Calvin, Phoebe and Joan Snyder Institute for Chronic Diseases

LCI

Live Cell Imaging Resource Lab

UNIVERSITY OF CALGARY

Practical approaches to optical microscopy education at the LCI resource lab

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LIVE CELL IMAGING RESOURCE LAB

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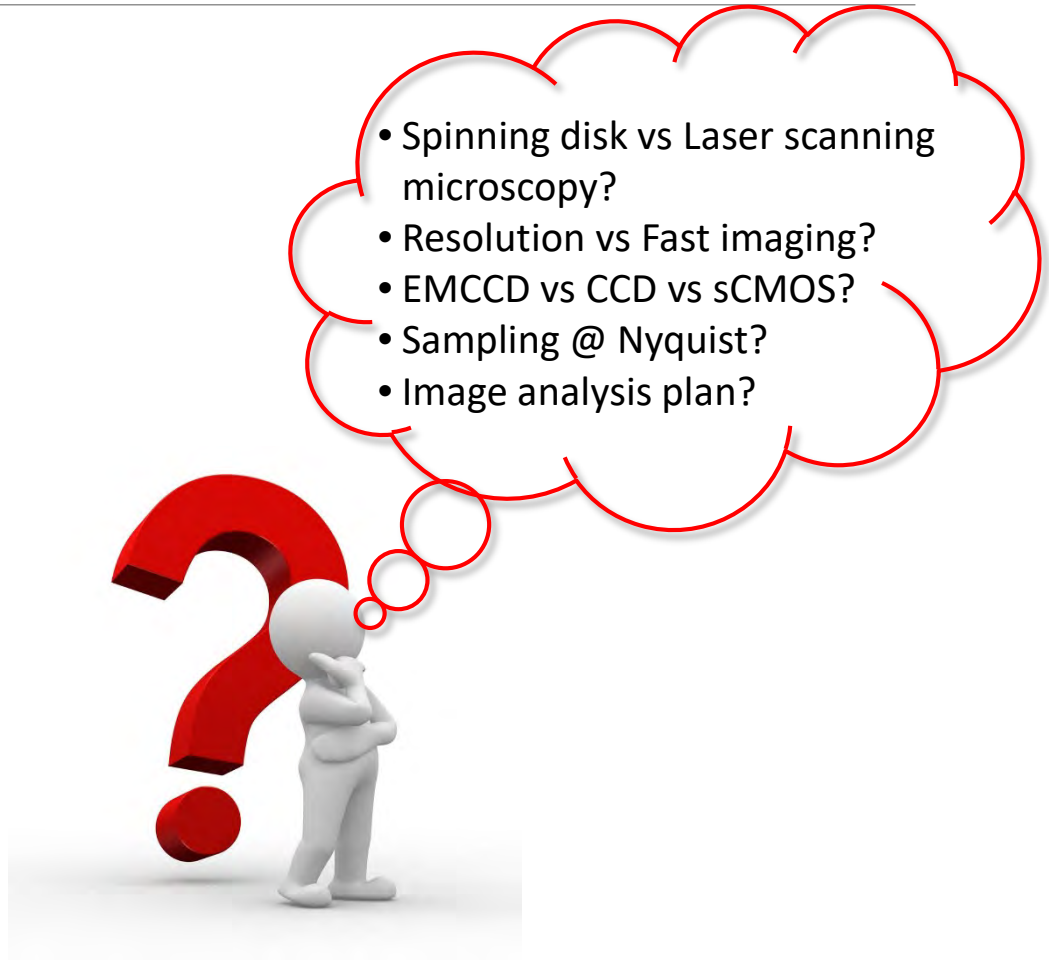
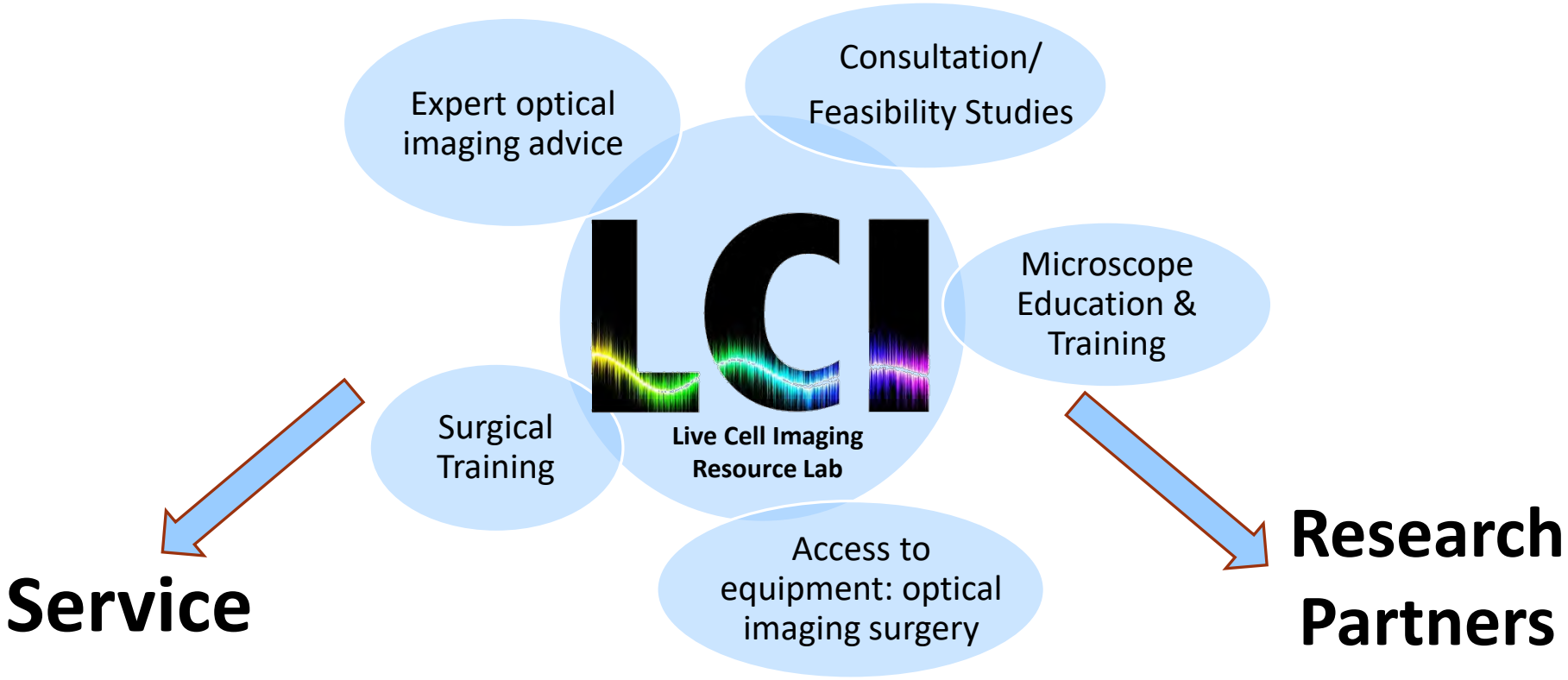
Knowledge gap in microscopy



What are the options for hands-on microscopy training?

- Montreal Light Microscopy Course (MLMC), Montreal, QC
- Canadian Light Microscopy Course (CLMC), Calgary, AB
- Marine Biological Laboratory, Woods Hole, MA
- Cold Spring Harbor Laboratory, Cold Spring Harbor, NY
- Mount Desert Island (MDI) Biological Laboratory, Bar Harbor, ME
- Institut Pasteur, Paris, France
- European Molecular Biology Laboratory (EMBL), Heidelberg, Germany
- Workshops offered by commercial organizations
- and many more…

How are we helping our research community?



Mission: Drive research, education and training in optical imaging

Educational activities at all level

- Step-wise training program for the LCI's users
- Workshops and educational opportunities for researchers who do not use the LCI instruments

Step-wise training program to the LCI users

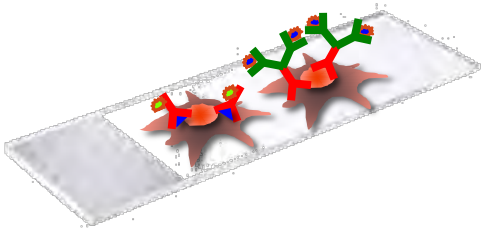
- Meeting with the researcher to **define the project** imaging goal
  - Experimental design
  - Image acquisition
  - Image analysis plan
- Pre-training **worksheet** and review **learning outcomes**
  - Introduction to fluorescence & wide-field microscopy
  - Laser scanning confocal microscopy
  - Spinning disk confocal microscopy
  - Multiphoton microscopy
  - Image analysis

- One-on-one training session(s) tailored to the project and the user's background
- Follow up meetings and on-going support with the researchers

Consolidating the skill set

Monthly (or as needed) microscopy workshops

- *Brightfield imaging*
- *White-light and contrast techniques*
- *Fluorescence wide-field microscopy*



Sample Preparation & Immunofluorescence

ImageJ

Image Processing & Analysis in Java

Image analysis

- *Digital imaging analysis*
- *Colour and colocalization*
- *Ethics of digital imaging*

Educational opportunities

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3 Graduate Microscopy Modules

3-day workshop
Fundamentals of microscopy

CLMC
Canadian Light Microscopy Course
July 17-21, 2017

5-day workshop
Intermediate to advanced microscopy

Example of the curriculum for the 3-day LCI jumpstart workshop

Microscope on a rail: Understanding image formation

White-light & Contrasting techniques

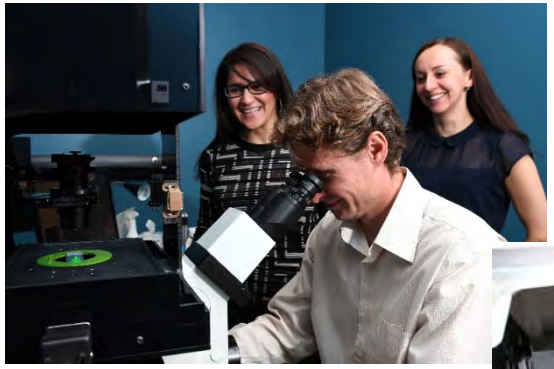
Intro to fluorescence microscopy & Digital imaging acquisition

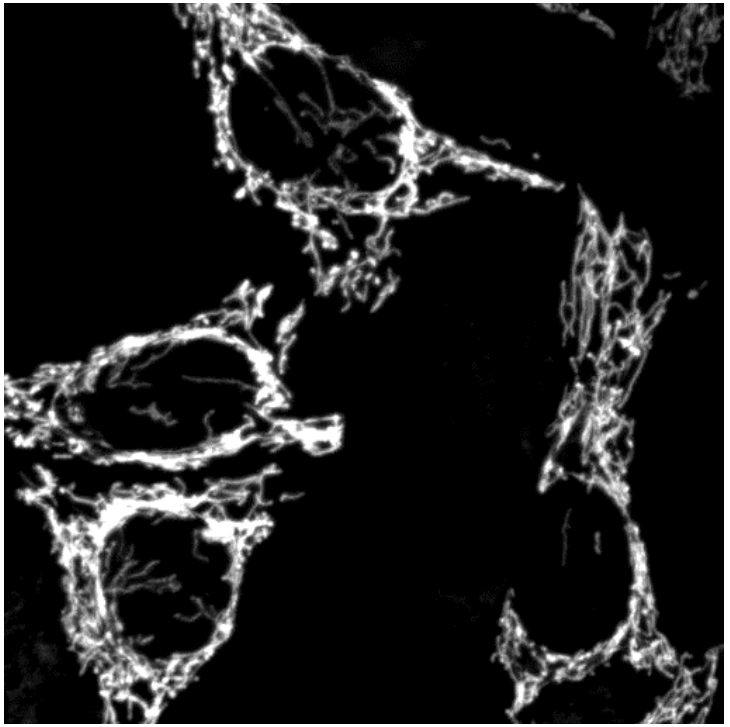
Over the years, the following people have contributed to the jumpstart:
Craig Brideau, Claire Brown, Andrew Chojnacki, Pina Colarusso, Grant Gordon, Jennifer Poirier, Kelvin Poon, Rima Wazen, Katarzyna Wojcik, and many others

Example of the curriculum for the 3-day LCI jumpstart workshop

Example of application-based activity

- *Acquisition of multi-color images*
- *Spatial and temporal sampling*
- *Setting up for live cell imaging*





HeLa cells stably expressing MitoDsRed.
Courtesy of Nicole Mancini, McKay lab

Example of the curriculum for the 3-day LCI jumpstart workshop

- **Case studies:** bridging the gap between theory and good practice

John needs multi-channel images of some fixed samples. He wants to understand the spatial relationships between proteins A, B, and C at the highest resolution possible. Proteins A and B are abundant and label well, but the protein C labelling is dim and hard to see. He has two microscope systems available to him, one with a sCMOS camera (QE=80%) and the other with a CCD (QE=55%). Both microscopes are adjusted to image at Nyquist at 40X magnification as purchased, but the CCD's photosites are twice the size of the sCMOS sensors. He has a 40X 1.3 NA for the CCD system and a 40X 0.75NA objective for the sCMOS system. Both microscopes have identical filter sets (GFP/RFP/Cy5) and identical light sources. You are John's PI. How would you advise John to label his proteins and which scope should he use?

Example of the curriculum for the 3-day LCI jumpstart workshop

Best practices for instrument maintenance

- Cleaning objectives & filters, Check dust
- Inspecting even illumination in epifluorescence microscopy
- Checking system behavior (drift test, multi-point visiting, stitching, multi-color, etc…)

Future directions

- Create partnerships with optical imaging centres across Canada to strengthen, refine and distribute the LCI's educational and training programme.

- Resource package for imaging platform manager including
  - Education material for workshops and community outreach events
  - Pre-training worksheets
  - Best practices for instrument maintenance
  - Training records & user agreement

Acknowledgments

- Andrew Chojnacki, PhD, In vivo Optical Imaging Specialist
- Pina Colarusso, PhD, Director
- Joel Glover, Optical imaging assistant
- Kamala Patel, PhD, Executive Director
- Katarzyna Wojcik, PhD, In vivo Optical Imaging Specialist

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