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Education:

- PostDoc. Fellow, Cell Dynamics, 2006, U.Mass. Med. School
- PostDoc. Fellow, Molecular Genetics, 2004, Public Health Research Institute
- Ph.D., Molecular and Cell Biology, 2003, Sackler Institute, NYU Med. School
- M.S., Molecular and Cell Biology, 2000, Sackler Institute, NYU Med. School
- B.A., Chemistry and Mathematics, 1995, NYU

Research Interest:

Biophotonics

Correct spatial and temporal localization of mRNAs has broad biological importance, being essential in diverse processes such as growth and differentiation, asymmetric cell division, long-term memory formation, axon guidance and the establishment of the basic body axes. Efficient transport of mRNAs requires highly orchestrated events between nuclear and cytoplasmic proteins. Though genetic data has revealed key roles for many proteins during the transport process, for some the direct associations with the localized transcript have been impervious to biochemical studies.

In the lab, we examine the spatio-temporal requirements of trans-acting factors during the mRNA transport process in Drosophila melanogaster oocytes. Specifically, we study the posterior pole determinant oskar mRNA as it interacts with Staufen and Armitage proteins during the dynamic and multi-step process of mRNA transport. Staufen is a double-stranded RNA-binding protein important for proper localization of oskar mRNA to the posterior during mid-oogenesis, and Armitage is an RNA silencing protein involved in oskar's translation repression during transport. Though implied, their mechanism of association with oskar mRNA remains unresolved, most likely due to the complexity of reconstructing all the molecular interaction via classical biochemical techniques. Several biological mechanisms act on oskar mRNA after transcription, including nuclear export, active cytoplasmic transport, translational repression, localization via anchoring, translational de-repression, and ultimately RNA decay. We believe that the RNA-protein complex can be resolved in vivo as it emerges through all these processes, via elegant fluorescent techniques used in concert with state of the art, single molecule tracking algorithms and live-cell imaging.

Selected Publications:

- Bratu DP, Catrina IE and Marras SAE. 2010 'Tiny molecular beacons for in vivo mRNA detection' RNA Visualization: Methods and Protocols, Methods in Molecular Biology, Humana Press (in press)
- Mhlanga MM*, Bratu DP*, Genovesio A, Rybarska A, Chenouard N, Nehrbass U, Olivo-Marin JC. 2009 'In vivo colocalisation of oskar mRNA and trans-acting proteins revealed by quantitative imaging of the Drosophila oocyte' PLoS One 4(7): e6241. (*equal contribution)

- Kattenhoff CK, Bratu DP, McGinness-Schultz N, Kopetsch BS, Cook HA and Theurkauf WE. 2007 ‘Drosophila rasiRNA pathway mutations disrupt embryonic axis specification through activiation of an ATR/Chk2 DNA damage response’ Developmental Cell 12, 45-55.
- Theurkauf WE, Klattenhoff C, Bratu DP, McGinnis-Schultz N, Koppetsch BS, Cook HA. 2006 'rasiRNAs, DNA Damage, and Embryonic Axis Specification' Cold Spring Harbor Symposia Quant Biol. 71, 171-80.
- Forstemann K, Tomari Y, Du T, Vagin VV, Denli AM, Bratu DP, Klattenhoff C, Theurkauf WE, and Zamore PD. 2005 ‘Normal microRNA maturation and germ-line stem cell maintenance requires Loquacious, a double-stranded RNA-binding domain protein’, PLOS Biology Vol. 3(7), e236, pages 1187-1201
- Bratu DP, Cha B-J, Mhlanga MM, Kramer FR, and Tyagi S. 2003 ‘Visualizing the distribution and transport of mRNAs in living cells’, PNAS USA Vol. 100 (23), pages 13308-13.

- Bratu DP. 2003 ‘Molecular beacons light the way: Imaging native mRNAs in living cells’, Discovery Medicine Vol. 3 (19), pages 44-47.
- Tyagi S, Bratu DP, and Kramer FR. 1998 ‘Multicolor molecular beacons for allele discrimination’, Nature Biotechnology Vol. 16, pages 49-53.