# *Science and Technology Centers: Integrative Partnerships*

## Contributions to
## Innovation and Economic Development

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Office of Integrative Activities

http://www.nsf.gov/od/oia/programs/stc00

# *STC: Integrative Partnerships*

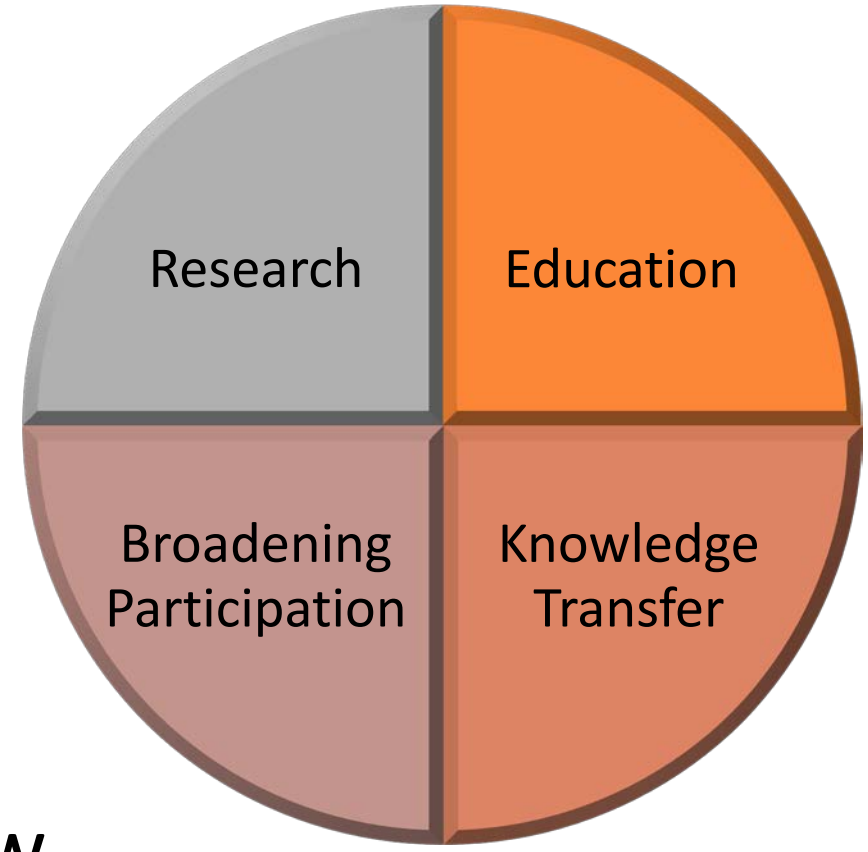
*The STC: Integrative Partnerships program supports innovative, grand-challenge research programs that require large-scale, long-term investments and embed education, diversity and the transfer of new knowledge to achieve the goals of the Center. STCs may involve any areas of science and engineering that NSF supports.*

# *Characteristics of STCs*

- "Center Mode": whole is greater than the sum of the parts (e.g., more than ten $500k/yr grants would provide) → "Value Added", Portfolio of integrated projects
- Exploit opportunities requiring the scope, scale, flexibility, duration, equipment and facilities of a Center → Bold yet achievable
- Support frontier investigations across and/or within disciplines ( "Transformative", "Grand Challenges") → Legacy
- Promote organizational linkages → Partnerships

# *Characteristics of STCs*

- Integrative learning and discovery for (U.S.) students → Broad set of career paths
- Engage and develop the Nation's talent, including groups underrepresented in STEM research and education → Diverse STEM workforce
- Foster science/engineering in service to society → Knowledge Transfer, new research areas, instrumentation, technologies



# *STC: Integrative Partnerships "Classes"*

- "Classes" of STCs to date: 1989, 1991, 2000, 2002, 2005/06, 2010, 2013, 2016
- *"Integrative Partnerships"* emphasis in the program title beginning with the Class of 2000
- Class of 2000 (5 Centers) "graduated" in 2010
  → Five new Centers started in Fall 2010
- Class of 2002 (6 Centers) "graduated" in 2013
  → Three new Centers started in Fall 2013
- Class of 2005/06 (6 Centers) "graduates" in 2017/18
  → Four new Centers started in Fall 2016
- Twelve current centers

# Knowledge Transfer Case Study: STC class of 2000

ENG/ECCS

NBTC Nanobiotechnology Center

Cornell U.

U.C. Santa Cruz

MPS/AST

cfAO

Center for Adaptive Optics

NSF Science & Technology Center

MPS/CHE

NSF STC

U.N.C. Chapel Hill

Environmentally Responsible Solvents and Processes

U. Arizona

GEO/EAR

SAHRA

Sustainability of semi-Arid Hydrology and Riparian Areas

Center for BEHAVIORAL NEUROSCIENCE

BIO/IOS

Georgia State U.

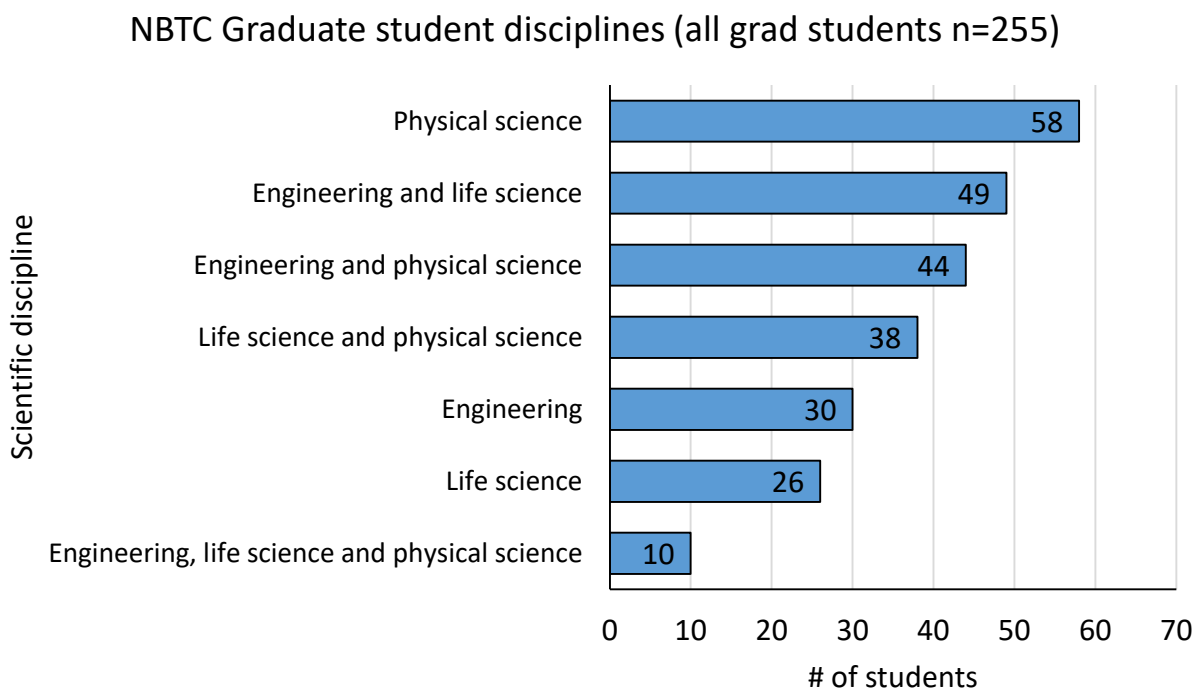
*Research undertaken by Christopher W. Williams, AAAS S&TP Fellow*

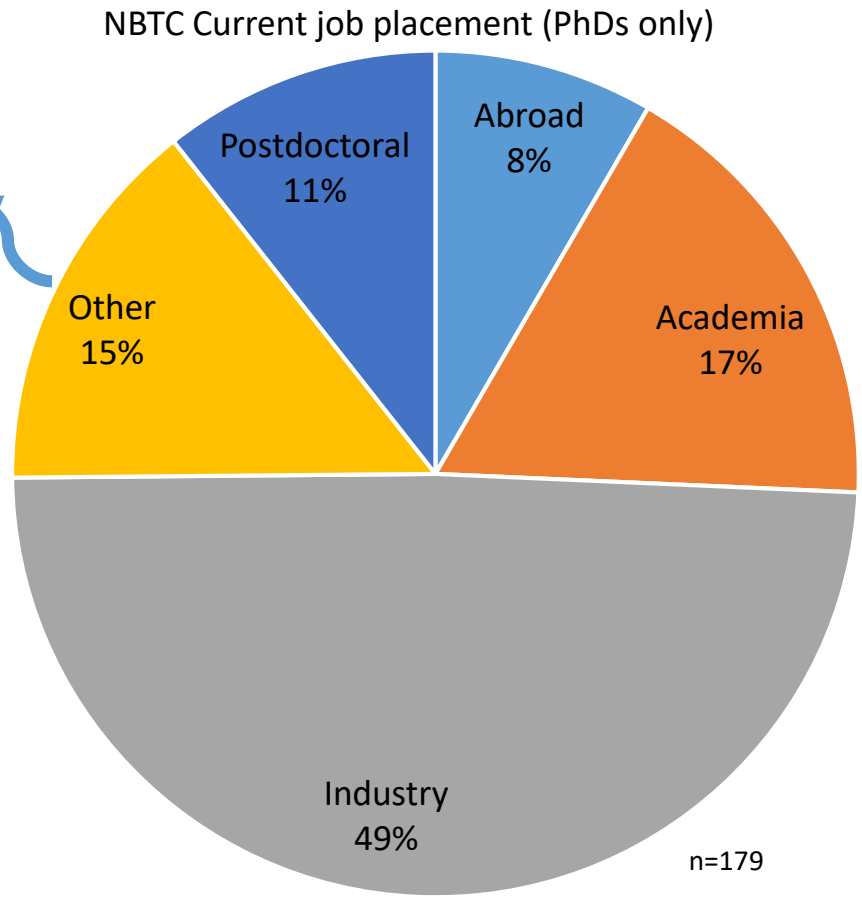
# Nanobiotechnology Center (NBTC):

## Synthesis of nano-microfabrication and biological systems

**311 graduate students**
Engineers
Life scientists
Physical scientists

- Consulting
- Government
- Non-profit
- Policy
- Research
- Student
- Law
- Professional
- Insurance



12 founders or co-founders of companies

# NBTC

11 leadership positions w/in companies

## *VP of Products and Co-founder of Quanergy*

- LiDAR- Light Detection and Ranging
- leading solid state LiDAR sensors and software
  - for real-time capture
  - high-definition 3D mapping data and object detection, tracking, and classification.


**Application areas include 'smart' and driverless cars**

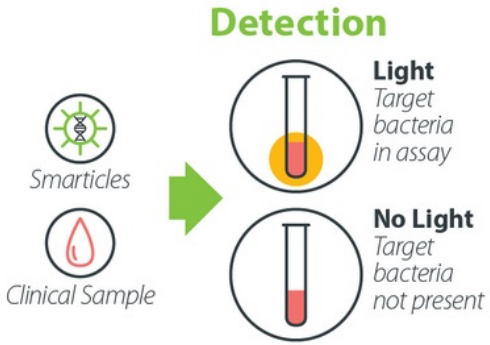
**Raised $90M in 2016**

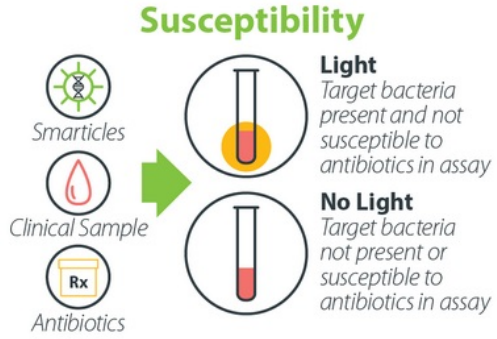
## *VP at Novomer*

- Transforming pollution into sustainable polymers and chemicals
- Ability to use CO and $CO_2$ to **offset global warming and climate change**
- Acquisition by Saudi Aramco valued at $100M


## *Co-founders, CTO, Scientific advisor of Geneweave*

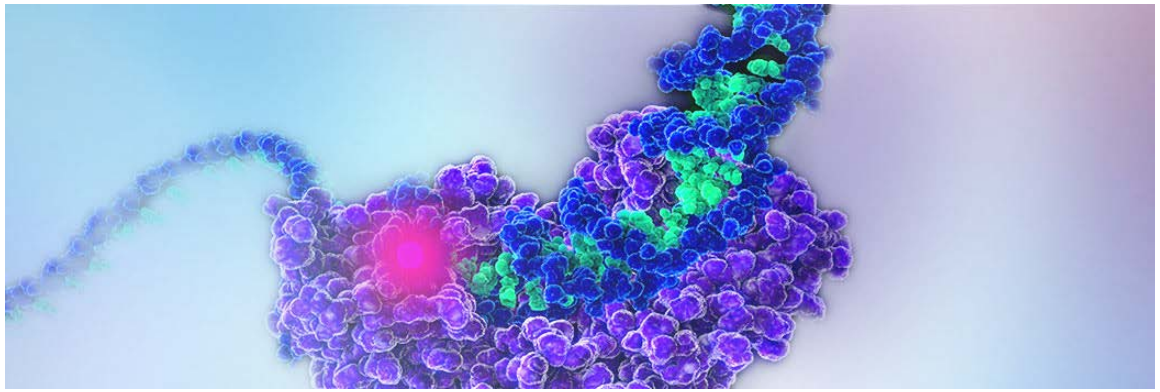
- Microbial diagnostics and "Smarticles"
  - quickly detect the presence of drug-resistant microbes in clinical samples
  - determine which antibiotics are best to treat them
- Roche acquired Geneweave in 2015 for $190M (up to $425M)




## *Chief Science Officer at Pacific Biosciences*

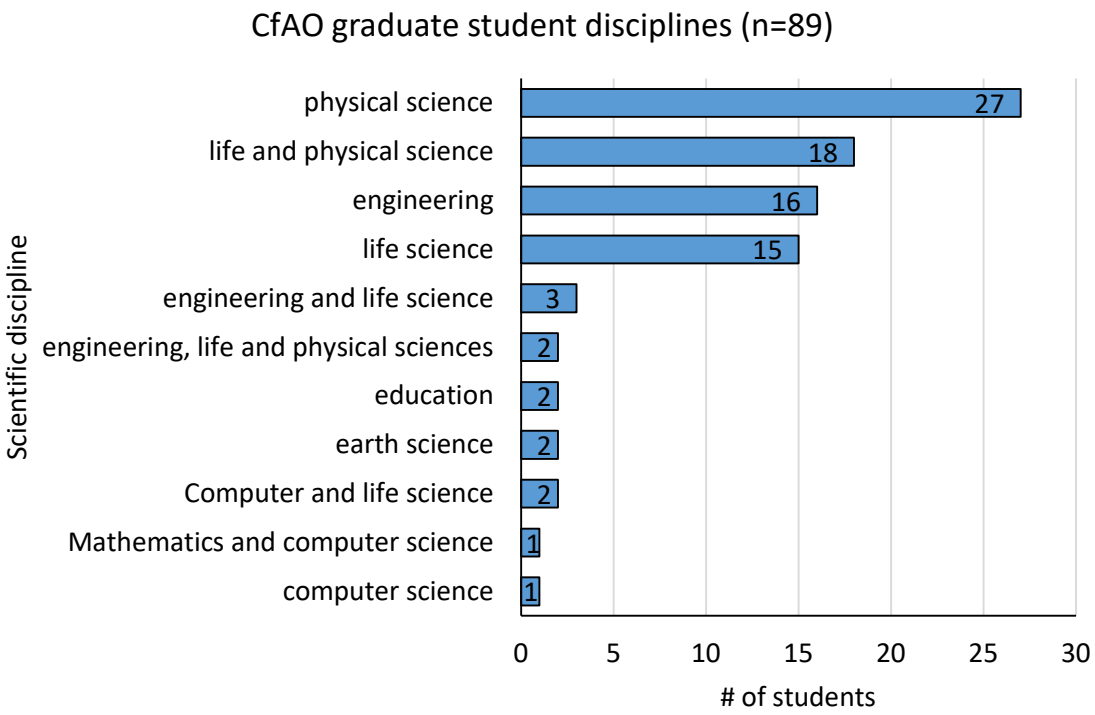
- Provides genomic analysis systems and related products
- ~100M in revenue annually
- Single Molecule, Real-Time (SMRT) sequencing



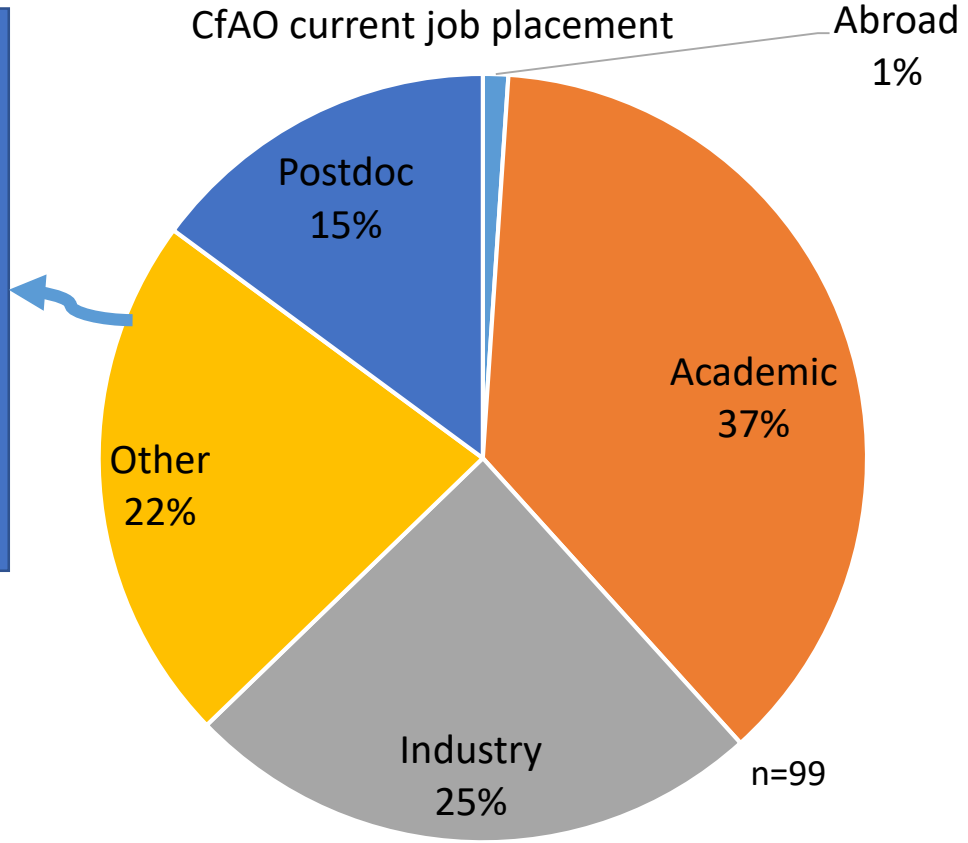
# Center for Adaptive Optics (CfAO):

## Astronomical and vision science applications of adaptive optics

**165 graduate students**
Engineers
Life scientists
Physical scientists
Others




- Entrepreneur
- Government
- Massage/physical therapy
- Non-profit
- Policy
- Teaching/education
- Finance
- Eye health
- Marketing
- Science communication



6 founders or co-founders of companies

# CfAO

12 leadership positions w/in companies

## *Co-founder, Chief Science Officer at hiQ Labs*

- hiQ Labs helps HR teams make better, more reliable people decisions
- As of March 2016, hiQ has 25 *Fortune* 500 customers
- Received $7.39M in investments in 2016


How do you retain the best and brightest employees? Which employees are being heavily recruited? What are your organization's skills and capabilities gaps? What talent should you recruit vs develop?

## *Co-founder and CTO at Smart Yields Inc.*

- Founded in 2015
- A cloud-based software product
  - Agriculture analytics and in-field monitoring devices
  - small- and mid-size farmers
  - Increase yields and protect crops
  - Sensors, alarms and RT monitoring
  - Over 81 sensors

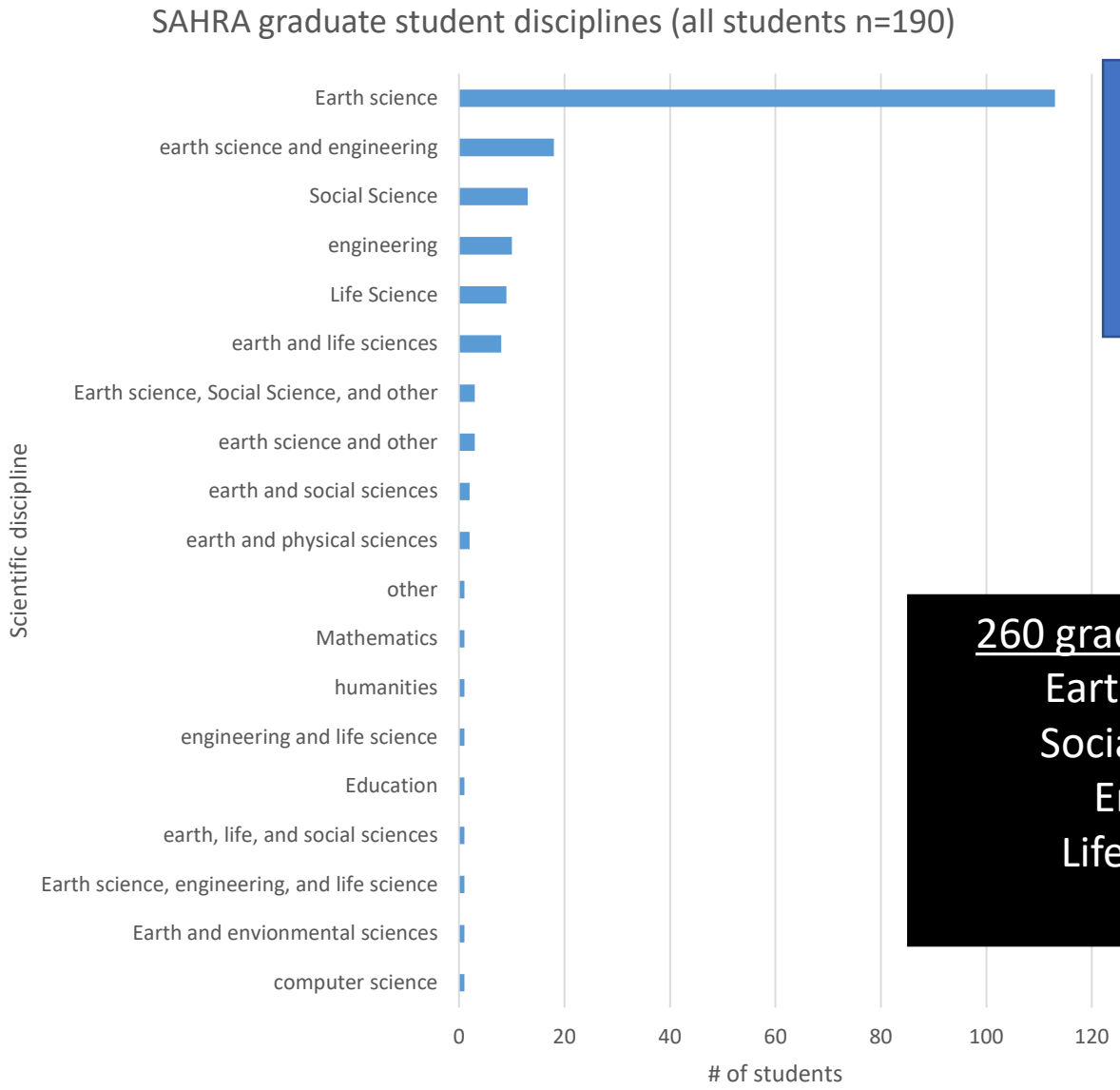
***$25K raised in 2015***


## *CEO at Smart Vision Labs*

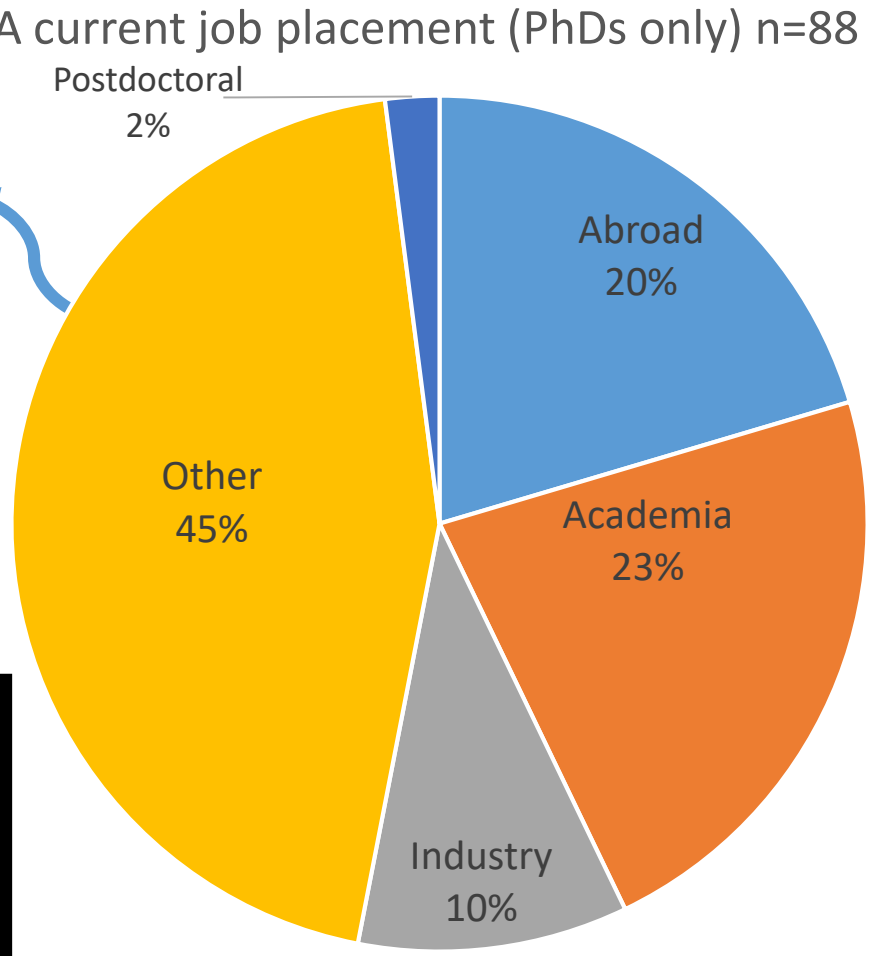

Smart phone-powered eye exam

- Goal- make eye exams cheap and accessible
- Measures vision using NASA technology
- SVOne Pro
  - self-guided vision testing system that bringing telemedicine to optometry.
- Found in 21 eye centers across NYC
- Raised $6.1M in 2015

# Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA): Promote sustainable management of water resources in semi-arid regions




- Consulting
- Government
- Non-profit
- Policy
- Research
- Student




**260 graduate students**

Earth scientists
Social scientists
Engineers
Life scientists
Others

3 founders or co-founders of companies

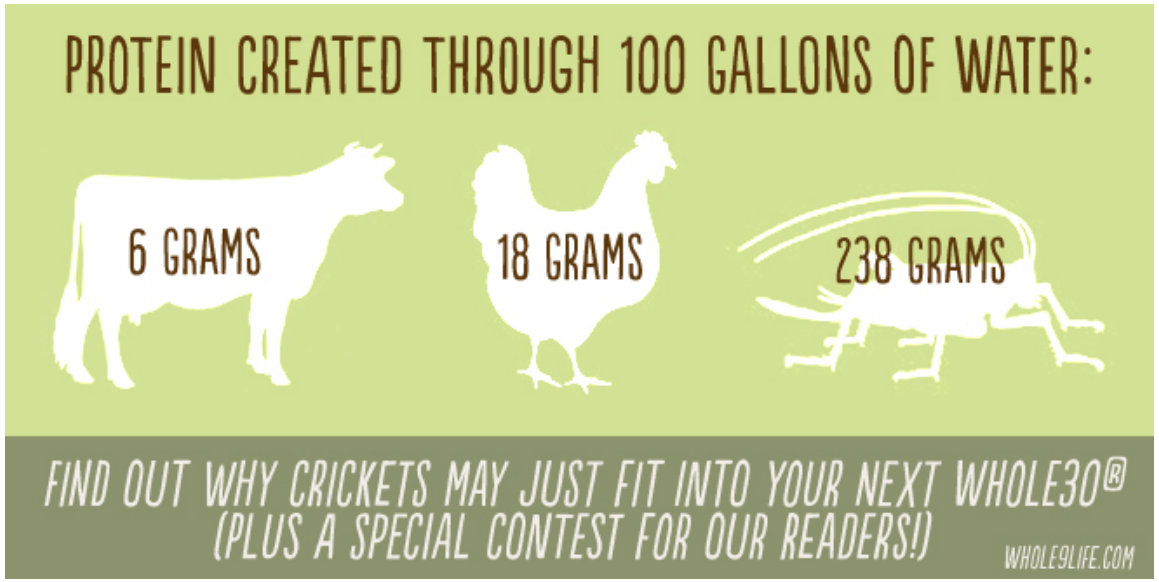
# SAHRA

4 leadership positions w/in companies

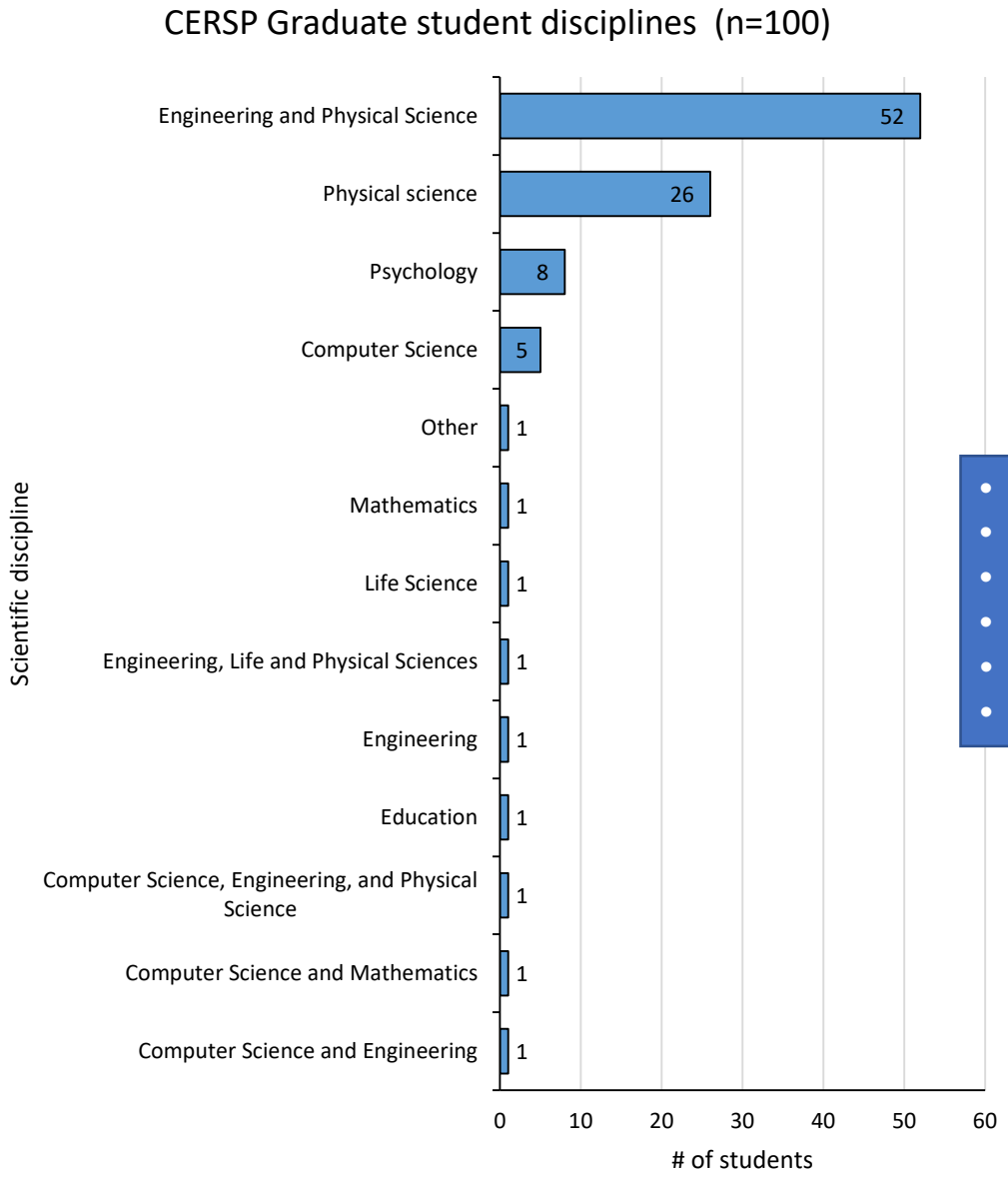
## ***Founder, Chapul***

- Founded in 2012
- Cricket-based food products
- Expected to be in 3-4,000 stores at start of 2017
- Contestants on Shark Tank
  - Valued between $300K and $1M (as of 2014)

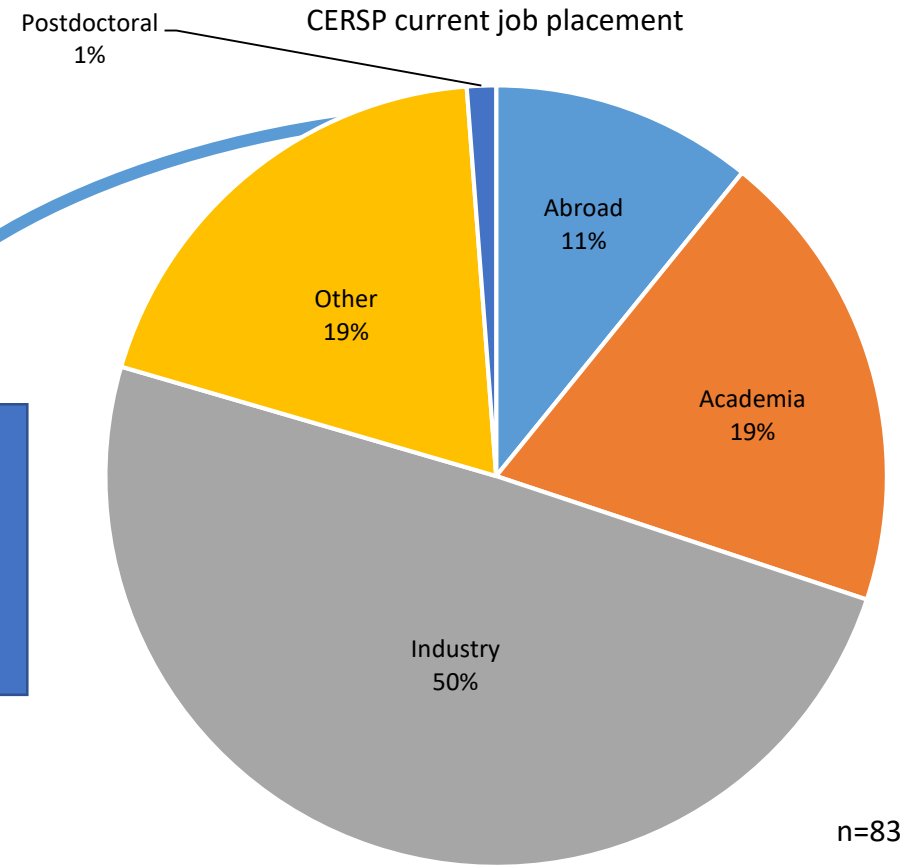




# Center for Environmentally Responsible Solvents and Processes (CERSP): Understanding of liquid and supercritical carbon dioxide (CO2)




- Consulting
- Government
- IT
- Non-profit
- Student
- Teacher




**149 graduate students**
Physical scientists
Engineers

6 founders or co-founders of companies

# CERSP

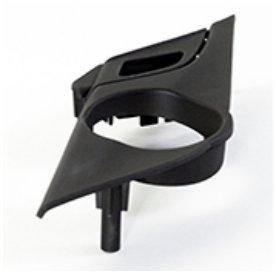
7 leadership positions w/in companies

## *VP, Sigma International*

- Global manufacturing company
  - Automotive decorative trim
  - North America, Asia and Africa
- ~$12M annually

SIGMA INTERNATIONAL

MOLD | PLATE | LED | PAINT



## *CTO, InDevR*

- Diagnostic biotechnology instruments
- Vaccine characterization and production
  - Influenza
- ~$3M annually
  - Funding from NIAID and BARDA

CYPHER ONE™

*automated hemagglutination analyzer*

VAXRRAY Influenza ™

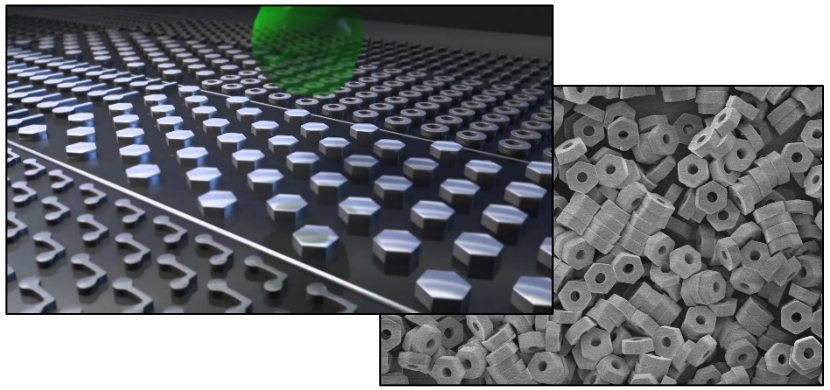
*rapid flu vaccine potency assay*

## *Co-founders, Liquidia Technologies*

- Biopharmaceutical company
- Founded in 2004
- ~$10M annually

LIQUIDIA TECHNOLOGIES

- PRINT technology
  - Nano-fabrication process
- Design drug particles
  - Uniformly in size and shape
    - Small molecules
    - Peptides
    - Biologics

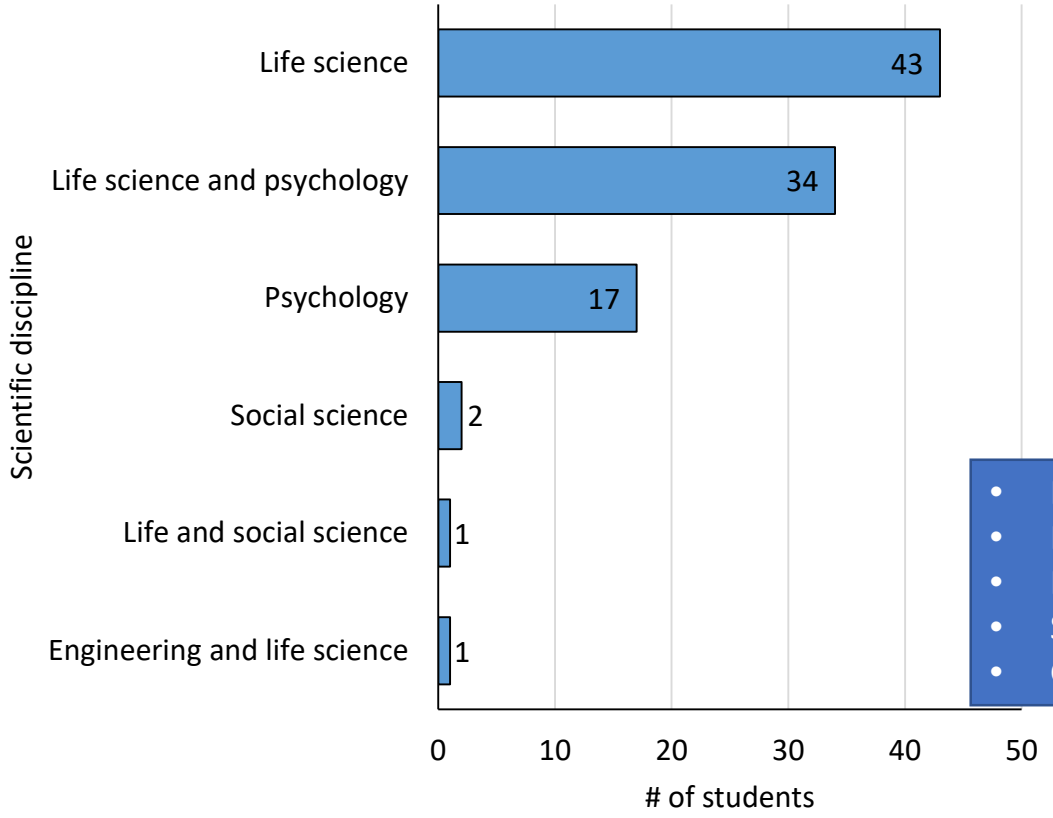


# Center for Behavioral Neuroscience (CBN):

## Collaboratory approach bringing modern molecular biology into behavioral research

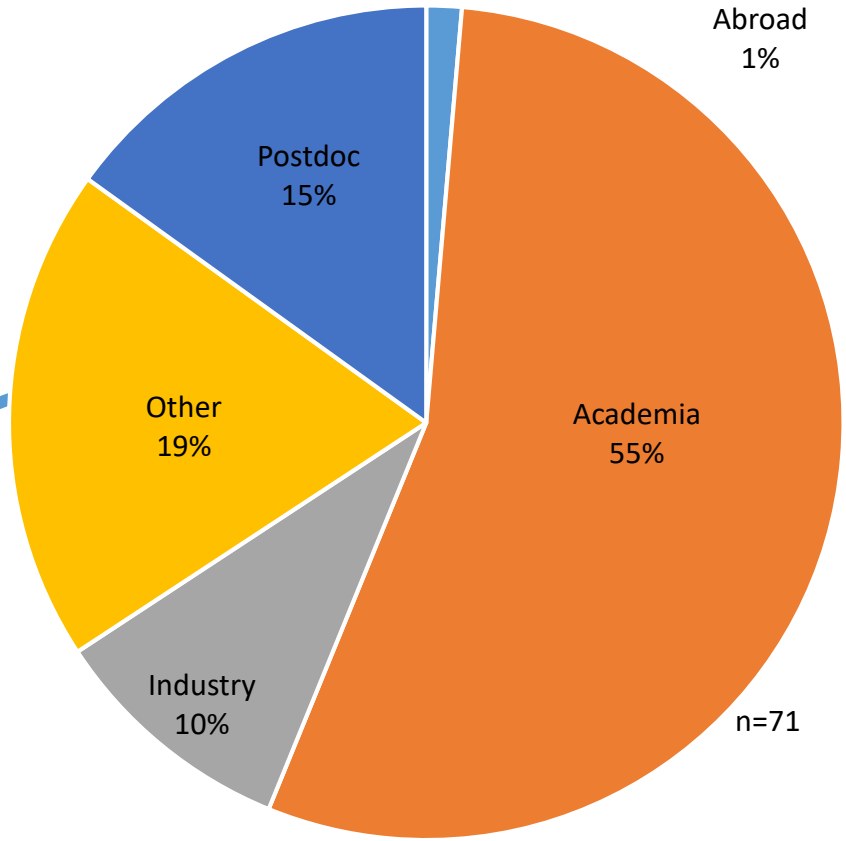
**117 graduate students**
Life scientists
Psychologists

CBN graduate student disciplines (all n=98)




- Professional
- Medical writer
- Patent agent
- Science writer
- Government research

CBN Current job placement (PhDs only)

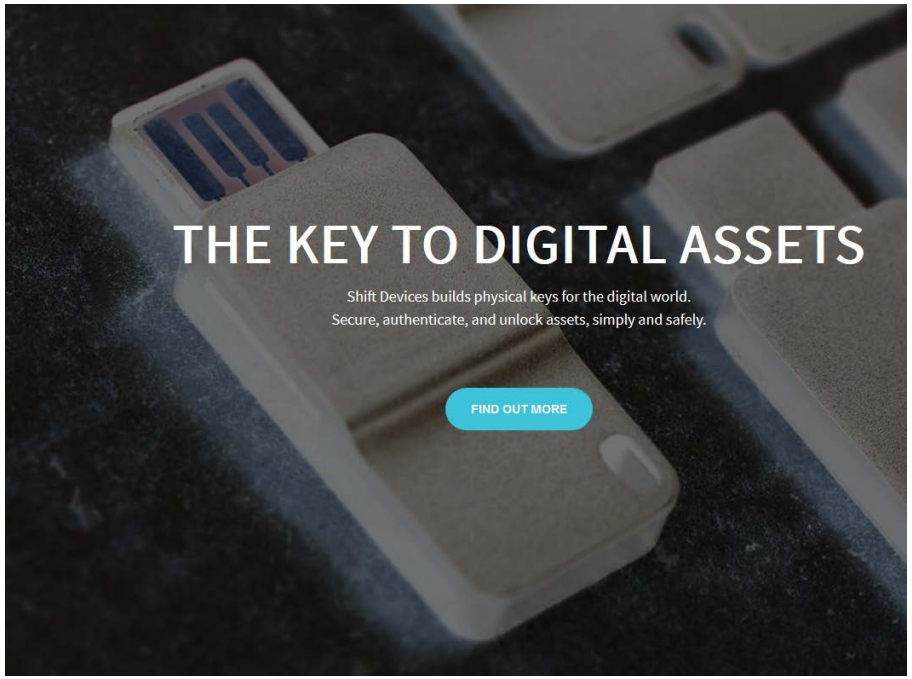


2 founders or co-founders of companies

CBN

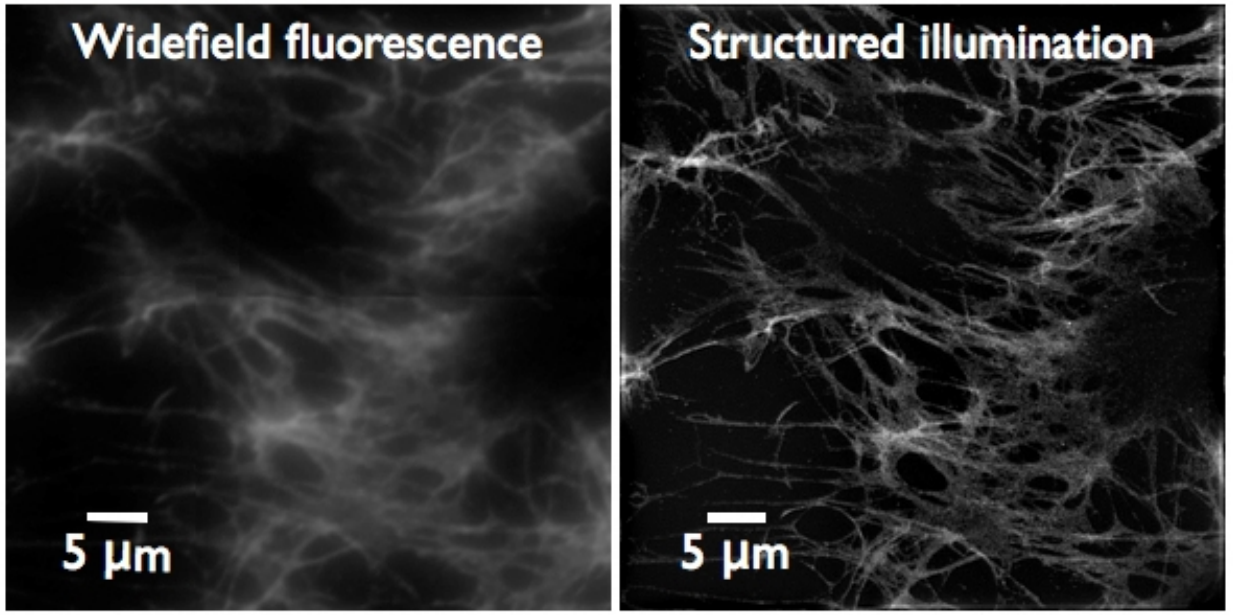
## *Co-founder Shift Devices*

- Digital security company
- Founded in 2015
- Applications
    - Secure storage
    - Digital signatures
    - Encrypted communication
    - Passwordless login



# Commercialization Highlight – STC Class of 2002

Dr. Francis Collins, the Director of NIH, in a 2012 article "'OMG' Microscope Lives Up to Its Name", noted the spectacular imaging provided by the GE Healthcare/Applied Precision Delta Vision OMX imaging system. He noted that the mitosis image in the article will "light up a billboard in Times Square" in 2012 and Dr. Collins felt that this is a "wonderful celebration of science!". What the NIH Director failed to mention is that the development of the OMX (or now it seems "OMG"!) microscope was the result of MRI/STC awards to UC Davis. The MRI award was to develop, commercialize, and enhance a high-resolution structured-illumination (SI) light microscope system,, with the first commercial OMX system to be tested at the NSF Class of 2002 Center for Biophotonics Science and Technology (CBST) .The resulting instrument that is now available to researchers throughout the world.




The comparison shows the difference between fluorescence imaging with a conventional microscope (left) and with the OMX microscope (right).