**Quantitative Chemical Imaging in Live Cells**

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The chemical milieu within an organelle has been evolutionarily optimized to enable the biochemistry that occurs within. My lab studies how organelle function impacts cell function by mapping chemicals within the organelle lumens using a new, quantitative chemical imaging technology based on DNA. DNA self-assembles into molecularly precise, synthetic assemblies, commonly referred to as DNA nanodevices. My lab creates DNA nanodevices that are chemically responsive, fluorescent probes that can be targeted to specific organelles(1). I will discuss how we get these probes to interface with cells in programmable and targeted ways to localize in specific organelles. I will show how we use these reporters to quantitatively image chemical messengers in organelles of cells in culture, in live multicellular organisms (2) as well as in cells obtained from blood draws (3) or skin biopsies from human patients (4). I will focus on two recent findings. One, where we solved a thirty-year problem in molecular sensing by mapping lumenal calcium in acidic organelles and in doing so, identified the first example of a lysosomal Ca2+ importer in the animal kingdom (2). In the second, I will describe a DNA-based voltmeter using which, we have measured the membrane potentials of several organelles *in situ* in live cells, many of which were unknown till now (5).

Literature:

[1] Chakraborty, K., et. al. Nucleic acid based nanodevices in biological imaging. **Ann. Rev. Biochem**, *2016*, 85, 349-373. [2] Narayanaswamy, N. et. al.A pH-correctable, DNA-based fluorescent reporter for organellar Calcium. **Nature Methods**, *2019*, 16, 95-102. [3] Thekkan, S. et al. A DNA-based fluorescent reporter maps HOCl production in the maturing phagosome. **Nature**. **Chem**. **Biol.** *2019*, in press. [4] Leung, K., et al. A DNA nanomachine chemically resolves lysosomes in live cells. **Nature** **Nanotechnology**, *2019*, in press. [5] Saminathan A., et al. A DNA-based voltmeter for organelles. **bioRxiv** 523019.