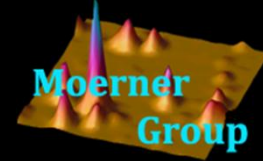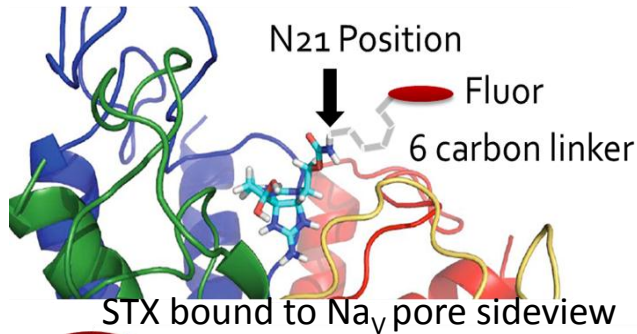# Super-Resolution Sampling of Sodium Ion Channel Distributions on Live Differentiated PC12s Using Novel Fluorescent Saxitoxins
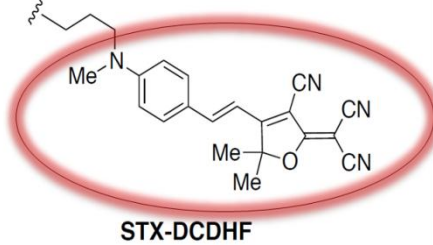
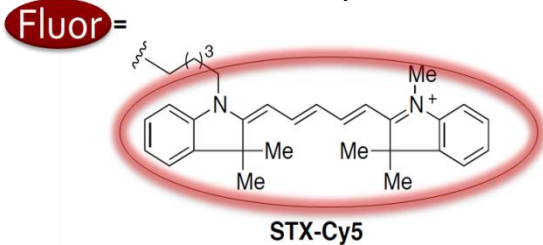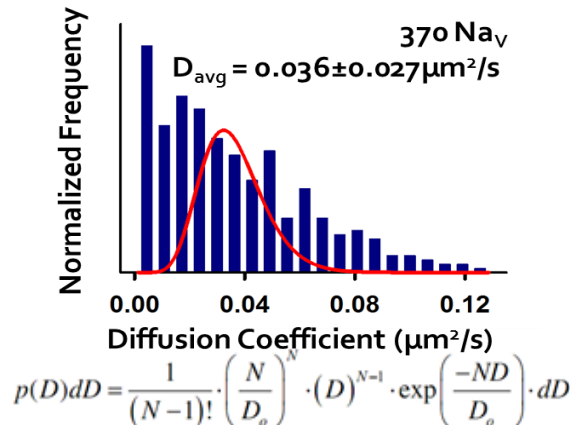Lee, H.-L;* Ondrus, A.;* Iwanaga, S.; Parsons, W.; Andresen, A.; DuBois, J; Moerner, W.E.

**Moerner Group**

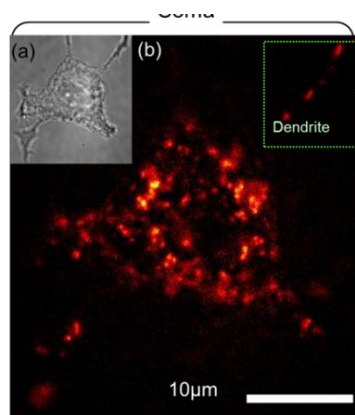**Fluorescent saxitoxins (STX) bind to voltage-gated sodium ion channels ($Na_V$) on PC12 neural models, with exquisite high fidelity.**
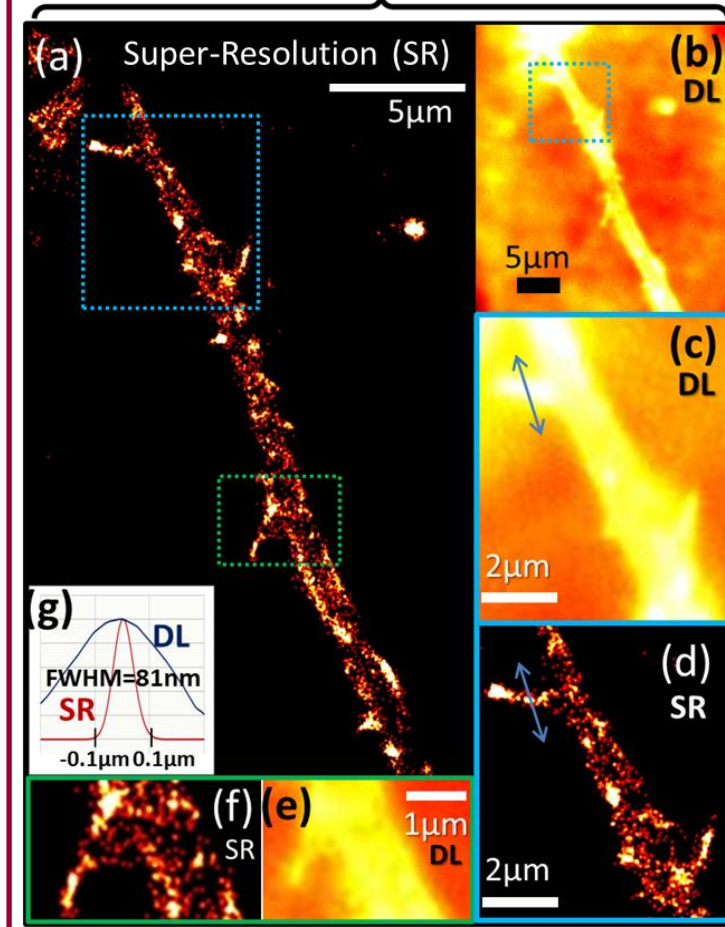


N21 Position

Fluor

6 carbon linker

STX bound to $Na_V$ pore sideview

| compound | $IC_{50}$ (nM) |
|---|---|
| ▲ STX | 1.9 ± 0.2 |
| ● STX-Cy5 | 39 ± 9 |
| ■ STX-DCDHF | 95 ± 21 |

Fluor =

STX-Cy5          STX-DCDHF

## STX-DCDHF enables tracking of single NaV on PC12 membrane



Soma

Dendrite

10µm

370 $Na_V$
$D_{avg} = 0.036 \pm 0.027 \, \mu m^2/s$

Normalized Frequency

Diffusion Coefficient (µm²/s)

$$p(D)dD = \frac{1}{(N-1)!} \cdot \left(\frac{N}{D_o}\right)^N \cdot (D)^{N-1} \cdot \exp\left(\frac{-ND}{D_o}\right) \cdot dD$$

## STX-Cy5 enables super-resolution sampling of NaV distribution

T= 0, averaged over 5s



(a) Super-Resolution (SR)     5µm

(b) DL     5µm

(c) DL     2µm

(g) DL / SR  FWHM=81nm  -0.1µm 0.1µm

(d) SR     2µm

(f) SR  (e) DL     1µm     2µm

Ondrus, A.*; Lee, H.-L.*; Iwanaga, S.; Parsons, W.; Andresen, A.; Moerner, W.E.; DuBois, J., Chem. Biol. 19, 902-912 (2012).