** *PLANT JOURNAL*  
Marathe, R., Smith, T. H., Anandalakshmi, R., Bowman, L. H., Fagard, M., Mourrain, P., Vaucheret, H., Vance, V. B.  
2000; 22 (1): 51-59
  - **Are gene silencing mutants good tools for reliable transgene expression or reliable silencing of endogenous genes in plants?** *Genetic engineering*  
Mourrain, P., Béclin, C., Vaucheret, H.  
2000; 22: 155-170
  - **Transgene-induced gene silencing in plants** *PLANT JOURNAL*  
Vaucheret, H., Beclin, C., Elmayan, T., Feuerbach, F., Godon, C., Morel, J. B., Mourrain, P., Palauqui, J. C., Vernhettes, S.  
1998; 16 (6): 651-659
  - **Arabidopsis mutants impaired in cosuppression** *PLANT CELL*  
Elmayan, T., Balzergue, S., Beon, F., Bourdon, V., Daubremet, J., Guenet, Y., Mourrain, P., Palauqui, J. C., Vernhettes, S., Vialle, T., Wostrikoff, K., Vaucheret, H.  
1998; 10 (10): 1747-1757
  - **ActA is a dimer** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Mourrain, P., Lasa, I., Gautreau, A., Gouin, E., PUGSLEY, A., Cossart, P.  
1997; 94 (19): 10034-10039
  - **Expression of contact, a new zebrafish DVR member, marks mesenchymal cell lineages in the developing pectoral fins and head and is regulated by retinoic acid** *MECHANISMS OF DEVELOPMENT*  
Bruneau, S., Mourrain, P., Rosa, F. M.  
1997; 65 (1-2): 163-173
  - **Nitrate reductase and nitrite reductase as targets to study gene silencing phenomena in transgenic plants** *EUPHYTICA*  
Vaucheret, H., Palauqui, J. C., Mourrain, P., Elmayan, T.  
1997; 93 (2): 195-200
  - **Nitrite reductase silencing as a tool for selecting spontaneous haploid plants** *Plant Cell Reports*  
Vaucheret, H., Mourrain, P., Robalo, J., Pollien, J.  
1995; 15 (1-2): 12-16