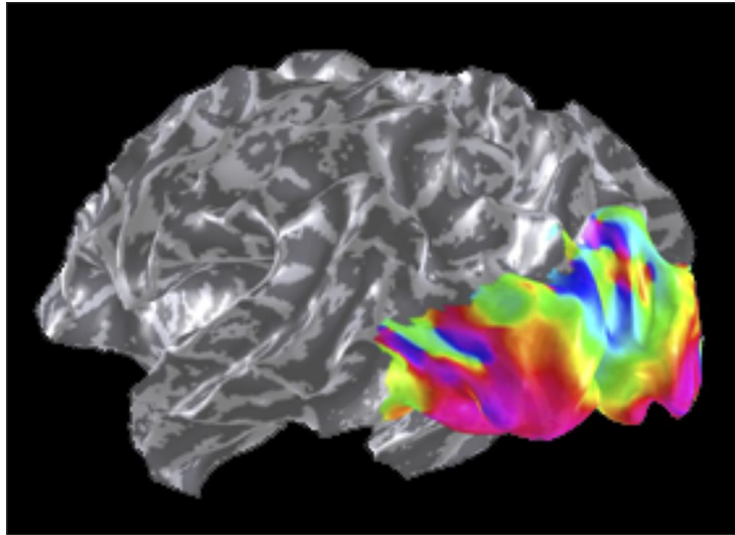
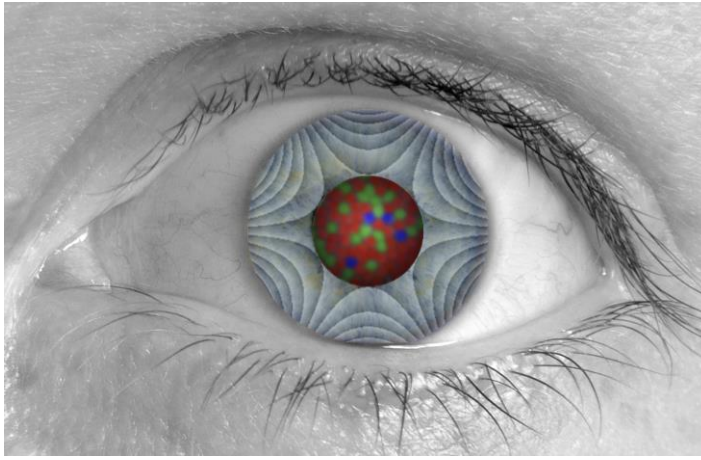
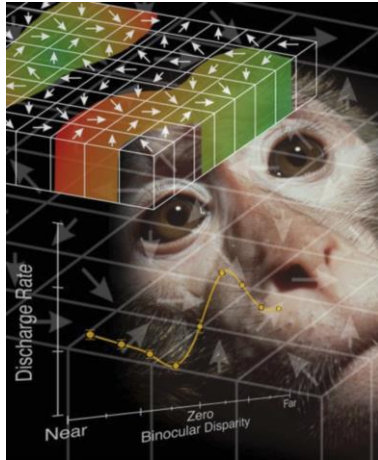


# Vision Restoration, Neural Circuits, and Virtual Reality

## Center for Visual Science

### David Williams



# CVS Faculty



Richard Aslin



Mina Chung



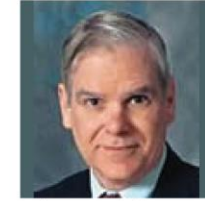
Greg DeAngelis



Charles Duffy



Steven Feldon



James Fienup



John Foxe



Edward Freedman



Lin Gan



Ralf Haefner



Benjamin Hayden



Jennifer Hunter



Krystal Huxlin



Robert Jacobs



Celeste Kidd



Wayne Knox



Peter Lennie



Richard Libby



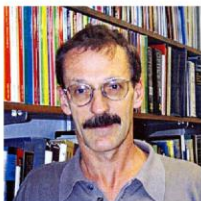
Scott MacRae



Bradford Mahon



Ania Majewska



William Merigan



Jude Mitchell



Gary Paige



Tatiana Pasternak



Rajeev Raizada



Jannick Rolland



Lizabeth Romanski



Jesse Schallek



Marc Schieber



Ruchira Singh



Duje Tadin



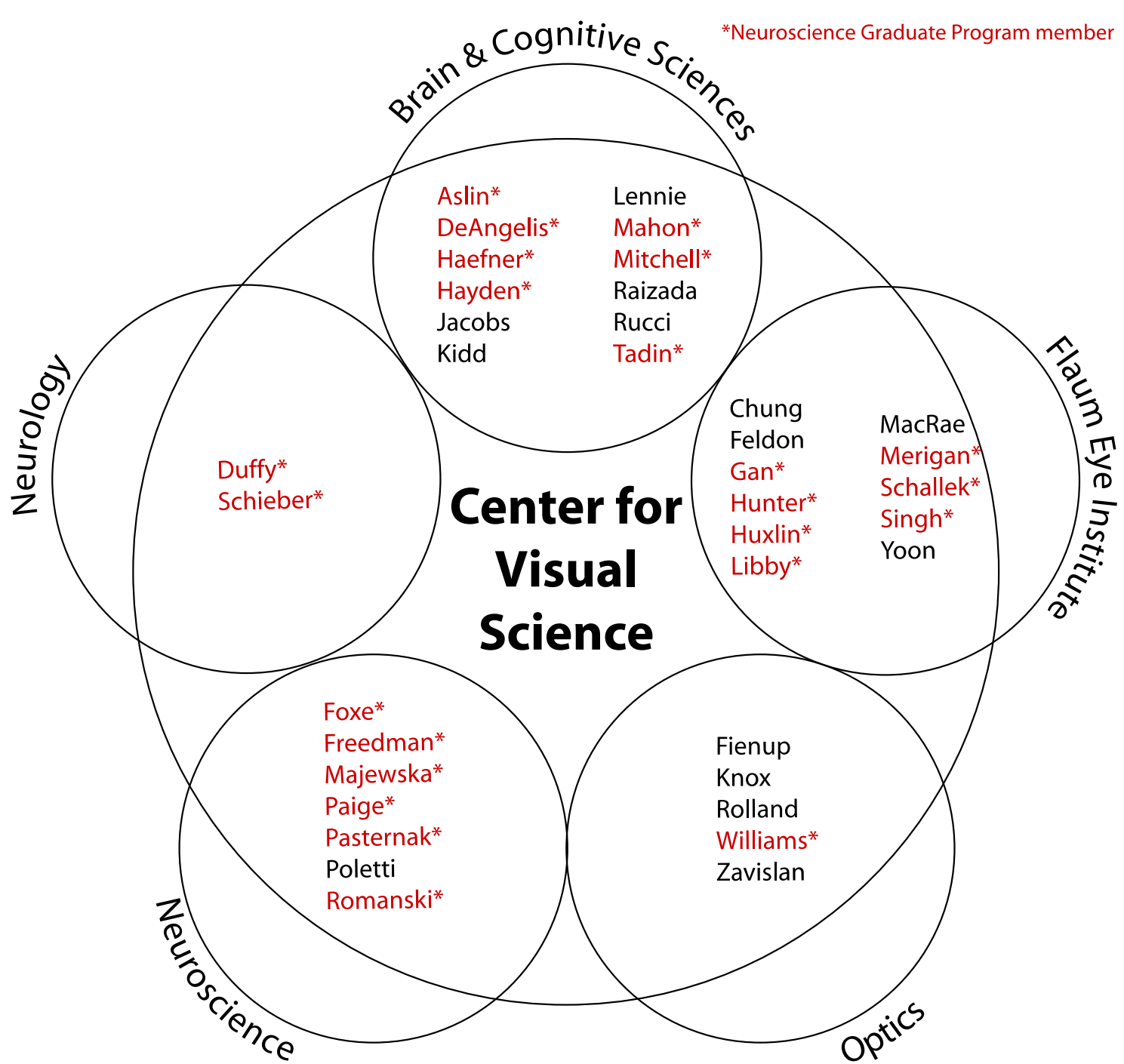
David Williams



Geunyoung Yoon



James Zavislan



## **Three Concepts:**

**Vision Restoration**

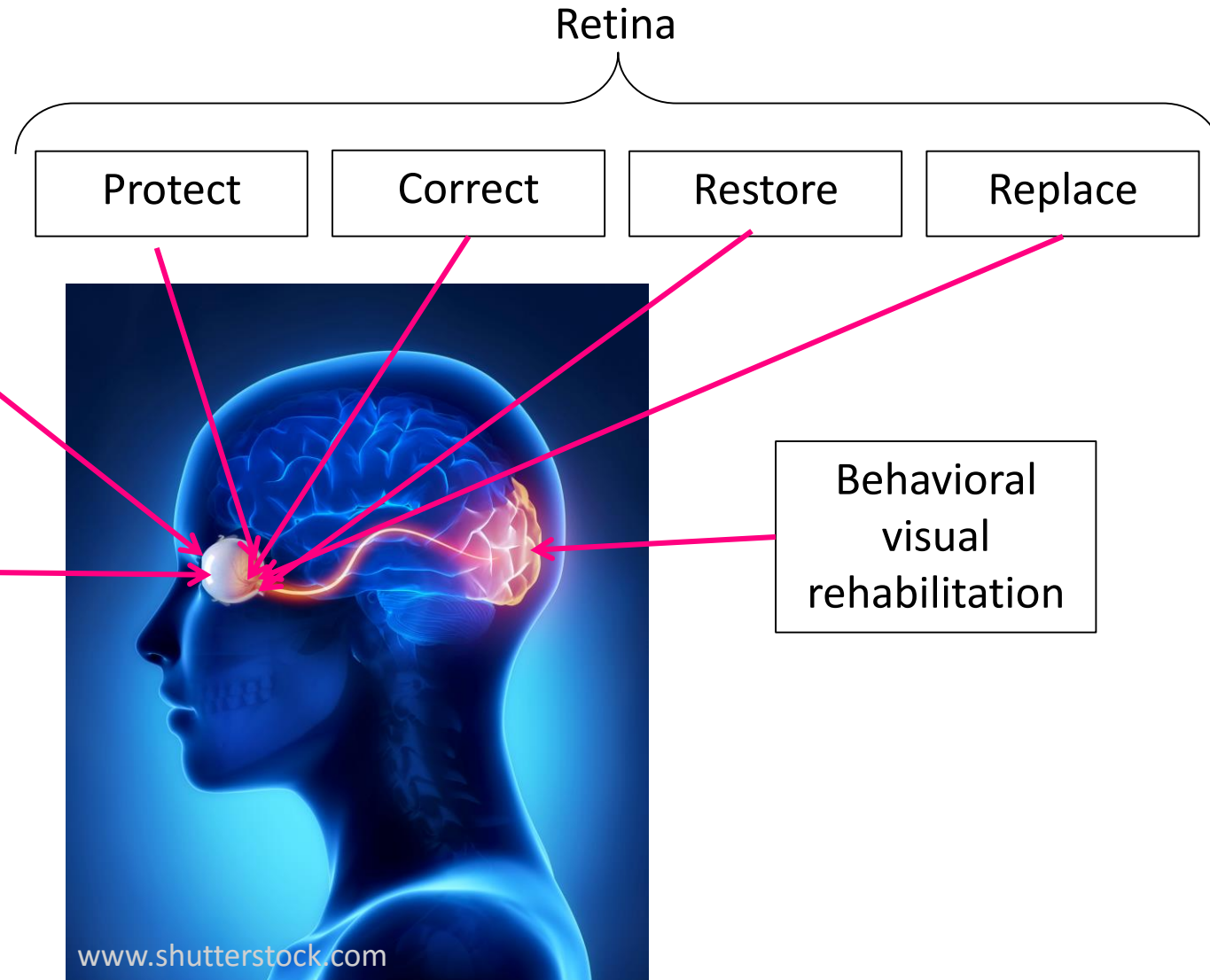
**Large Scale Recording of Neural Activity**

**Underlying Behavior**

**Virtual and Augmented Reality**



# Vision Restoration



# Vision Restoration

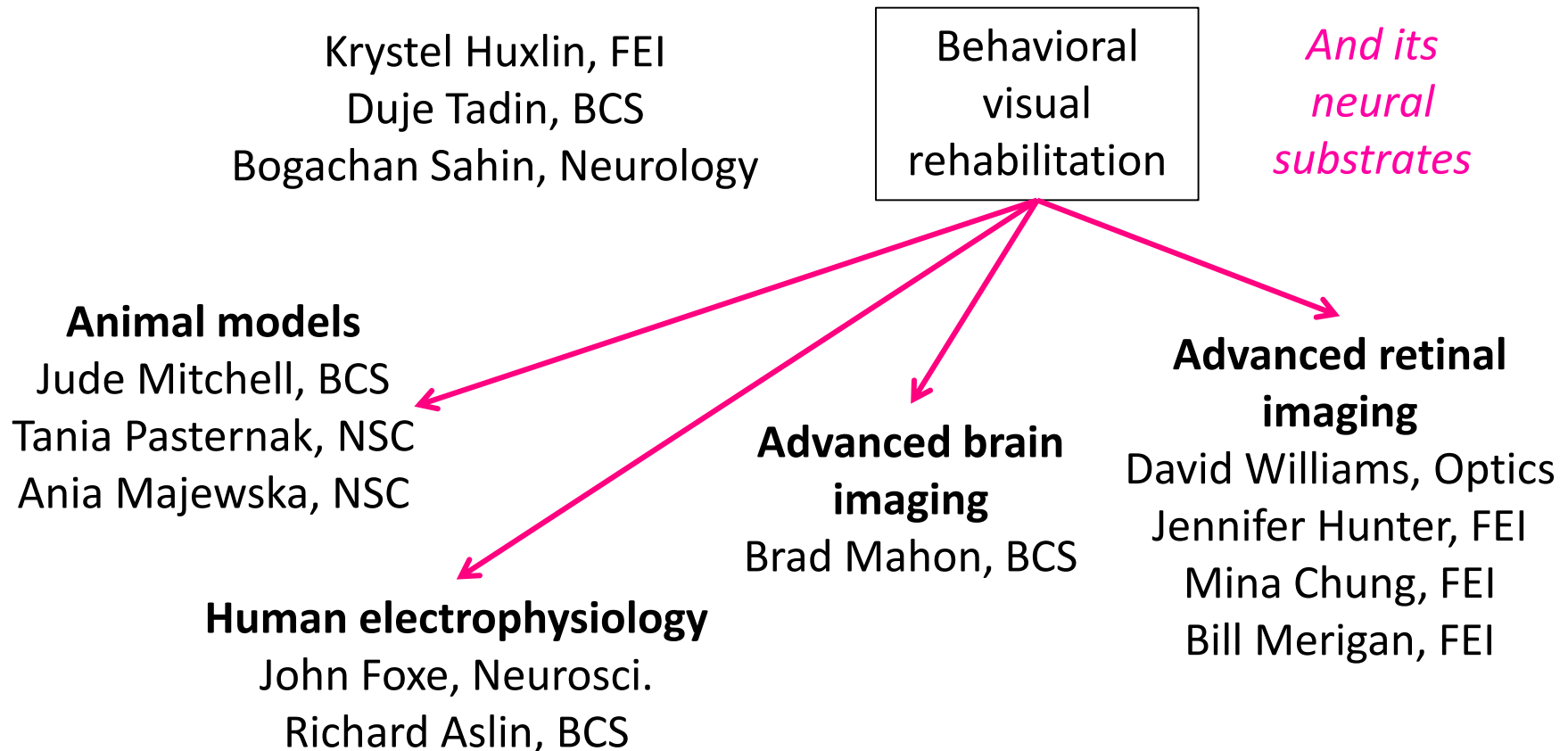
*Potential synergies and expansion into Center of Excellence*



Behavioral  
visual  
rehabilitation

# Vision Restoration

*Potential synergies and expansion into Center of Excellence*



# Vision Restoration

Retina

Protecting cells  
from injury

Correcting  
genetic errors

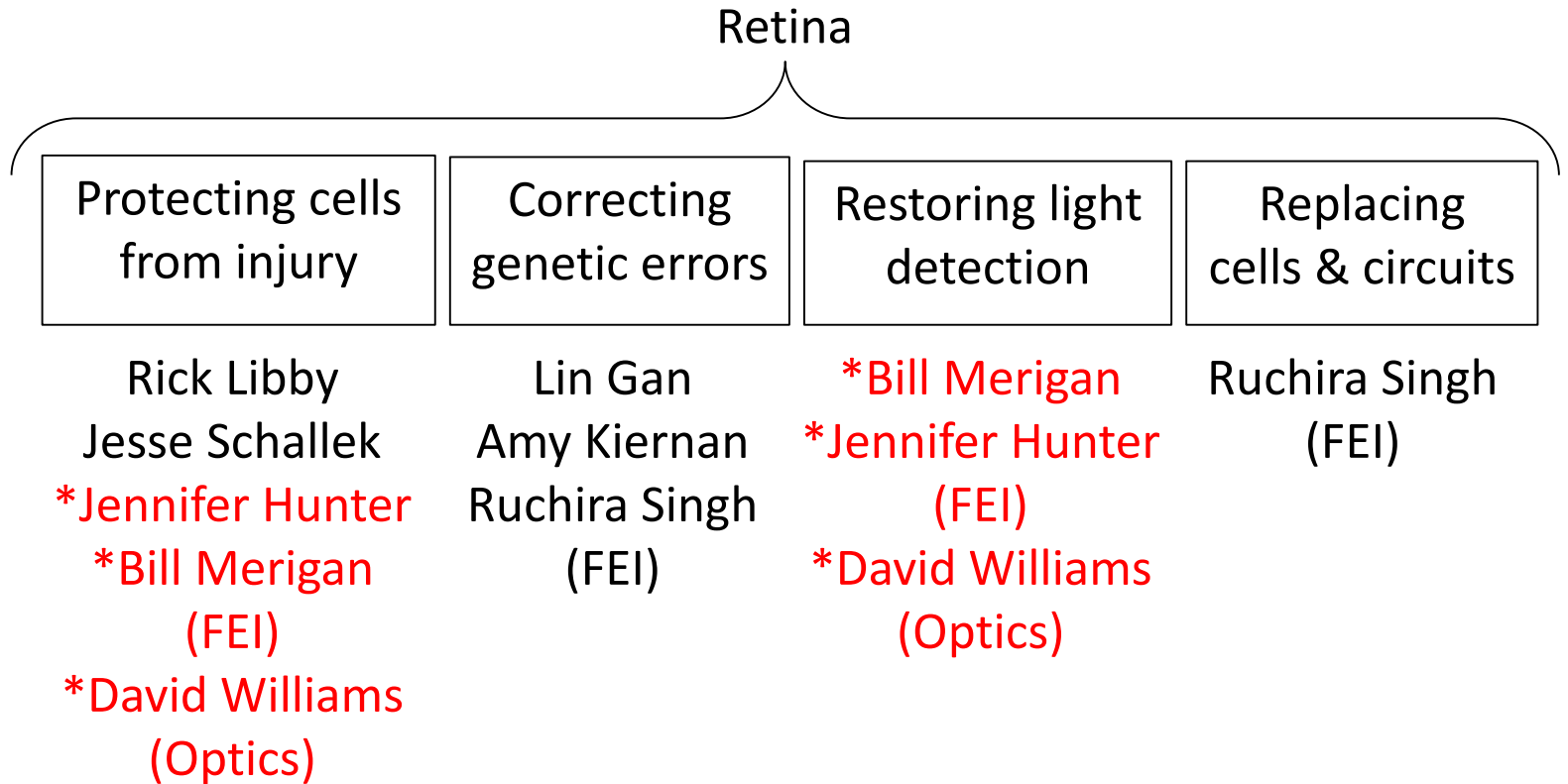
Restoring light  
detection

Replacing  
cells & circuits





# Vision Restoration



*\*Audacious Goals Initiative  
Example of large, collaborative project grant*

# National Eye Institute Audacious Goals Initiative grant \$3.8M



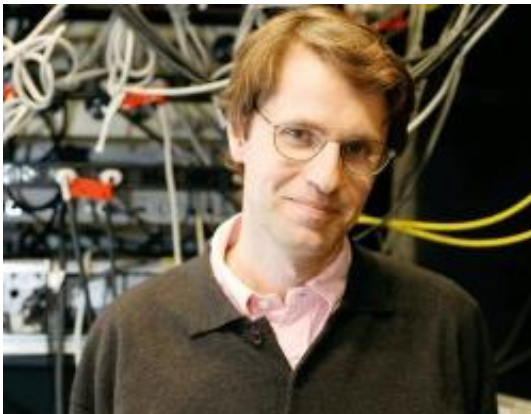
David Williams, PI



Bill Merigan, FEI



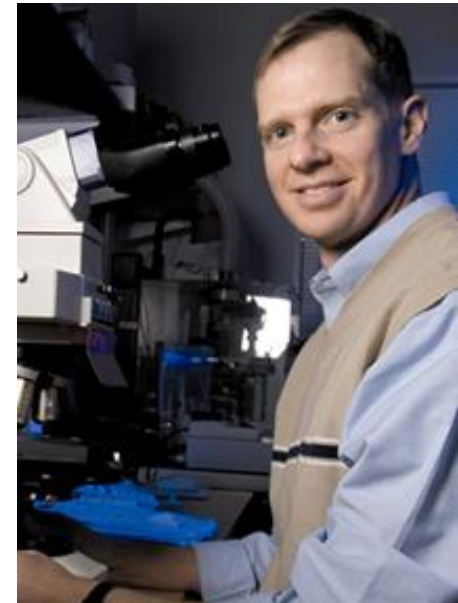
Jennifer Hunter, FEI



Botond Roska  
Friedrich Miescher Institute  
for Biomedical Research

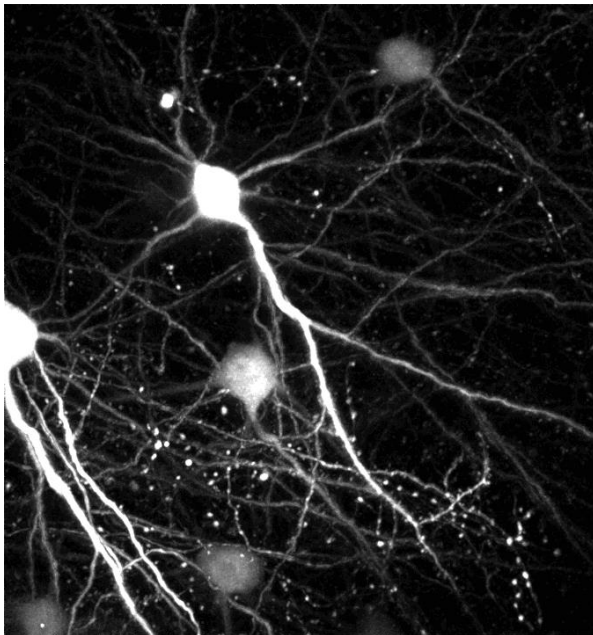
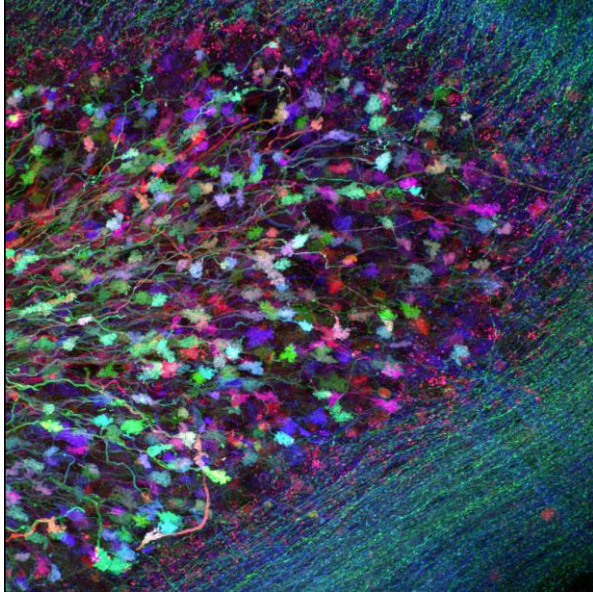


Connie Cepko  
Harvard Medical School



David Gamm  
Univ. Wisconsin

# Large scale recording of neural activity underlying behavior



- Record 10,000+ neurons simultaneously *in vivo* within and between brain areas during behavior
- Understand how single cell and network activity interact to determine behavior in health and disease
- Establish interdisciplinary collaborations to develop new techniques for recording from neural networks in behaving animals
- Capitalize on UR strengths in systems neuroscience, *in vivo* imaging, optical technique development, data analysis
- Test computational theories of neural coding with unprecedented power
- Align with federal funding initiatives.

**Recording neural activity in behaving animals**

Laurel Carney  
Greg DeAngelis  
Charles Duffy  
Ben Hayden  
Ken Henry  
Chris Holt  
Krystel Huxlin  
John Mink  
Jude Mitchell  
Tania Pasternak  
Liz Romanski  
Marc Schieber

**In vivo imaging of single brain cells**

Handy Gelbard  
Steve Goldman  
Jennifer Hunter  
Ania Majewska  
Bill Merigan  
Maiken Nedergaard  
Krishnan Padmanabhan  
Jesse Schallek  
Takahiro Takano  
David Williams

**Optical technique/probe development**

Andrew Berger  
Ed Brown  
Jim Fineup  
Tom Foster  
Wayne Knox  
Todd Krauss  
Ben Miller  
Duncan Moore  
Jannick Rolland  
Lewis Rothberg  
Roman Sobolewski  
Jim Zavislan

**Data analysis**

Sandhya Dwarkadas  
Ralf Haefner  
Henry Kautz  
Ji Liu  
Jiebo Luo  
Guarav Sharma  
Center for Imaging Science, RIT

# **Virtual and Augmented Reality**

**Industry is now driving a  
renaissance in multisensory science**

**Apple, Facebook (Oculus), Google  
MagicLeap, Samsung.....**



Optical technology



Handheld

Optical technology



Handheld



Crivelli (1352)

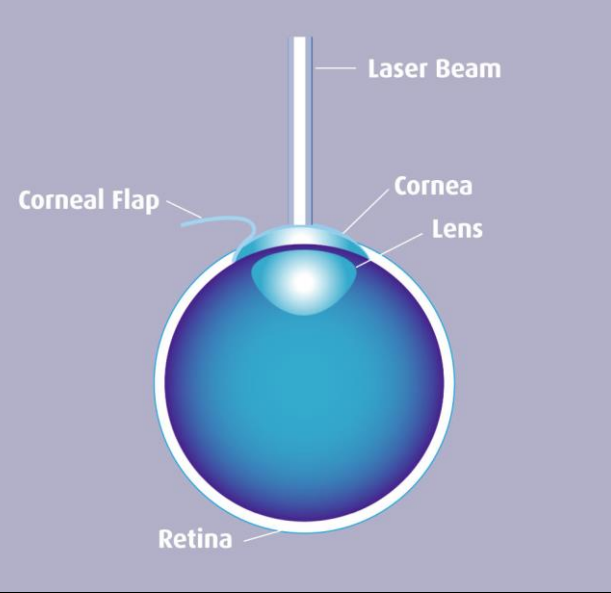
Headmounted



Handheld



Headmounted



Biointegrated

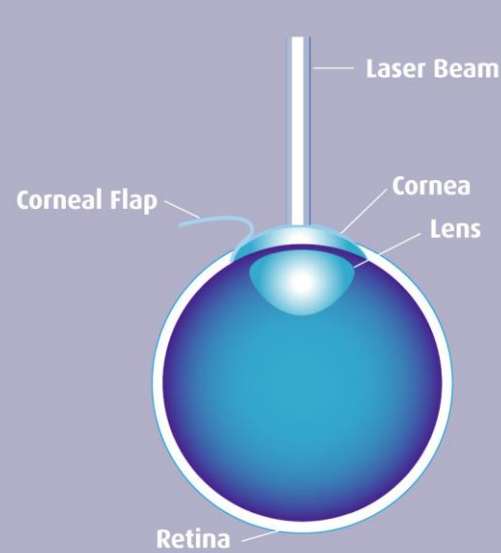
Optical technology



Handheld



Headmounted



Biointegrated

Digital technology



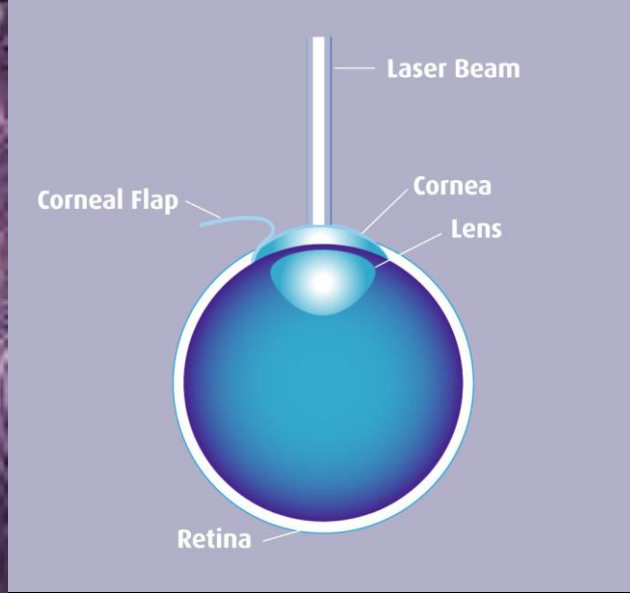
Optical technology



Handheld



Headmounted



Biointegrated

Digital technology





Optical technology

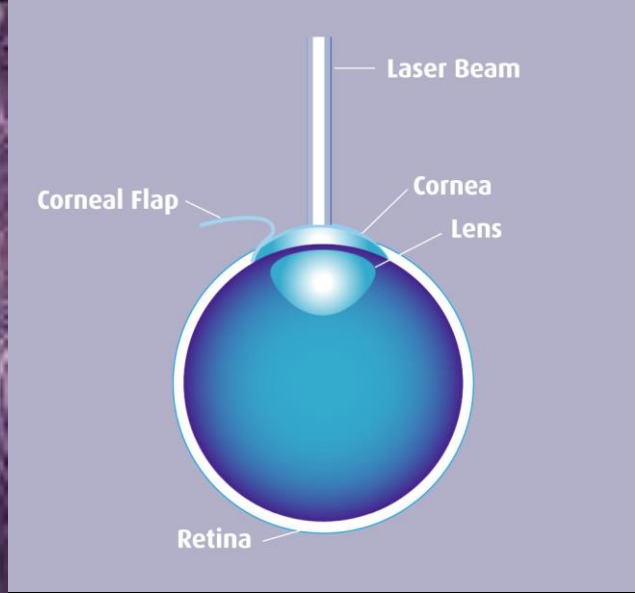


Handheld



Crivelli (1352)

Headmounted



Biointegrated

Digital technology



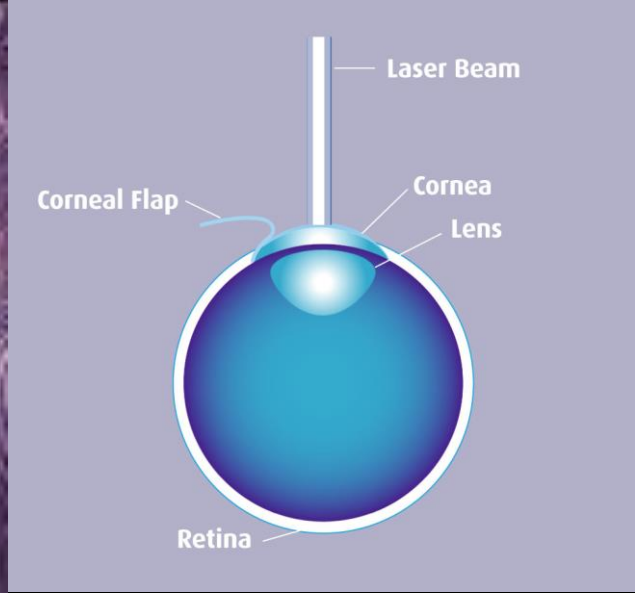
Optical technology



Handheld

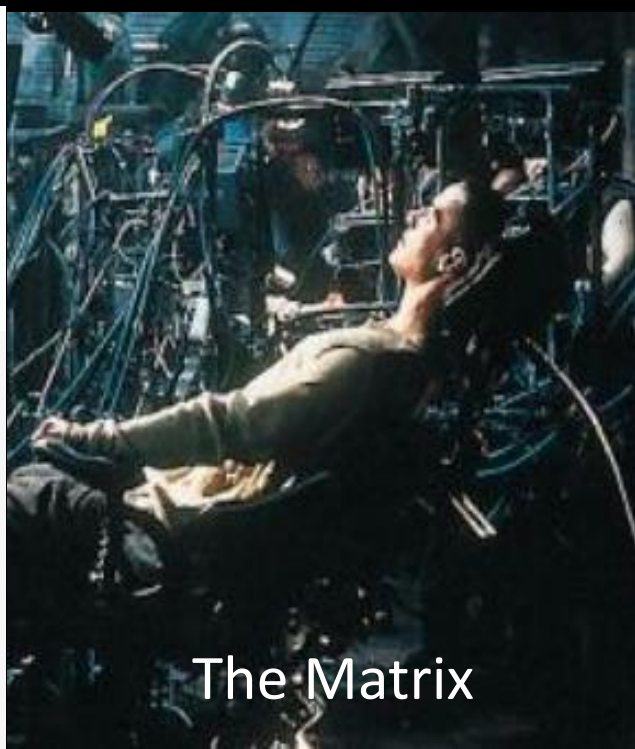
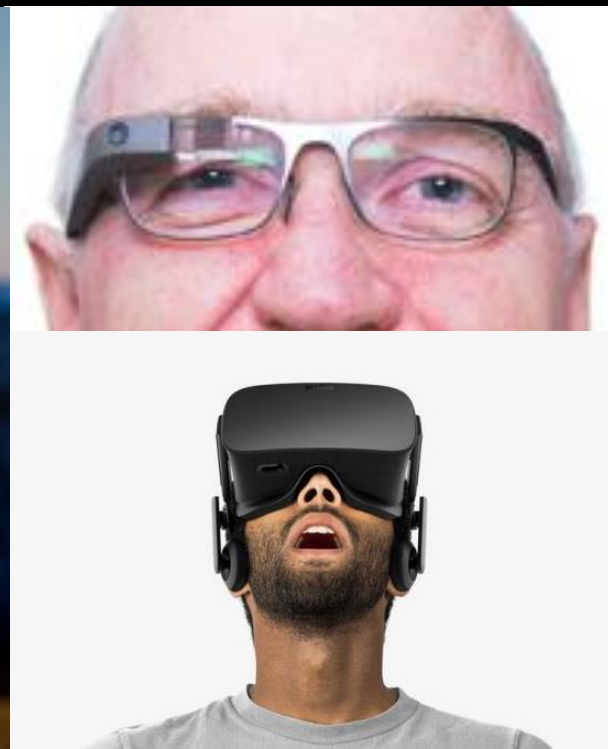


Headmounted



Biointegrated

Digital technology



The Matrix

**AS& E Deans Office**

David Williams, Dean of Research\*

**Brain and Cognitive Sciences**

Gregory DeAngelis, Chairman\*

Jude Mitchell\*

Robert Jacobs

Bradford Mahon\*

Michele Rucci

Duje Tadin\*

**Computer Science/Institute of Data Science**

Henry Kautz, Director, Institute for Data Science

Jeibo Luo

Ehsan Hoque

Ji Liu

Scott Steele

Chenliang Xu

**Electrical & Computer Engineering**

Mark Bocko, Chairman

Gaurav Sharma

Zhuyao Duan

**English**

Gregory Heyworth

**Flaum Eye Institute**

Krystal Huxlin\*

Geunyoung Yoon

**History**

Michael Jarvis

**Institute of Optics**

Jannick Rolland

Nick Vamivakas

Jen Kruschwitz

Duncan Moore

**Neuroscience**

John Foxe\*

Brad Berk

Laurel Carney\*

Edmund Lalor

Ross Maddox\*

Martina Poletti

Tania Pasternak\*

Marc Schieber\*

**Orthopedics**

David Mitten, MD

**Physics & Astronomy**

John Howell

\*NGP Faculty

## **Elements of a Plan:**

- **Faculty Hiring.**
- **Establish corporate partnerships through master agreements**
- **Define individual and collaborative research projects**
- **Graduate student and postdoctoral training**
- **Leverage CEIS.**
- **Seek Federal Funds (ERC or STC?)**
- **Host symposia (the Engineering the Eye Series)**
- **Create a new research platform (Anechoic chamber for Multisensory research?)**
- **Create a new center?**
- **Kick-off meeting: December 14, Genesee Valley Club, 9-1 pm**