Building An Innovation-Driven Cancer Center:
Clinical Care, Research, and Entrepreneurship

Laurie Owen, Ph.D.
Associate Director
USA Mitchell Cancer Institute

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State-of-the-Art Research and Clinical Facilities (Occupied October 2008)

$85 Million Construction and Equipment

Largest Single USA Research Investment ($135 M)

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Mitchell Cancer Institute Strategic Goals

- **Develop and maintain a cutting-edge interdisciplinary, research- and innovation-driven clinical cancer institute with regional and national impact.**

- **Achieve NCI Cancer Center designation.**

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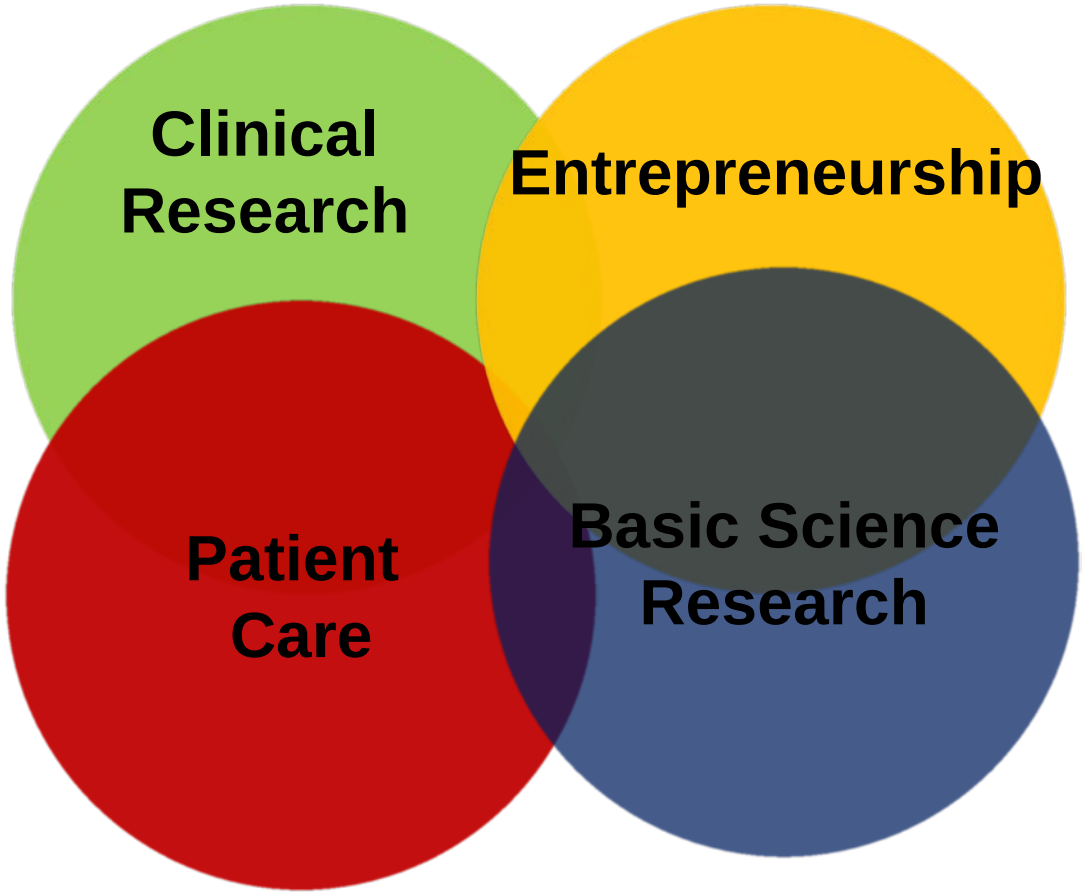
The Mitchell Cancer Institute



Innovation and Impact

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Research Programs at MCI

12 PI-Led Research Groups focused on:

- Cancer Biology
- DNA Damage and Repair
- Biomarkers and Early Detection
- Cancer Prevention and Drug Discovery

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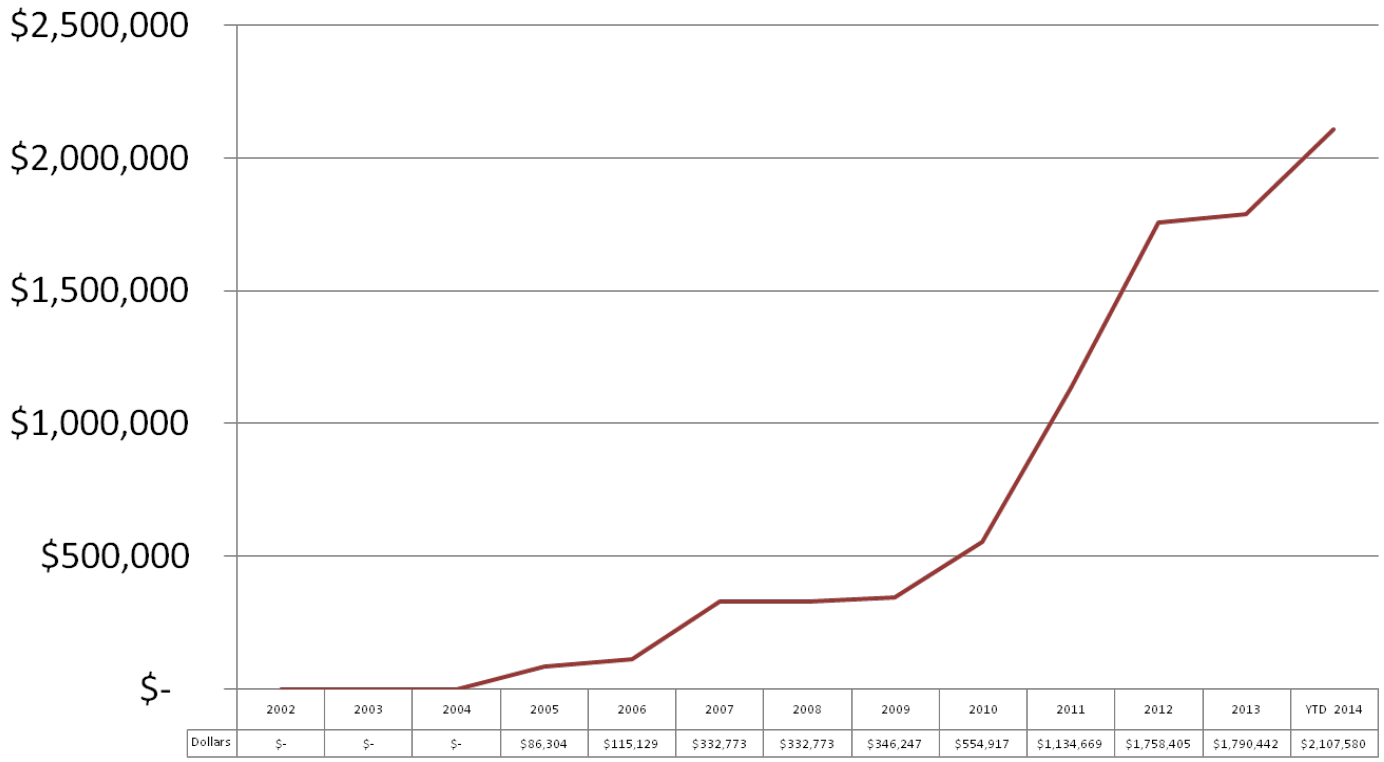
Cumulative Federal Peer-Reviewed Grants Dollars Per MCI PI



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	YTD 2014
Dollars	$-	$-	$-	$86,304	$115,129	$332,773	$332,773	$346,247	$554,917	$1,134,669	$1,758,405	$1,790,442	$2,107,580

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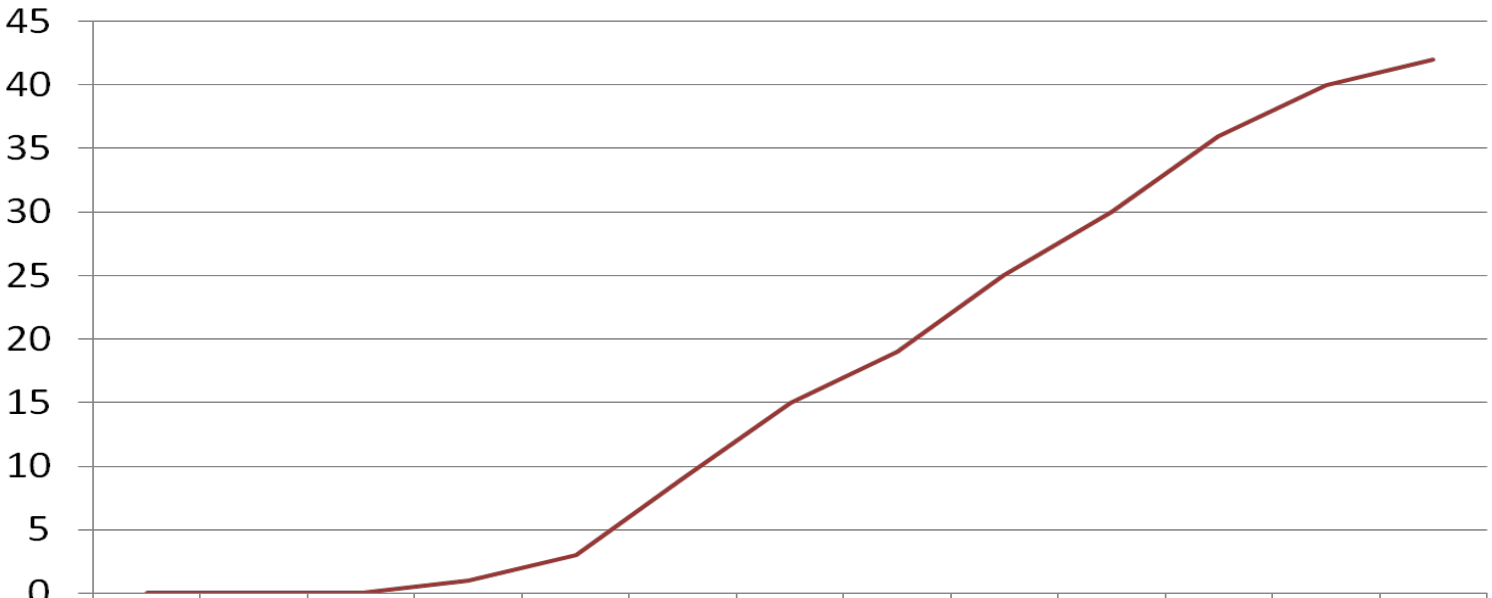
Cumulative MCI Invention Disclosures



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	YTD 2014
Disclosures	0	0	0	1	3	9	15	19	25	30	36	40	42

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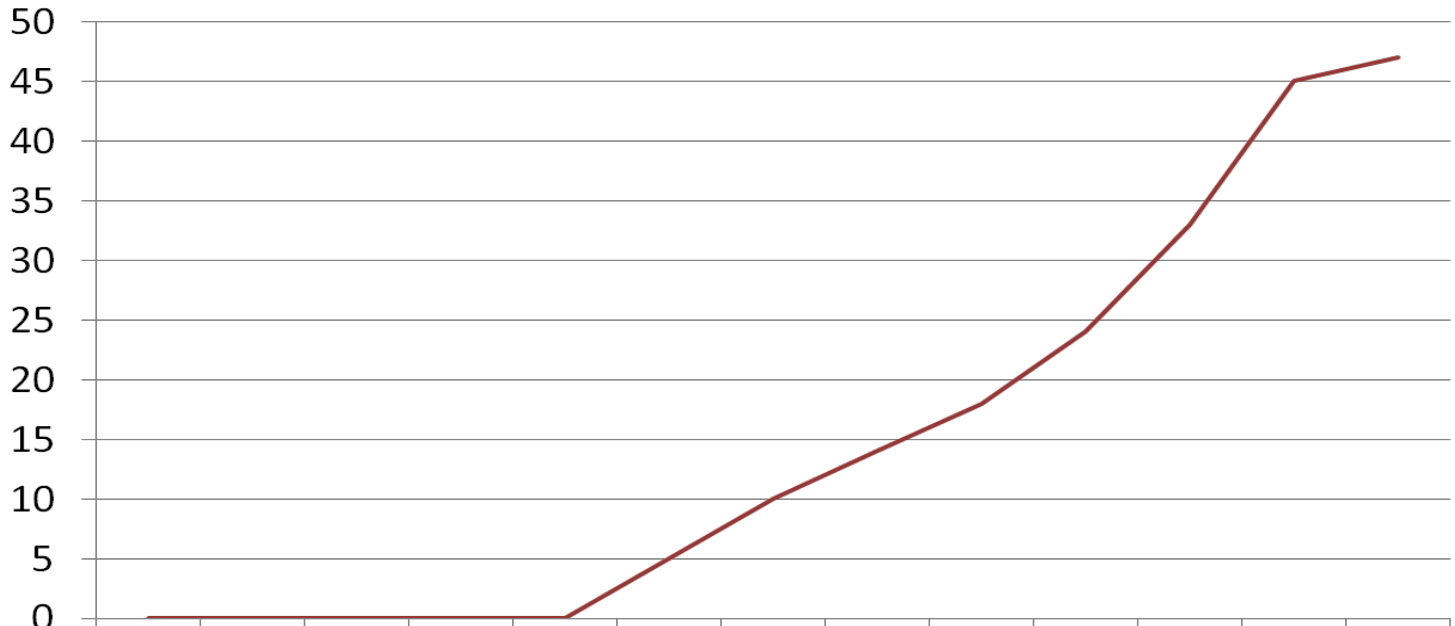
Cumulative MCI Patents Filed



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	YTD 2014
Patents Filed	0	0	0	0	0	5	10	14	18	24	33	45	47

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Ingredients For Growing A Successful Research Program

- Talented, Interested, and Energetic Faculty
- Workforce (students, postdoctoral fellows, staff)
- Collaborations
- Institutional Support
- Institutional Infrastructure
  - Compliance (IRB, IACUC, Bio-safety, etc.)
  - Grant/Contract Support
  - Tech Transfer/Commercialization
  - Space/Equipment

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MCI Shared Resources and Cores

- Atomic Absorption Spectroscopy
- Tumor Biobank
  - Biofortis (Labmatrix)
- Flow Cytometry
  - Cancer stem cell isolation
- Mass Spectrometry and Proteomics
  - Waters Ultima QTOF, ThermoFisher Orbitrap,
  - ThermoFisher Q-Exactive Plus nano-LC (Orbitrap)
- Cellular Bioenergetics
  - Seahorse Extracellular Flux (XF)
  - Hypoxia chamber, incubator
- High Throughput Screening for Drug Discovery
  - Automated liquid handling
  - Robotic arm, confocal imager and multimode
  - multiplate reader
- Advanced Microscopy
  - Super-resolution microscopy, laser micro-dissection

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Unique Shared Use Facilities at MCI

- High-throughput automated screening with industrial robot, liquid handling, imaging read-out (1 of 2 facilities in State)

- Advanced Microscopy Center
  Super-resolution microscopy (SIM and STORM)
  (1 of 4 facilities in United States)

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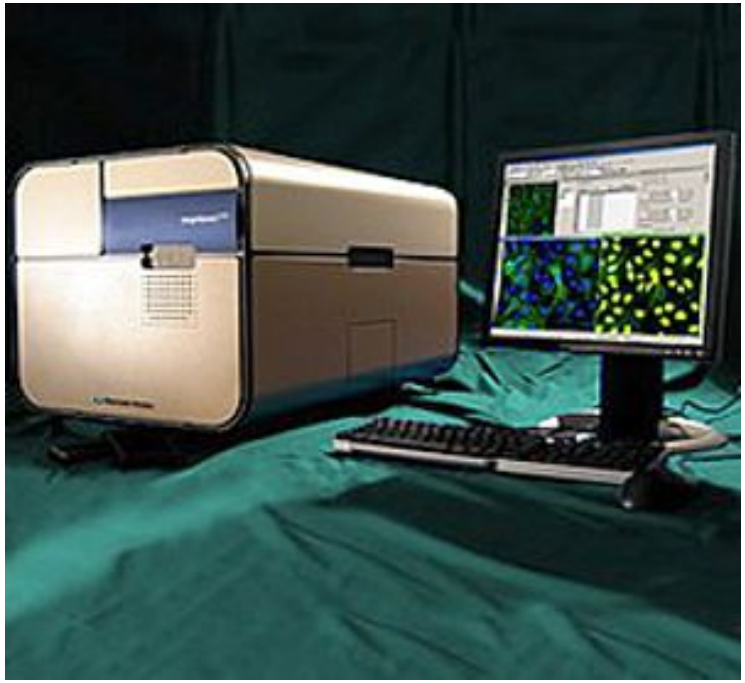
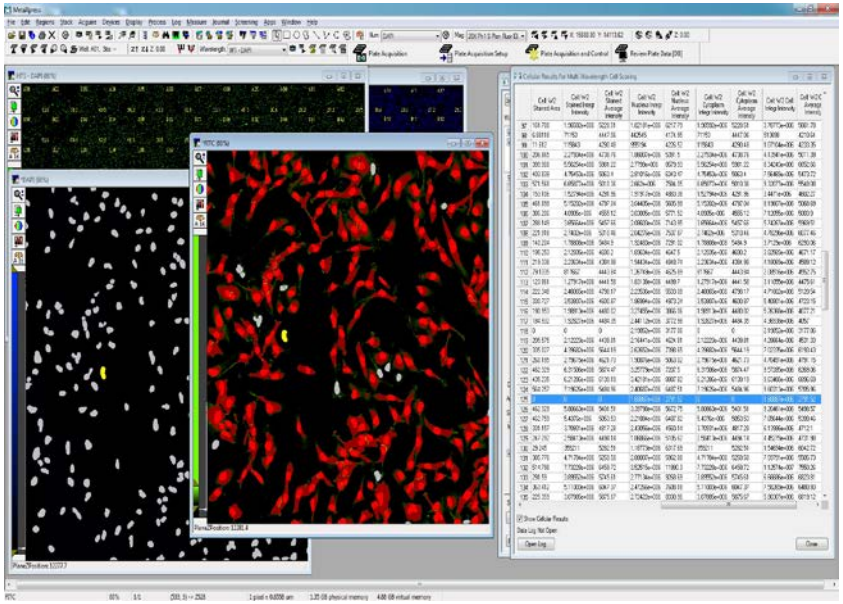
Image-Based High Content Screening





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Beckman Coulter FXp Liquid Handler

What are the Strengths of High Content Screening?

- HCS can measure cell health and treatment effects of experimental anticancer drugs (e.g. apoptosis, cell cycle arrest, etc)
- HCS can measure translocation of intracellular proteins (e.g. transcription activation)
- HCS can measure changes in cell morphology (e.g. differentiation)
- HCS can find rare events in adherent cultured cells
- Or all of these in the same assay with high reproducibility, low variability, in very low volumes

Laboratory Automation and High Throughput: Built to do experiments in microscale

Smaller well volumes save expensive and/ or precious reagents

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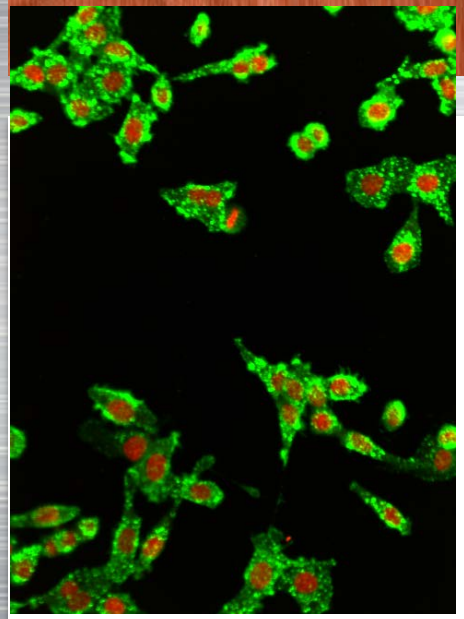
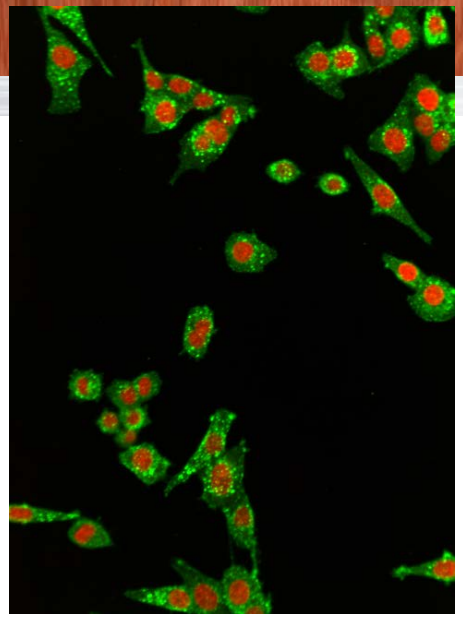
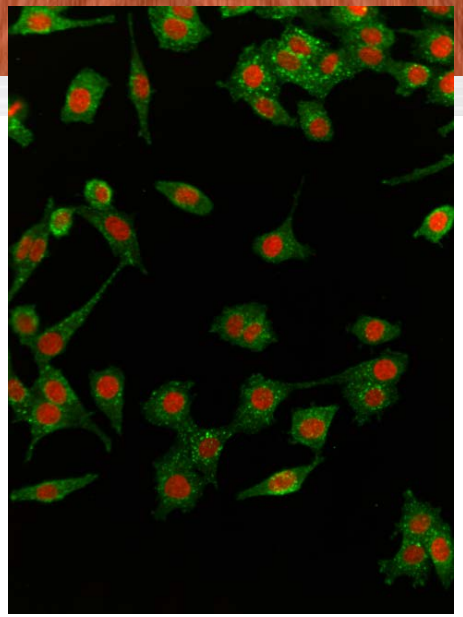
Inhibition of EGFR Autophosphorylation



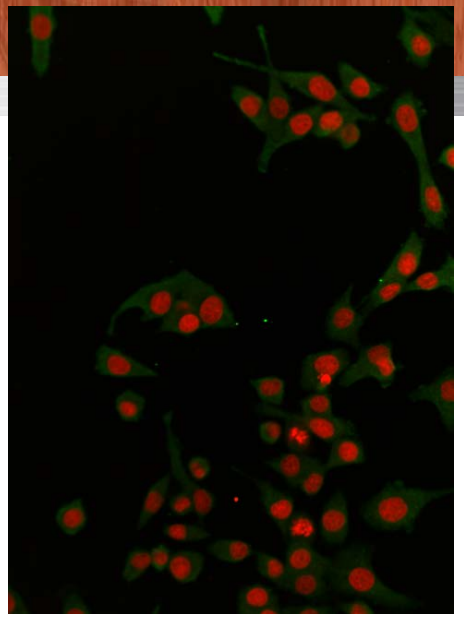
EGF + Vehicle



EGF + 25 nM MH-31

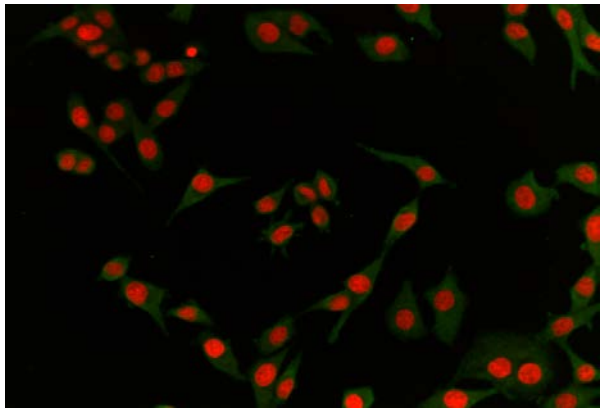


EGF + 225 nM MH-31



EGF + 2000 nM MH-31

Minus EGF Control



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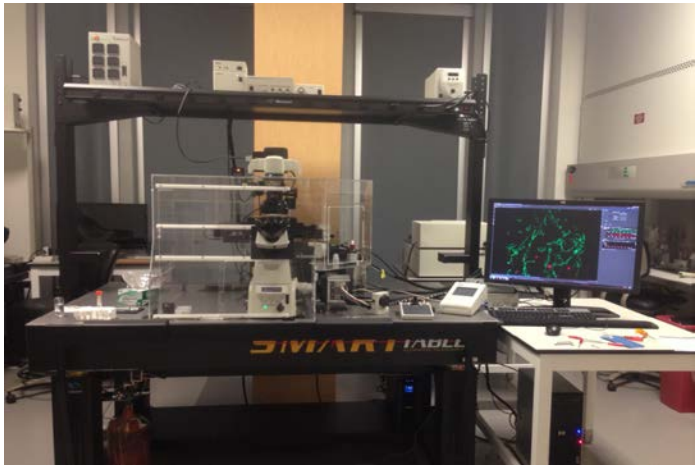
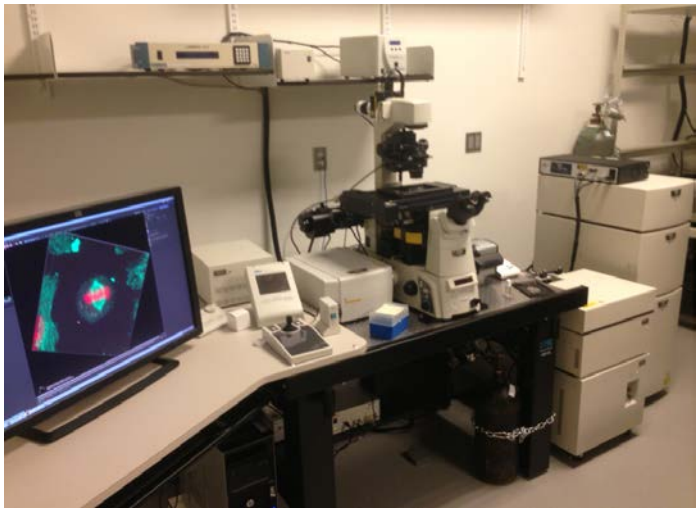
Advanced Imaging Facility at MCI

SIM

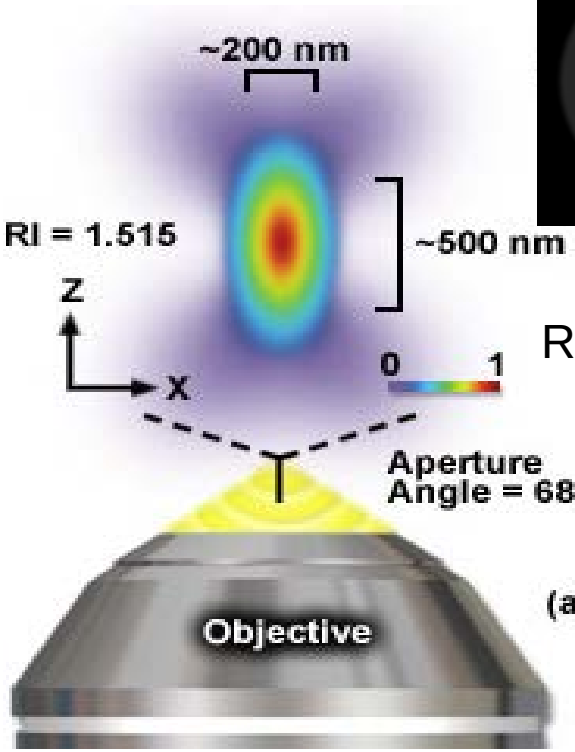


STORM



Resolution of Visible Light vs. Super-Resolution (sub-diffraction)

- Resolution of visible light limited by light diffraction
- Defined by Abbe Equation (1873)- 200 nm



Light microscopy (<200nm) Super-resolution

Resolved Not Resolved Resolved

50 nm-SIM
20 nm-STORM

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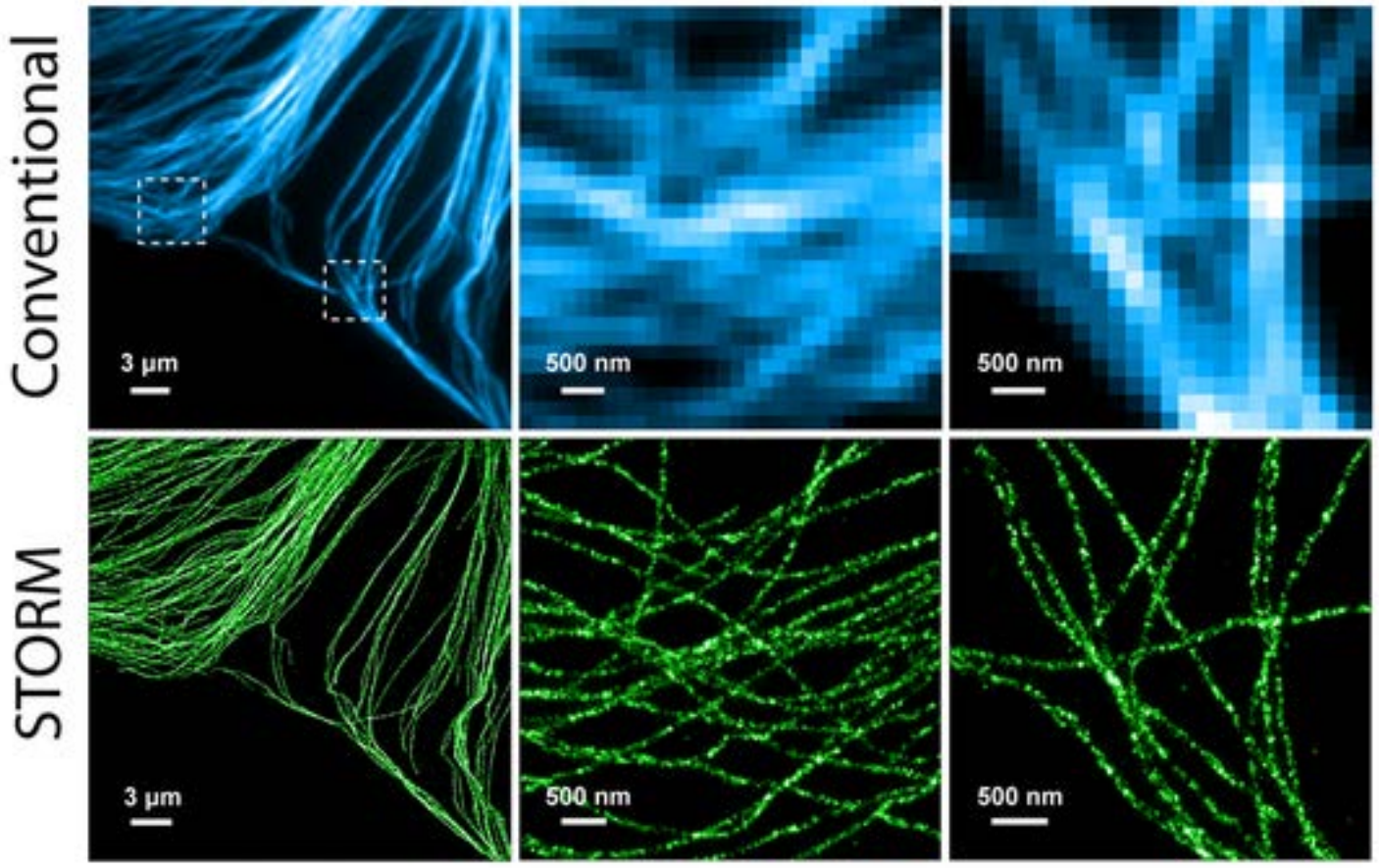
Image Comparison Conventional Vs. Super-Resolution Microscopy



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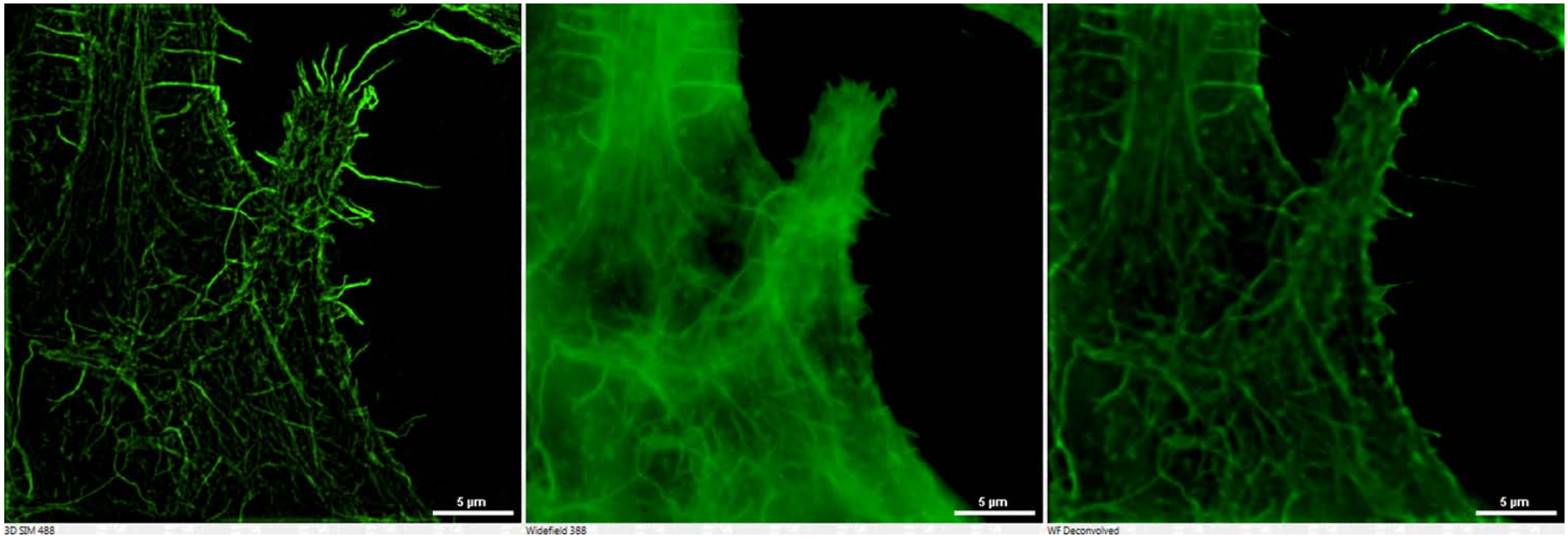
Super-Resolution Compared to Conventional Microscopy



3D-SIM

Widefield

Deconvolved Widefield

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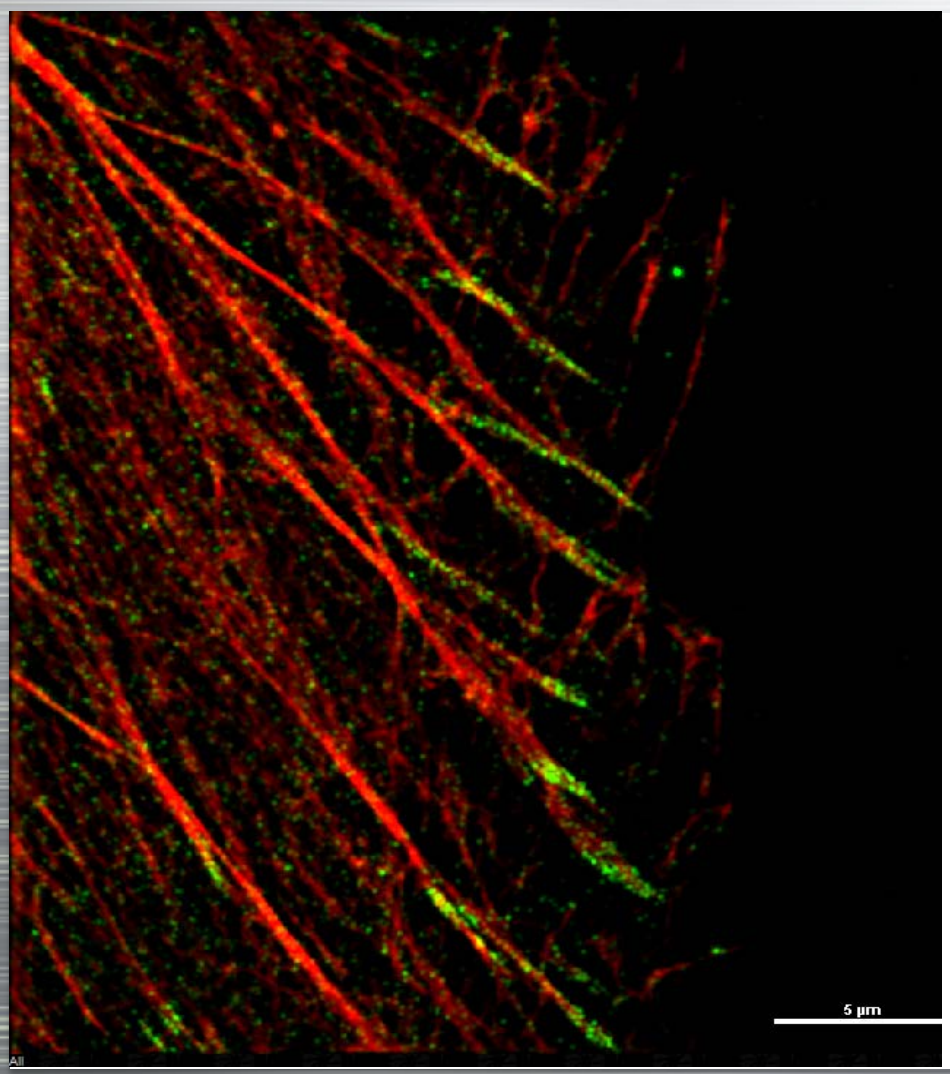
Super-Resolution Imaging



3D-SIM super-resolved image of actin (red) and VASP (green) association in A549 cells

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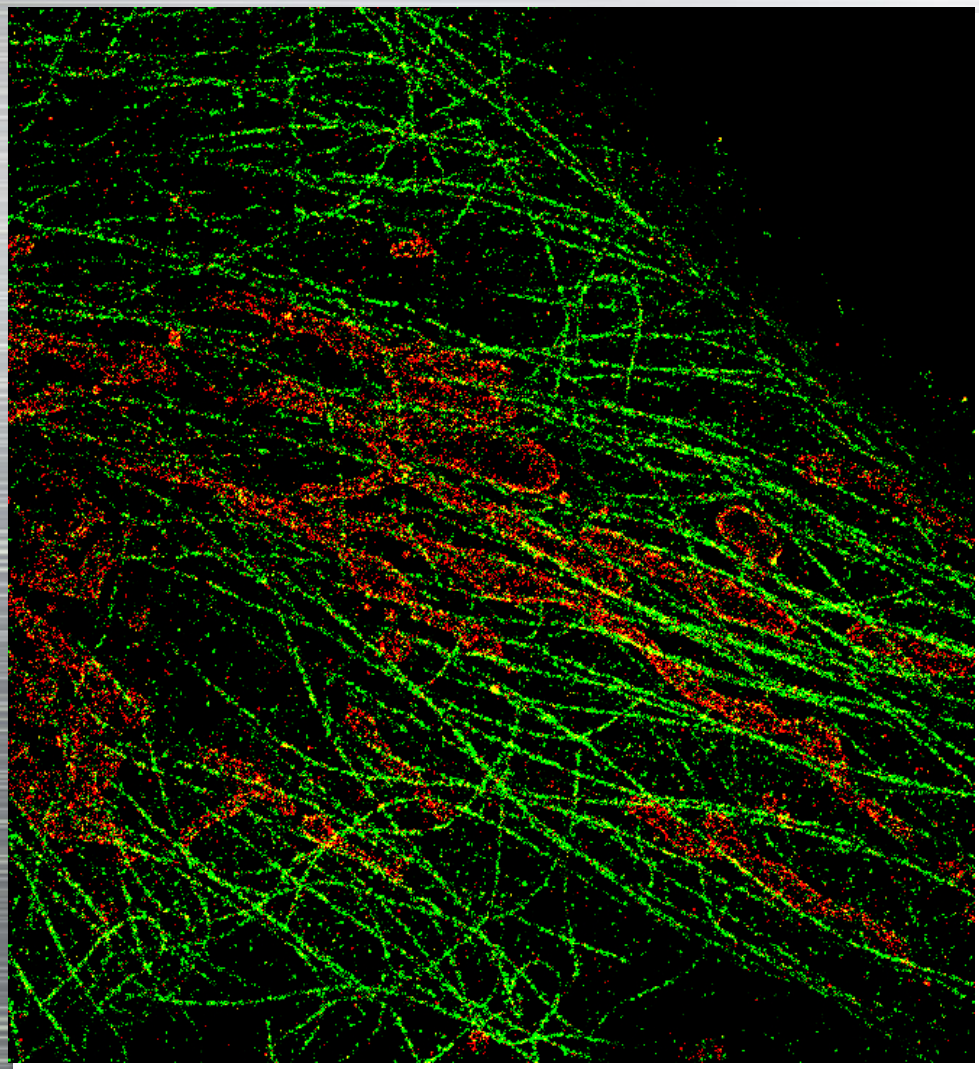
Super-Resolution Imaging



STORM super-resolved image of mitochondria (red) and microtubules (green) in HeLa cells

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