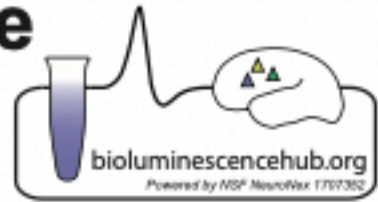


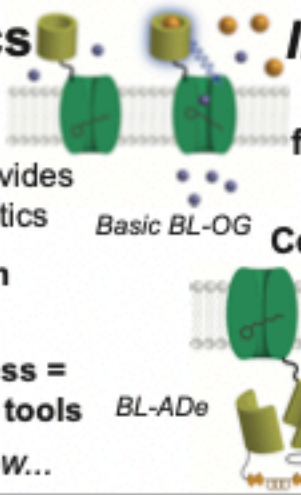
Distinct Advantages of BioLuminescence for Neuroscience

Christopher I. Moore¹, Diane Lipscombe¹, Ute Hochgeschwender², Nathan C. Shaner³, Justine J. Allen (Program Manager)¹
 1. Brown University, Providence, RI; 2. Central Michigan University, Mount Pleasant, MI; 3. University of California San Diego, San Diego, CA



BioLuminescent-OptoGenetics (BL-OG)

Single molecule provides Chemo- & OptoGenetics
 Optical confirmation when drug hits target
 OptoGenetic progress = new ChemoGenetic tools
 Examples See below...



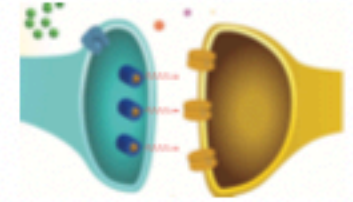
Activity-Dependent BL-OG

Intraluminescence

Real-time, all-molecular feedback driven by a local increase in calcium
 Cell-specific self-regulation to cease or perpetuate the cell's activity patterns
 Example Detect calcium bursts to drive or terminate spindles

Interluminescence

All-optical synapses
 Selectively modulate communication only with endogenous firing
 Examples See below...



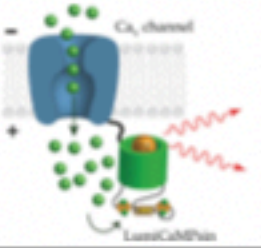
Calcium Sensing

Generating novel BL calcium indicators with several advantages over 1P Fluorescent imaging
 Chemical light production avoids:
 Photodamage
 Photobleaching
 Autofluorescence
 allows decreased implanted microscope size



LumiPoreIns

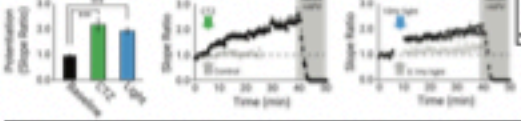
BL calcium indicators tethered to CaV channels can provide highly selective, nano-domain sensing



BL-OG LuMinOpsins (LMO3)

Enable New Kinds of Hypothesis Testing

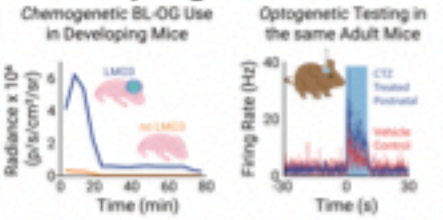
IPSC control by LMO3 Post-Stroke: **Chemogenetic** or **Optogenetic** activation drives **Behavioral Recovery** and **Synaptic Enhancement**



Yu et al. J Neurosci 2019

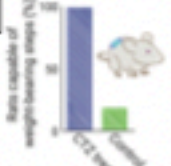
Medendorp...Moore, Hochgeschwender, iScience 2021

Developmental Chemogenetic drive & Adult Optogenetic circuit interrogation



Petersen... Hochgeschwender Front Neurol

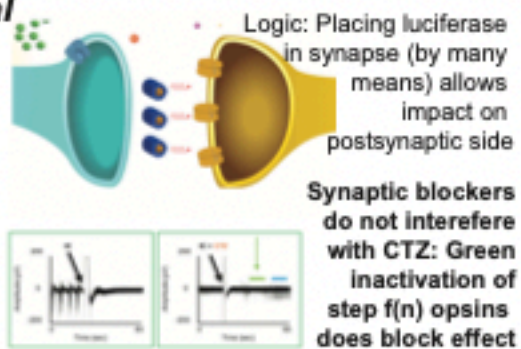
BL-OG stimulation Recovers Locomotor Ability following Spinal Cord Injury



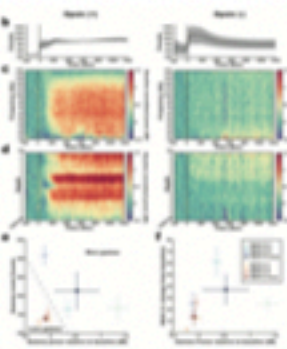
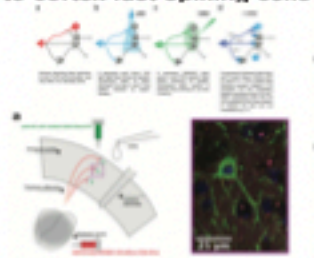
Optical Synapses

Synaptic Luciferase Drives Postsynaptic Optogenetic Targets

Prakash, Murphy...Moore, Hochgeschwender, 2022 Communications Biology

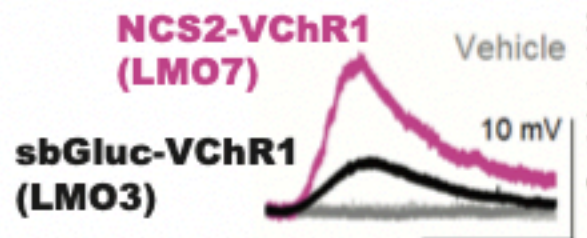


Logic: Placing luciferase in synapse (by many means) allows impact on postsynaptic side



Synaptic blockers do not interfere with CTZ: Green inactivation of step f(n) opsins does block effect

LMO7: Bright New Luciferase Drives Stronger Control



Education, Dissemination



Bioluminescence Practicum 42 students, 37 colleges
 Intensive, hands-on study; lectures on website
 Undergraduate Interns 30 students, 13 colleges
 Summer of mentored research in a Hub laboratory
 Interviews with Experts 6 interviews
 World-class scientists; recordings on website
 BL Constructs via Addgene Database on website
 Searchable, filterable, features and attributes
 LMO3 Mouse at JAX Available now!

www.bioluminescencehub.org

Broad Impact of Hub

