Educational Resources and Tools

William Giang

2023-06-13

Table of contents

## Resources for beginners

For understanding digital images, image formation, and basic image processing and analysis, my all-time favorite resource has to be Pete Bankhead’s [Introduction to Bioimage Analysis](https://bioimagebook.github.io/index.html).

For more details about fluorescence microscopy, [MyScope (Microscopy Austrailia)](https://myscope.training/#/LMlevel_2_1) is a good resource–especially if you go through their simulators for confocal/STED microscopy.

Collection of online beginner resources with content category indicated by the icons ✔️ and ❌.

| Name | Sample Prep | Microscopy | Analysis[[1]](#footnote-22) |
| --- | --- | --- | --- |
| [Introduction to Bioimage Analysis](https://bioimagebook.github.io/index.html) | ❌ | ✔️ | ✔️ |
| [MyScope (Microscopy Austrailia)](https://myscope.training/#/LMlevel_2_1) | ❌ | ✔️ | ❌ |
| [Microcourses](https://www.youtube.com/c/Microcourses) | ❌ | ✔️ | ❌ |
| [MicroscopyU (Nikon)](https://www.microscopyu.com/) | ✔️ | ✔️ | ❌ |
| [Designing a rigorous microscopy experiment: Validating methods and avoiding bias](https://rupress.org/jcb/article/218/5/1452/120908/Designing-a-rigorous-microscopy-experiment) | ✔️ | ✔️ | ✔️ |
| [Tutorial: guidance for quantitative confocal](https://www.nature.com/articles/s41596-020-0313-9) | ✔️ | ✔️ | ✔️ |
| [Fiji Training Notes (Cameron Nowell)](https://bridges.monash.edu/articles/educational_resource/Fiji_Training_Manual_v6_5_/21901989) | ❌ | ❌ | ✔️ |
| [Lecture BioImage Analysis 2020 (Robert Haase)](https://www.youtube.com/playlist?list=PL5ESQNfM5lc7SAMstEu082ivW4BDMvd0U) | ❌ | ❌ | ✔️ |

## Colocalization

Colocalization is a frequent analysis request, but avoid the common pitfalls!

Collection of colocalization resources

| Name | Sample Prep | Microscopy | Analysis |
| --- | --- | --- | --- |
| [Colocalization Analysis (ImageJ)](https://imagej.net/imaging/colocalization-analysis) | ❌ | ❌ | ✔️ |
| [A practical guide to evaluating colocalization in biological microscopy](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3074624/) | ❌ | ❌ | ✔️ |
| [Image co-localization–co-occurrence versus correlation](https://journals.biologists.com/jcs/article/131/3/jcs211847/77151/Image-co-localization-co-occurrence-versus) | ❌ | ✔️ | ✔️ |
| [A localization tale](https://docs.google.com/presentation/d/1ptm-dbG9yN_BmTkxl8yOnFY8jbB7fRoOzrHVUY16s1c/edit#slide=id.g94c31bc59f_0_0) | ❌ | ❌ | ✔️ |
| [Deconstructing co-localisation workflows: A journey into the black boxes](https://www.youtube.com/watch?v=P2JvFe0hB_M) | ❌ | ✔️ | ✔️ |

## Light-sheet

Collection of light-sheet resources with content category indicated by the icons ✔️ and ❌.

| Name | Sample Prep | Microscopy | Analysis |
| --- | --- | --- | --- |
| [Tutorial: practical considerations for tissue clearing and imaging](https://www.nature.com/articles/s41596-021-00502-8) | ✔️ | ✔️ | ❌ |
| [Practical considerations for quantitative light sheet fluorescence microscopy](https://www.nature.com/articles/s41592-022-01632-x) | ❌ | ✔️ | ✔️ |

## Analysis software downloads and resources

While the free viewers from microscope companies can be helpful for inspecting metadata in an easy-to-parse way[[2]](#footnote-39), knowing how to use Fiji (or ImageJ with Bio-Formats) will be more beneficial for beginners. Most likely, you’ll need to use microscopes from different companies and also use Fiji for some processing/analysis.

| Name | Brief Description | Resources |
| --- | --- | --- |
| [Fiji](https://fiji.sc/) | A “batteries-included” distribution of ImageJ | [link](https://imagej.net/learn/) |
| [NIS-Elements Viewer](https://www.microscope.healthcare.nikon.com/products/software/nis-elements/viewer) | Nikon’s free standalone program for .nd2 files |  |
| [Imaris Viewer](https://imaris.oxinst.com/imaris-viewer) | Free 3D/4D image viewer (limited!) | [Imaris Homeschool](https://imaris.oxinst.com/homeschool) |
| [Leica LAS X Office](https://www.leica-microsystems.com/products/microscope-software/p/leica-las-x-ls/downloads/) | Free software for viewing Leica files |  |
| [SVI Huygens](https://svi.nl/HomePage) | Deconvolution, Visualization, Analysis | [Deconvolution video](https://www.youtube.com/watch?v=UODclB0TPSg) |

### Fiji Plugins and Macros

Exporting a .lif file to individual .tifs can be done through Fiji. One macro that does the trick can be found [here](https://github.com/pmascalchi/ImageJ_Export-LIF-as-Individual-Images). See [my video instructions](https://www.youtube.com/playlist?list=PL3BZUVMG21mvojErrOMw0KQvHxoGTitNj).

Setting colors and adjusting brightness & contrast for multi-channel datasets can be done through [BIOP Channel Tools](https://c4science.ch/w/bioimaging_and_optics_platform_biop/image-processing/imagej_tools/ijab-biop_channel_tools/).

## Acquisition (scope-specific)

My documentation for a Nikon Ti2-E with a Yokogawa CSU-X1 spinning disk unit and 405nm photostimulation capabilities can be found [online](https://willgiang.github.io/scope-docs-site/).

My video tutorials for the Advanced Light Microscopy Core’s Leica SP8 FALCON and Leica SP8 STED 3X are on [YouTube](https://www.youtube.com/playlist?list=PL3BZUVMG21mtACjh-THnm5JTHY_zHb6o8)

1. Due to space limitations, “Analysis” refers to both image analysis and processing. [↑](#footnote-ref-22)
2. Another benefit of looking at .nd2 files using NIS-Elements Viewer (as opposed to Bio-Formats) is the faster loading which is especially helpful if inspecting metadata is the sole goal. [↑](#footnote-ref-39)