

Representative Publications

(key: *italicized-high school/undergrad*; **bold-grad student**; underlined-postdocs and research faculty)

- Ayme-Southgate, A., Vigoreaux, J.O., Benian, G., and Pardue, M.L. (1991). *Drosophila* has a twitchin/titin-related gene that appears to encode projectin. *Proc. Natl Acad. Sci. USA*, 88, 7973-7977.
 - Vigoreaux, J. O., Saide, J. S., Valgeirsdottir, K. and Pardue, M. L. (1993) Flightin, a novel myofibrillar protein of *Drosophila* stretch-activated muscles. *J. Cell Biol.* 121, 587-598.
 - Vigoreaux, J. O., **Hernandez, C.**, **Moore, J.**, Ayer, G. and Maughan, D. (1998) The effect of a genetic deficiency that spans the *Drosophila* flightin gene on the ultrastructure and function of the flight muscles. *J. Exp. Biol.* 201, 2033-2044.
 - Vigoreaux, J. O., **Moore, J. R.**, and Maughan, D. W. (2000) Role of the elastic protein projectin in stretch activation and work output of *Drosophila* flight muscles. In "Elastic filaments of the Cell". Pollack, G. and Granzier, H., editors. Kluwer Academic/Plenum Publishers. pp 237-250.
 - Reedy, M. C., Bullard, B., and Vigoreaux, J. O. (2000) Flightin is essential for thick filament assembly and sarcomere stability in *Drosophila* flight muscles. *J. Cell Biol.* 151: 1483-1500.
 - Soto-Adames, F., **Alvarez-Ortiz, P.**, and Vigoreaux, J. O. (2014) An Evolutionary Analysis of Flightin Reveals a Conserved Motif Unique and Widespread in Pancrustacea. *J. Mol. Evol.* 78: 24-37. doi 10.1007/s00239-013-9597-5.
 - Lemas, D., Lekkas, P., Ballif, B., and Vigoreaux, J. O. (2015) Intrinsic disorder and multiple phosphorylations constrain the evolution of the flightin N-terminal domain. *J. Proteomics*. <http://dx.doi.org/10.1016/j.prot.2015.12.006>.
1. *Integrative biology of muscle and locomotion*. Vigoreaux's group has spearheaded and participated in several multi-team collaborative efforts aimed at understanding the emergent properties of muscle, utilizing insect flight muscle as a paradigm for integrative biology. Using genetics as their foundation, they investigated how changes in protein structure and function manifest at increasing scales of biological organization, up to the intact animal.

Representative Publications

- Dickinson, M., Hyatt, C., Lehmann, F-O., **Moore, J.**, Reedy, M. C., Simcox, A., Tohtong, R., Vigoreaux, J.O., Yamashita, H. and Maughan, D. (1997)

Phosphorylation-dependent power output of transgenic flies: an integrated study. *Biophys. J.* 73, 3122-3134.

- Maughan, D. W. and Vigoreaux, J. O. (1999) An integrative view of insect flight muscle: genes, motor molecules and motion. *News In Physiol. Science.* 14, 87-92.
- **Barton, B., Ayer, G.,** Heymann, G. Maughan, D. Lehmann, F., and Vigoreaux, J. O. (2005) Flight muscle properties and aerodynamic performance of *Drosophila* expressing a flightin transgene. *J. Exp. Biol.*, 208: 549-560.
- Vigoreaux, J. (2006) *Nature's Versatile Engine: Insect Flight Muscle Inside and Out*, editor, Springer/Landes Bioscience, New York/Georgetown. 307pp.
- Tanner, B.C. W., Miller, M. S., Miller, B. M., Lekkas, P., Irving, T. C., Maughan, D. W. and Vigoreaux, J. O. (2011) COOH-terminal truncation of flightin decreases myofilament lattice organization, cross-bridge binding, and power output in *Drosophila* indirect flight muscle. *Am. J. Physiol. Cell Physiol.*, 301: C383-391.
- **Chakravorty, S.,** Tanner, B.C.W., Foelber, V.L., Vu, H., Rosenthal, M., Ruiz, T., and Vigoreaux, J.O. (2017) Flightin Maintains Myofilament Lattice Organization Required for Optimal Flight Power and Courtship Song Quality in *Drosophila*. *Proc. Royal Society B.* doi:10.1098/rspb.2017.0431.

(iii) *Biomechanics of thick filaments.* In addition to their fundamental role in contractility, thick filaments are major contributors to structural and viscoelastic properties that define differences between muscle types and between healthy and diseased muscle. The Vigoreaux lab has described basic mechanical properties of thick filaments and examined the effect of mutations on these properties and their subsequent manifestation in the living animal. One study established that a cardiomyopathy-associated mutation in myosin binding protein C (MyBP-C) reduces the filament's Young's modulus, underscoring the role of MyBP-C in maintaining left ventricle elastance during systole.

Representative Publications

- Kreplak, L., Nyland, L., Contompasis, J. L., and Vigoreaux, J. O. (2009) Nanomechanics of native thick filaments from indirect flight muscles. *J. Mol. Biol.*, 386: 1403-1410.
- Nyland, L. R., Palmer, B. P., Chen, Z., Maughan, D. W., Seidman, C. E., Seidman, J. G., Kreplak, L., and Vigoreaux, J. O. (2009) Cardiac myosin binding protein-C is essential for thick filament stability and flexural rigidity. *Biophys. J.*, 96: 3273-3280. doi: 10.1016/j.bpj.2008.12.3946. PMCID: PMC2718271.

- *Contompasis, J.*, Nyland, L., Maughan, D. and Vigoreaux, J. O. (2010) Flightin is necessary for length determination, structural integrity and large bending stiffness of insect flight muscle thick filaments. *J. Mol. Biol.* 395: 340-348.
 - *Gasek, N.*, Nyland, L., and Vigoreaux, J.O. (2016) The contributions of the amino and carboxyl terminal domains of flightin to the biomechanical properties of *Drosophila* flight muscle thick filaments. *Biology* 5,16; doi:10.3390/biology5020016.
1. *Muscle energetics.* The Vigoreaux lab has explored fundamental mechanisms and specialized adaptations in muscle energetics using a comparative approach. Empirical evidence accords with models of supramolecular complexes for glycogenolytic and glycolytic enzymes. The existence of complexes *in vivo* that effectively channel substrate intermediates has long been speculated based on circumstantial evidence and thermodynamic principles. The studies have implications for multisystem diseases that exhibit underlying mitochondrial dysfunction (e.g., myalgic encephalomyelitis).

Representative Publications

- Maughan, D., **Henkin, J.**, and Vigoreaux, J. (2005) Concentrations of glycolytic enzymes and other cytosolic proteins in the diffusible fraction of a vertebrate muscle proteome. *Mol. Cell Proteomics* 4.10: 1541-1549.
 - **Vishnudas, V.**, *Guillemette, S.*, Lekkas, P., Maughan, D., and Vigoreaux, J. O. (2013) Characterization of intracellular distribution of an adenine nucleotide transporter (ANT) in *Drosophila* indirect flight muscles. *CellBio*, 2: 149-162.
<http://dx.doi.org/10.4236/cellbio.2013.23017>.
 - Carlson, B. A., Vigoreaux, J. O., and Maughan, D. W. (2014) Diffusion rates of endogenous cytosolic proteins from rabbit skinned muscle fibers. *Biophys. J.* 106(4): 780-792. <http://dx.doi.org/10.1016/j.bpj.2013.12.044>.
 - **Menard, L.**, Maughan, D. W. and Vigoreaux, J. O. (2014) The structural and functional coordination of glycolytic enzymes in muscle: evidence of a metabolon? *Biology* 3, 623-644; doi:10.3390/biology3030623
1. *Pleiotropy of myosin regulatory light chain function.* The regulatory light chain of myosin (RLC) is a highly conserved protein that is an integral component of the muscle contractile machinery. Combining genetics with a multidisciplinary approach the Vigoreaux lab has uncovered the mechanistic basis for RLC's roles in contractile regulation and stretch activation. These results have informed studies of function and mutation effects in skeletal and cardiac muscle. They have further characterized pleiotropic effects of RLC mutations on distinct muscle-driven

behaviors, results that shed light into the functional constraints that drive evolution of RLC, and possibly of other muscle proteins.

Representative Publications

- **Moore, J. R.**, Dickinson, M. H., Vigoreaux, J. O., and Maughan, D. W. (2000) Removal of the 46 amino acid N-terminal extension of the *Drosophila* myosin regulatory light chain has little effect on the stretch activation response of the indirect flight muscles. *Biophys J.* 78: 1431-1440.
- Farman, G.P., Miller, M.S., M.C. Reedy, F.N. Soto-Adames, J.O. Vigoreaux, D.W. Maughan, and T.C. Irving (2009) Phosphorylation and the N-terminal extension of the Regulatory light chain help orient and align the myosin heads in *Drosophila* flight muscle. *J. Structural Biol.*, 168: 240-249.
- Miller, M.S., G.P. Farman, J.M. Braddock, F.N. Soto-Adames, T. C. Irving, J.O. Vigoreaux, and D.W. Maughan. (2011) Regulatory Light Chain Phosphorylation and N-terminal Extension Increase Cross-Bridge Binding and Power Output in *Drosophila* at In Vivo Myofilament Lattice Spacing. *Biophys J.*, 100: 1737-1746.
- **Chakravorty, S.**, Vu, H, Foelber, V., and Vigoreaux, J.O. (2014) Mutations of the *Drosophila* Myosin Regulatory Light Chain Affect Courtship Song and Reduce Reproductive Success. *PLOS One*. DOI: 10.1371/journal.pone.0090077.