

# 细胞膜超分辨成像策略及其生物应用

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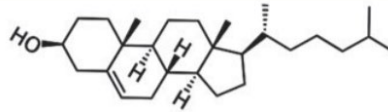
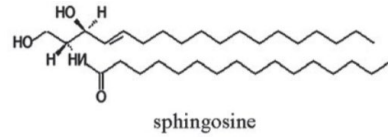
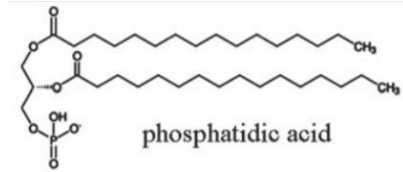
**Reporter: zhou wei**

**Date: 2020-05-12**

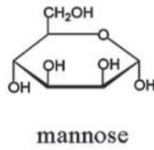
# Properties of plasma membrane

Lipids

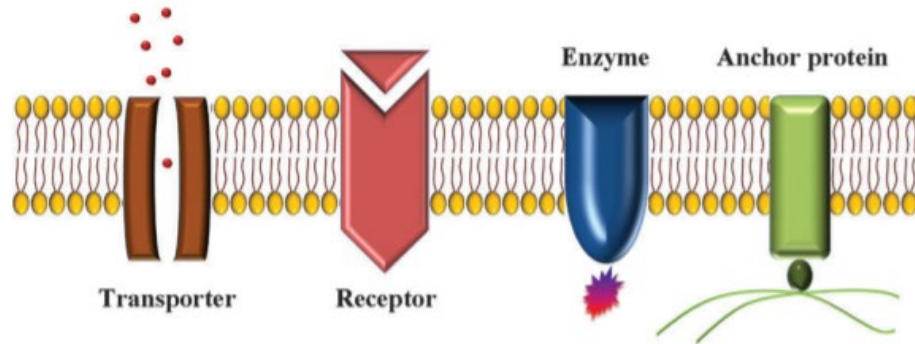
- phosphoglycerides
- sphingolipids
- sterol lipids



Carbohydrates



Membrane proteins



Extracellular material

virus、anion、dopamine....

component

number

location



Plasma membrane dynamic change

CellLight 试剂

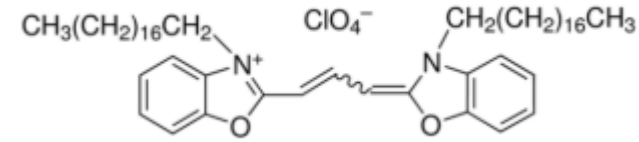
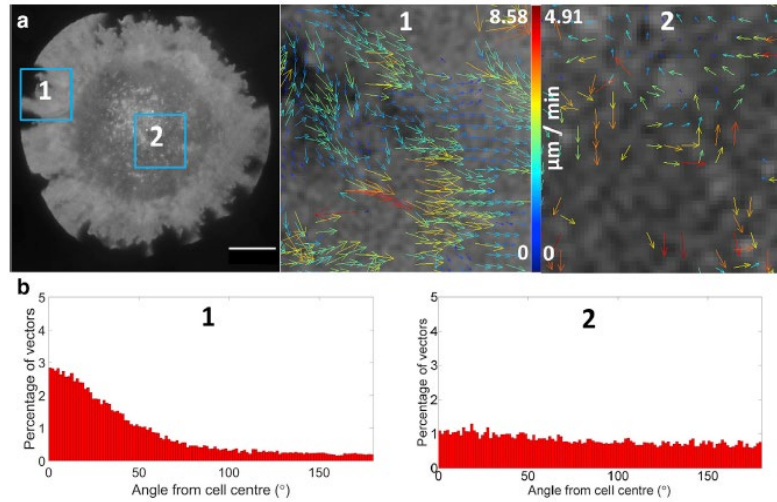
WGA 偶联物

CellMask、DI染料

# Lipid probe

## Alkyl chain

通过长碳链实现染料在水相中聚集导致荧光淬灭，当长碳链插入细胞膜中，实现染料分散，荧光恢复

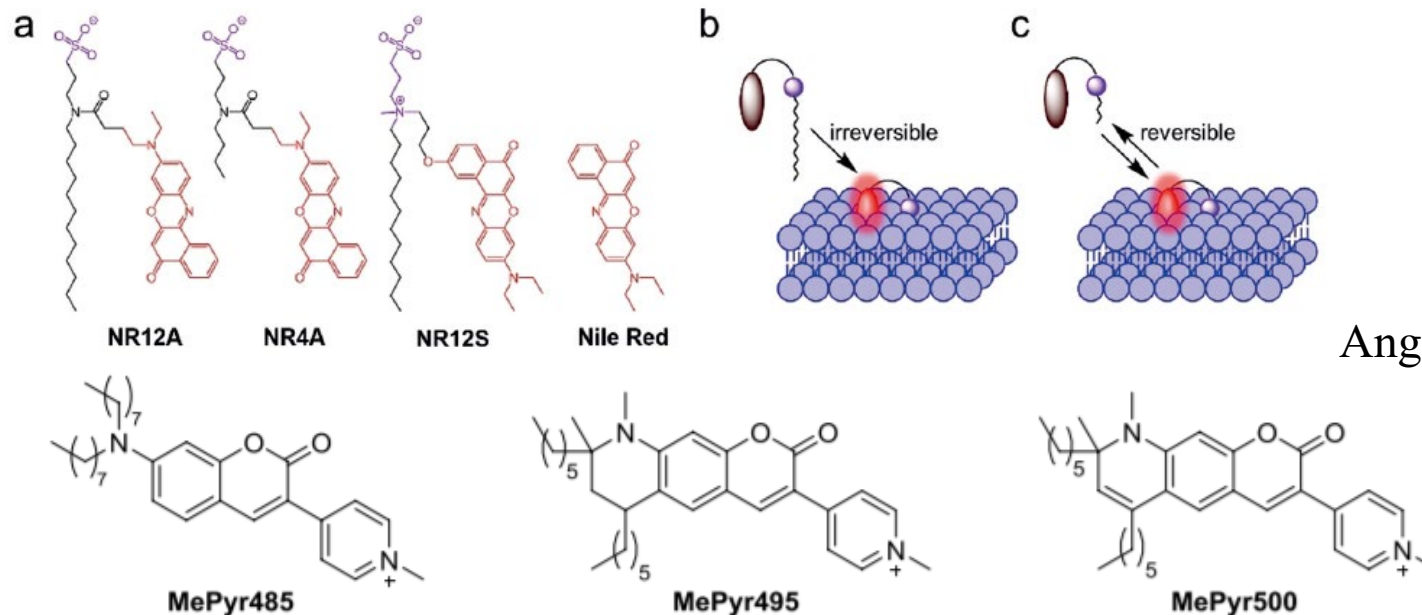


Dio细胞膜荧光染料，研究膜流动性

Biophysical Journal-2017-1703

## Ionic alkyl chain

在烷基链上增加离子基团，增加其在细胞膜上的牢固性，达到长时间细胞膜成像的目的



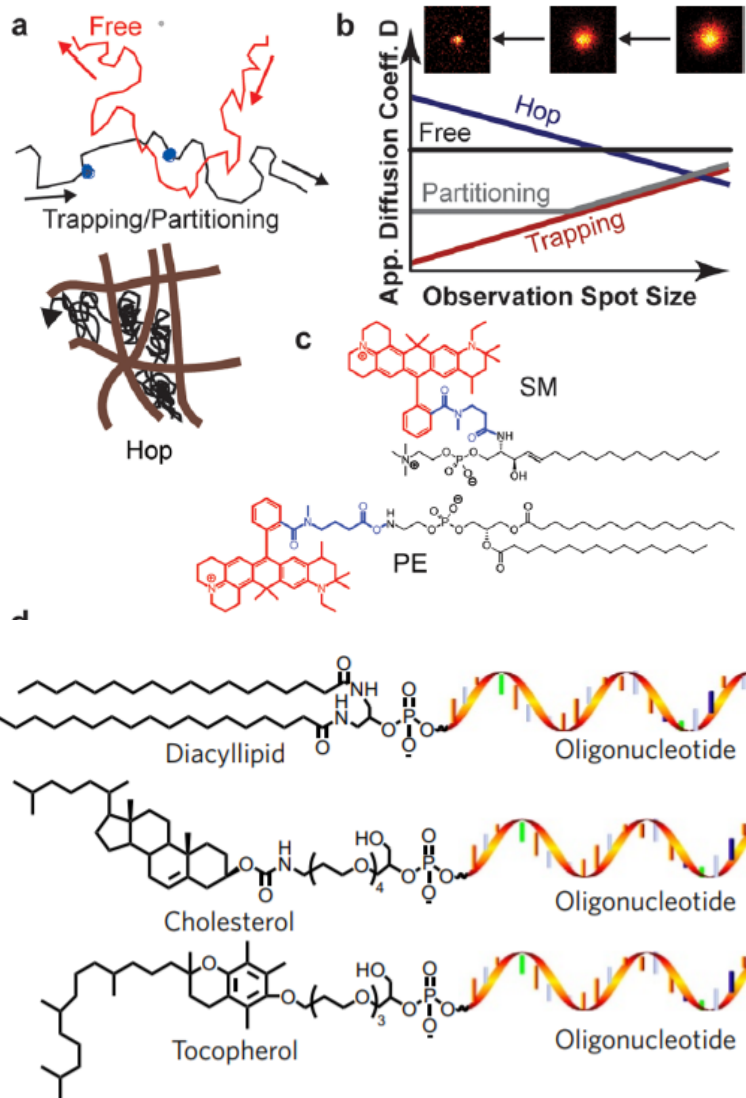
Angew-2019-14920

European Biophysics Journal -2019-485

# Lipid probe

## Different lipids

通过不同的脂质分子，将染料标记到不同的微环境的脂质结构域中，研究其相应的问题



通过不同脂质靶向基团，将荧光染料靶向到细胞膜上，通过STED-FLCS技术研究细胞膜的脂质差异

Nano Lett-2015-5912

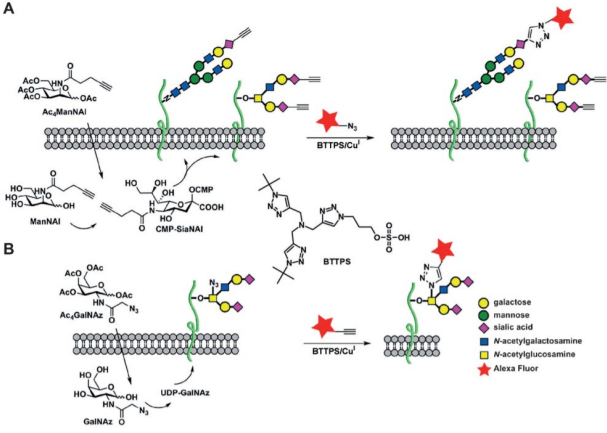
研究相同脂质结构域的快速相遇融合过程

Nature Nanotechnology-2017-453

# Carbohydrate probe

## 糖类物质修饰

对糖类物质进行化学修饰从而将荧光染料绑定到特定位置



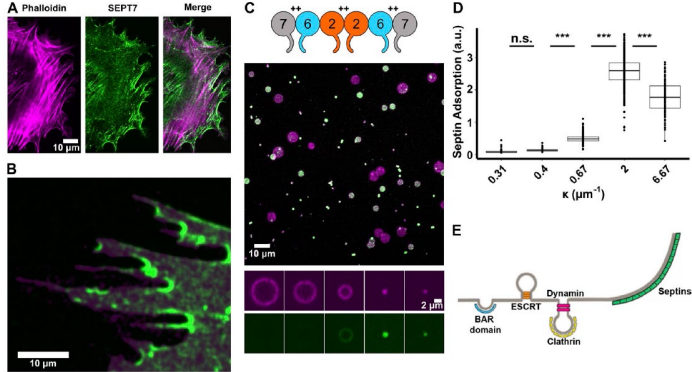
荧光染料通过生物正交连接到糖类进行STORM超分辨成像

Angew-2015-1765

Angew-2014-10921

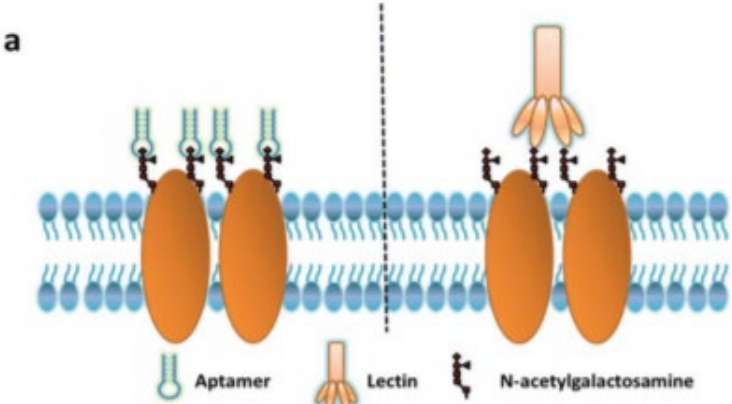
## 识别糖类物质

在荧光染料上连接靶向基团，以凝集素和适配体为主



Alexa647-凝集素

J. Cell Biol-2016-23



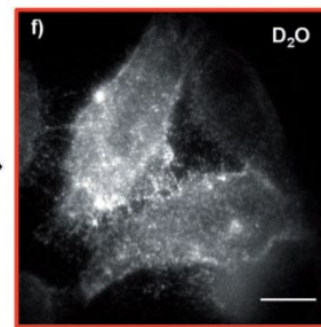
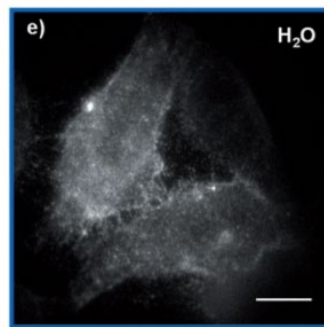
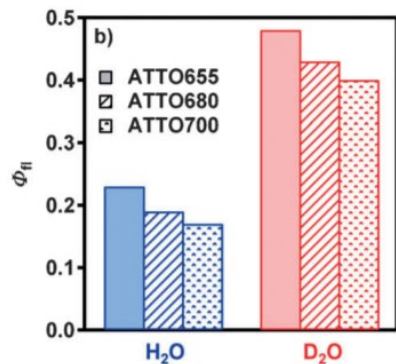
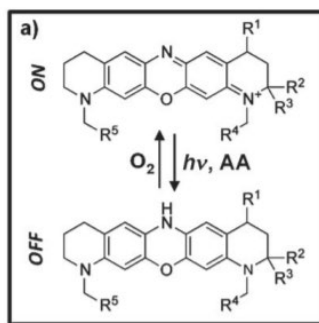
适配体相对于凝集素来说，属于一对一结合，不会形成交联反应

Nanoscale-2018-7457

# Membrane protein probe

## Protein ligand

在荧光染料上连接蛋白受体，可以与相应蛋白进行识别，从而将荧光染料标记到相应位置

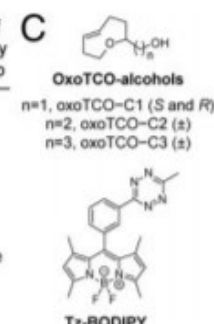
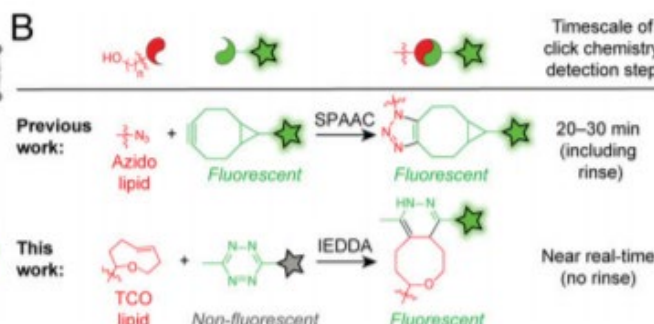
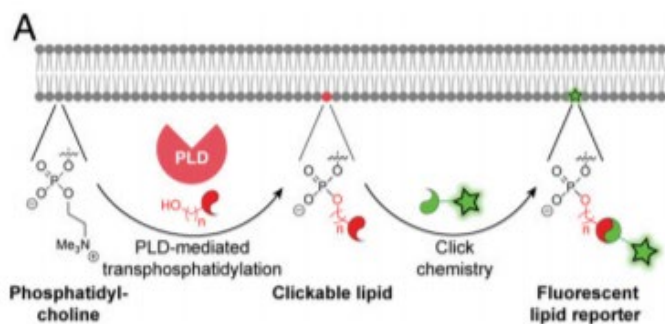


连接CCR5蛋白受体，STORM成像

Angew-2013-8948

## Catalytic substrate

通过酶的催化属性将染料标记到相应的底物上

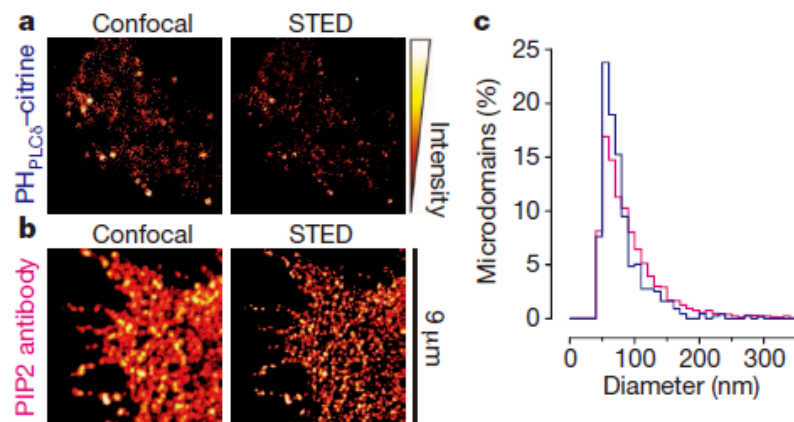


SIM成像，研究磷酸酯酶活性

PNAS-2019-1

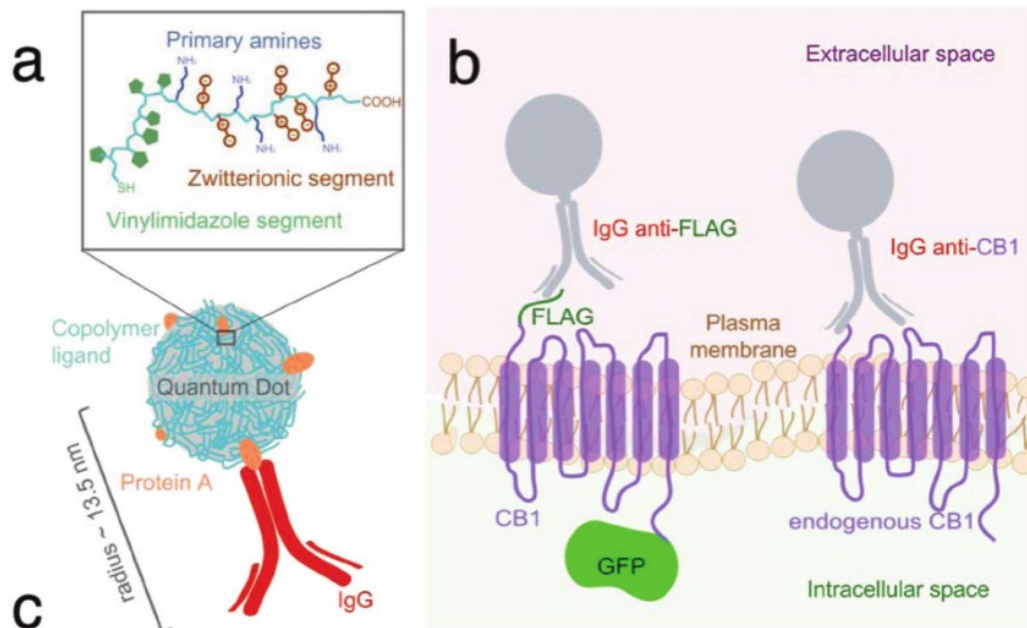
# Membrane protein probe

## Antibody labeling



小分子荧光染料连接抗体

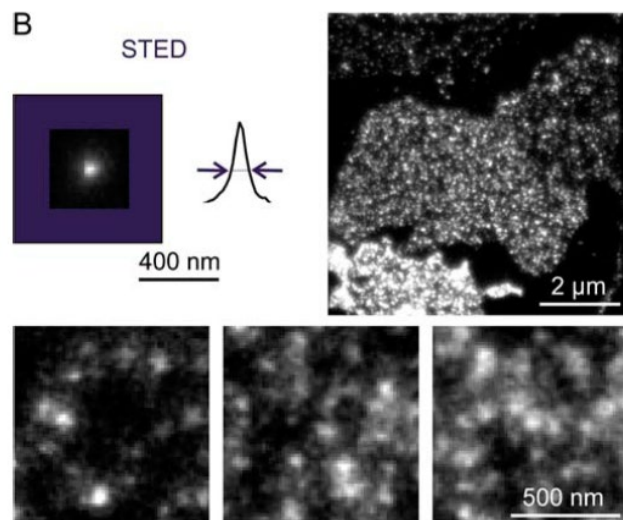
Nature-2011-552



Small-2019-1902796

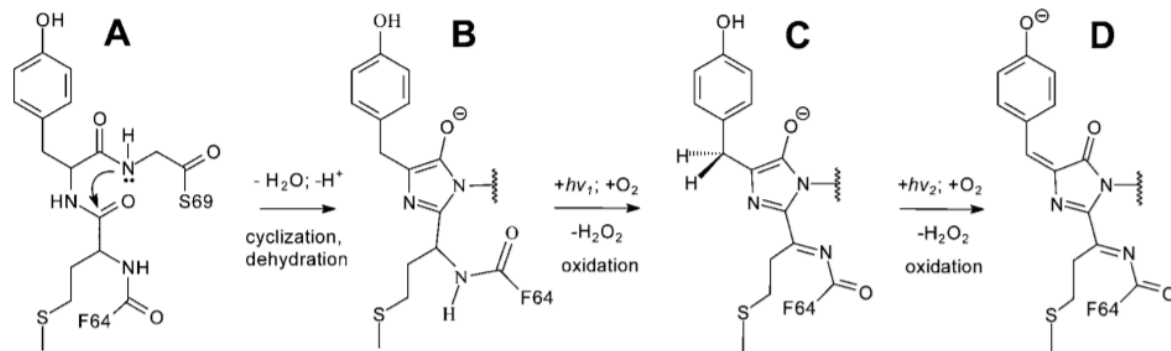
# Membrane protein probe

Fluorescent protein

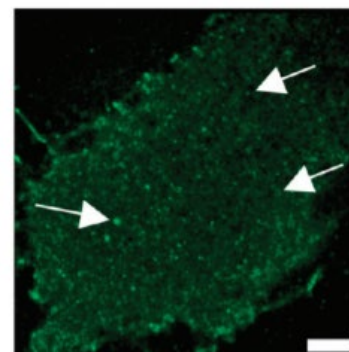


SNARE-GFP融合蛋白实现细胞膜蛋白STED成像，  
研究细胞膜突出融合蛋白簇的形成

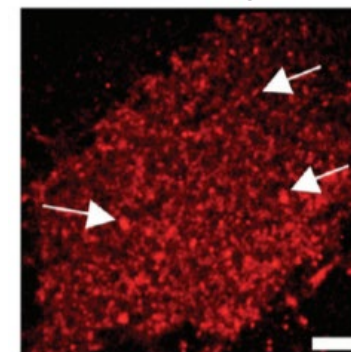
Biophysical Journal-2006-2843



VSVG-PAGFP



EGFR-PATagRFP



JACS-2010-132



# Cell membrane dynamic image

蛋白之间相互作用，  
蛋白结构域变化

protein-protein



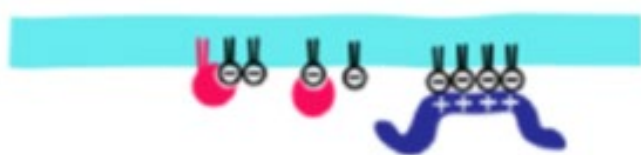
lipid-lipid & protein-lipid



脂质之间以及脂质和  
蛋白之间相互作用，  
结构域变化

质膜上脂质成分比  
例变化引起细胞表  
面电荷变化

electrostatic



curvature



质膜膜曲率的变化，  
胞吞胞吐、囊泡、  
伪足

病毒在质膜上组装、神经物质在质膜上响应等

以上结构变化其尺寸大部分在10nm到两三百纳米