

**Single-molecule membrane biology**  
**DTC Bionano 2013**  
**Mark Wallace**

The cell membrane provides the barrier through which a cell must communicate with its environment. The proteins present in this membrane control many of the most important functions of the cell; including sight, hearing, smell, neurotransmission, and the immune response. Single-molecule methods have provided some of the most important insights into the behaviour of membrane proteins, including their function, stoichiometry and interactions.

Present to your colleagues an assessment of how single-molecule methods have helped address one of the following important questions for membrane biology:

1. Describe how single-molecule methods have improved our understanding of ion channels.
2. Evaluate the successes and limitations of current single-molecule methods for the determination of membrane protein interactions.
3. What role do lipids play in determining membrane protein function?
4. Do lipid rafts exist?

**Suggested starting references**

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Formation and dissociation of M1 muscarinic receptor dimers seen by TIRF imaging of single molecules Hern JA,et al. Proc Natl Acad Sci U S A. 2010 February 9; 107(6): 2693–2698.

Steric confinement of proteins on lipid membranes can drive curvature and tubulation Stachowiak JC,et al. Proc Natl Acad Sci U S A. April 27, 2010 vol. 107 no. 17 7781-7786

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Simultaneous optical and electrical recording of single gramicidin channels. Borisenko V,et al. Biophys J. 2003 Jan;84(1):612-22.

Structural rearrangements in single ion channels detected optically in living cells Sonleitner A,et al. Proc Natl Acad Sci U S A. 2002 October 1; 99(20): 12759–12764.