

## NeuroLucida® 360

### Automatic 3D Neuron Reconstruction and Quantitative Analysis

NeuroLucida 360 is the premier tool used by neuroscientists to quickly and accurately reconstruct intricate neuronal structures that range in scale from complex, multicellular networks of neurons to sub-cellular dendritic spines and putative synapses.

With the sophistication to analyze specific neuronal structures such as axons, basal dendrites, apical dendrites, and axon-carrying dendrites, you can completely reconstruct and analyze any neuron in any species.

The most advanced image detection algorithms allow you to confidently reconstruct cells using a variety of labeling and microscopy techniques.

Whether you are interested in analyzing individual neurons or the interactions of neurons, see why NeuroLucida 360 far surpasses all other software for automatic neuron reconstruction!

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### The Complete Solution for Neuronal Reconstruction and Analysis

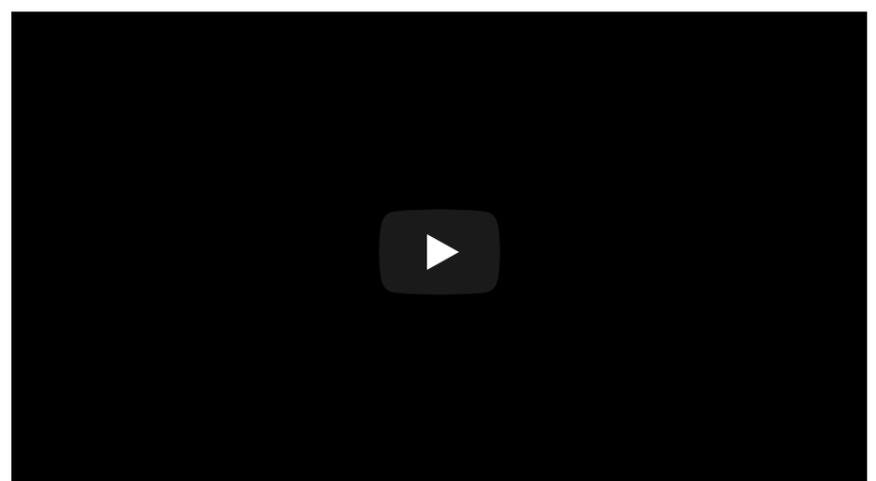
- Axons
- Dendrites
- Somas
- Dendritic spines
- Synapses
- Varicosities

NeuroLucida 360 has been used to reconstruct thousands of neurons including pyramidal, chandelier, and projection neurons.

It leverages the expertise and experience we gained in the long history of developing our renowned NeuroLucida system, the most widely used software for neuron tracing, and used in laboratories worldwide to produce over 10,000 peer reviewed citations.

### NeuroLucida 360 Overview

With hundreds of peer-reviewed citations, scientists around the world trust NeuroLucida 360 to efficiently and accurately reconstruct neurons in 3D. Watch the video to see how fast, easy, and accurate our software is!



## Quantify Neuronal Morphology

NeuroLucida 360 is the most widely used software for automatic neuron reconstruction for creating and analyzing realistic, meaningful, and quantifiable neuron reconstructions from microscope images. Perform detailed morphometric analyses of neurons, such as quantifying:

- the number of dendrites, axons, nodes, synapses, and spines
- the length, width, and volume of dendrites and axons
- the area and volume of the soma
- the complexity and extension of neurons

### Case Study

#### Case Study 1:

As reported in Science, NeuroLucida 360 now offers more accuracy than ever before. In the paper "[Cortical column and whole-brain imaging with molecular contrast and nanoscale resolution](http://science.sciencemag.org/content/363/6424/eaau8302)" (<http://science.sciencemag.org/content/363/6424/eaau8302>)" (2019) researchers performed a morphological analysis of extremely high resolution 3D images of dendritic spines in the fruit fly brain. Using NeuroLucida 360 in combination with expansion microscopy and lattice light sheet microscopy the researchers obtained comprehensive morphometric data with more accuracy than ever before. Measurements reported in the study include the length of the entire neck of the dendritic spine, contact points where each spine attaches to its dendrite, the extent of the head and neck along the spine backbone, and most impressively, spine neck diameter.

Read More

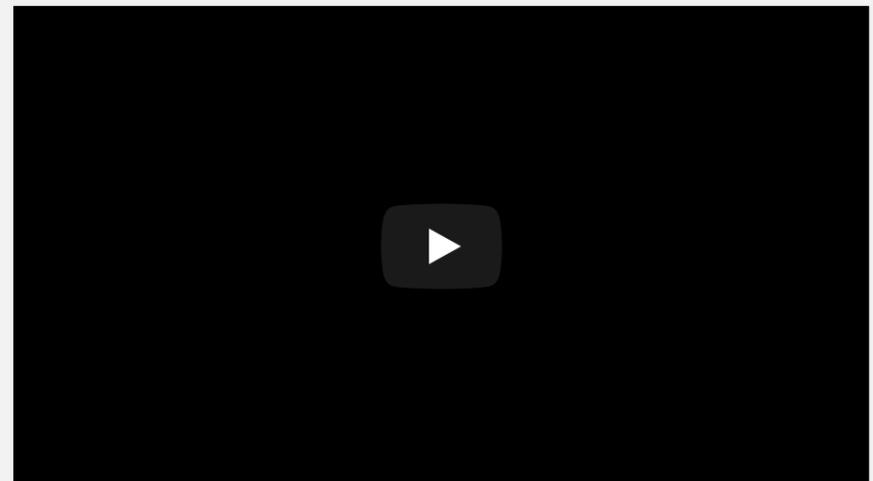
<https://www.mbfbioscience.com/neuroLucida-360-case-1>



<http://science.sciencemag.org/content/363/6424/eaau8302>

#### Case Study 2:

In this case study, we demonstrate how the Dr. John Tompkins and his lab at UCLA utilized MBF Bioscience's multi-resolution image segmentation strategies to understand the structure-function relationships of cells within the stellate ganglion. After performing electrophysiological recordings, the cells were labeled with a fluorescent dye and processed for imaging. Using NeuroLucida 360, the Tompkins lab reconstructed select neurons from images at 40x magnification. These cells were annotated with their corresponding electrophysiological recording ID. The entire stellate ganglion was also imaged at 10X magnification and contoured using integrated FAIR anatomy terminology lists. The registration of the high-resolution cellular reconstructions to the whole stellate ganglion allowed the Tompkins lab to bring the physiological and morphological data into context with the entire ganglion. Dr. Tompkins is contributing this data to the SPARC program.



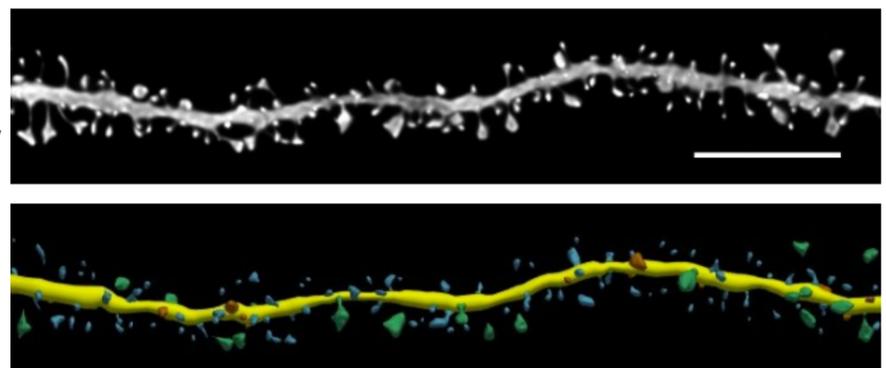
#### Case Study 3:

##### Researchers Identify Potential Treatment for Patients at Risk for Alzheimer's Disease

In a paper published in Science Signaling, researchers at the Herskowitz Lab, at the University of Alabama at Birmingham, used NeuroLucida 360 to analyze spine density and dendritic length in hAPP mice — a mouse model of AD. Their findings describe a treatment that could protect against synapse loss and prevent the onset of dementia in patients at risk for Alzheimer's disease.

Read More

<https://www.mbfbioscience.com/neuroLucida-360-case-study-3>



# NeuroLucida 360 has been cited in over 400 published research papers.

[View all citations \(https://www.mbfbioscience.com/NeuroLucida360-bibliography\)](https://www.mbfbioscience.com/NeuroLucida360-bibliography)

nature

The Journal of  
Comparative Neurology

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American  
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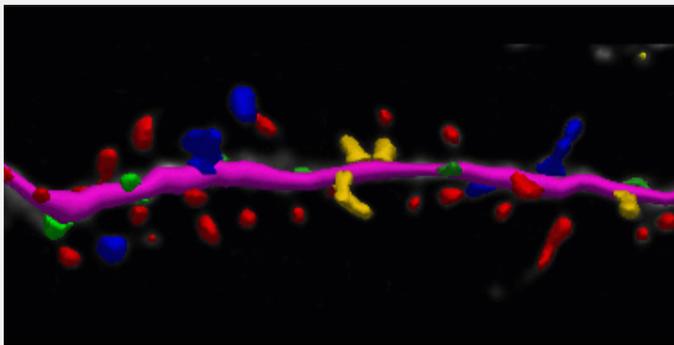
Journal of  
Neurophysiology

Cell  
PRESS

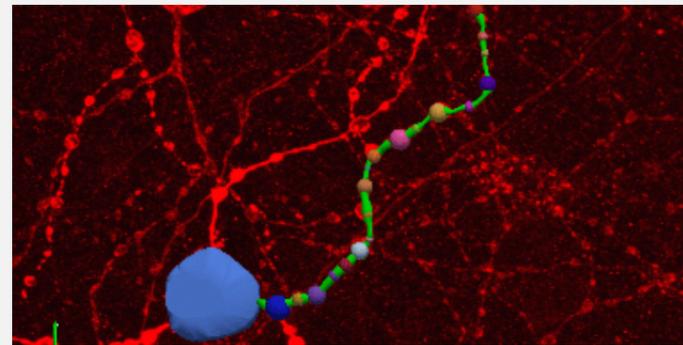
## Automatic Detection and Modeling

NeuroLucida 360 is uniquely designed to automatically model, classify and quantify dendritic spines in 3D. Spines are automatically classified by type (i.e., mushroom, filipodia, stubby, thin as described in the scientific literature). It is also designed to model and quantify somas, varicosities, and synapses.

### Detect and Classify Spines



### Trace Branches and Detect Varicosities

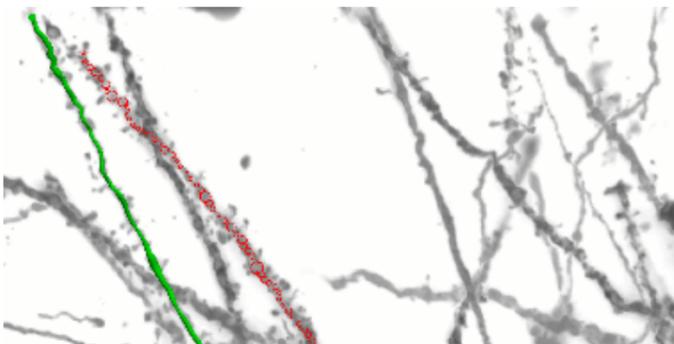


## Works With All Types of Microscopy

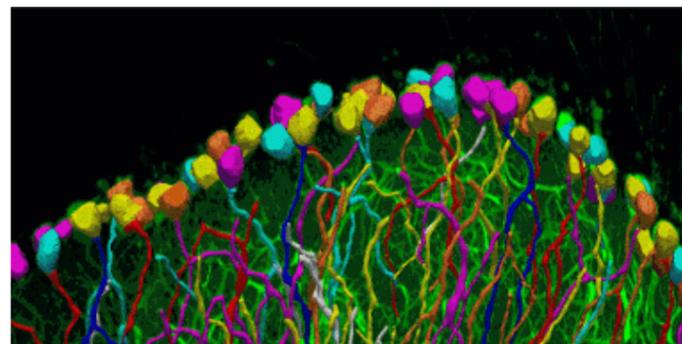
NeuroLucida 360 works with 3D and 2D images from virtually all forms of microscopy. It excels at handling very large images such as whole slide images or large 3D images of cleared tissue.

- brightfield
- confocal
- light sheet
- expansion microscopy
- Micro-CT
- two-photon
- fluorescence
- slide scanners
- fMost

### Trace Golgi Stained Neurons



### Reconstruct Neurons from Cleared Tissue

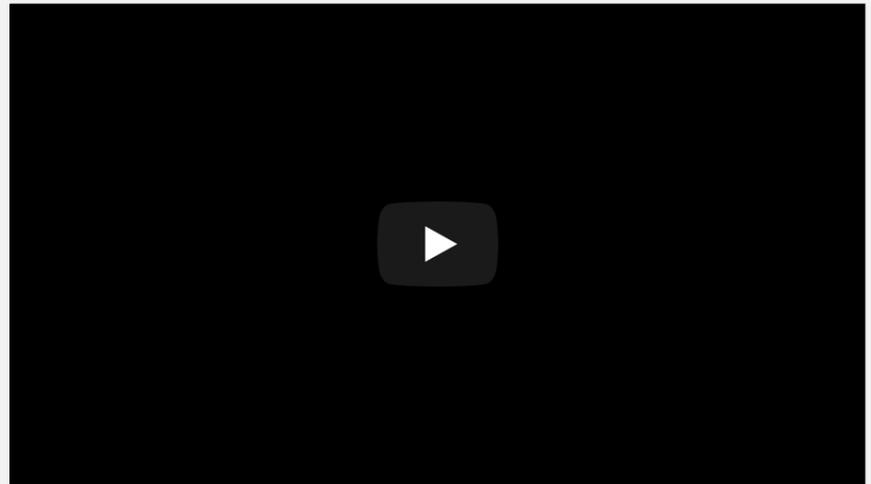


## Analyzing Images Acquired through Expansion Microscopy

Expansion microscopy allows imaging and analysis of structures otherwise too small for detection using light microscopy methods. By enlarging cells and

subcellular components while preserving their structure, researchers can examine neural connections and networks on a much finer scale. All of the tracing and quantification features in NeuroLucida 360 can be used to analyze images acquired through expansion microscopy techniques.

Both automated and user-guided tracing tools can be used in conjunction with model scaling adjustments to allow researchers to obtain correct measurements of structures both in the expanded volume and of the original volume of the tissue (based on the calculated scale factor). One of the many advantages of analyzing expanded tissues in NeuroLucida 360 is that the expansion process permits visualization of sub-cellular neuronal processes such as dendritic spine neck length and diameter that are otherwise too small to measure accurately in unexpanded tissues. Dendritic spines analysis in NeuroLucida 360 has been adjusted to make the most from this increased resolution to improve spine detection, classification, and morphometric analyses.



## A Full Suite of Tools to Edit Structures in 3D and Deliver Ground-Truth Data

With NeuroLucida 360's full suite of tools you can manually trace and edit your reconstructions, creating a ground-truth representation of your neuron data.

You can also fine-tune and correct the automatic reconstructions in cases of particularly challenging image data. Some of the edit functions available are:

- Detach dendrite/axon branch segments
- Connect dendrite/axon branch segments
- Remove dendrite/axon trees or branch segments
- Adjust dendrite/axon diameters
- Move location of individual axon/dendrite points in X, Y and Z
- Change dendritic spines by splitting, or merging, or reclassifying

- Are you looking for a microscope based neuron tracing system? Check out [NeuroLucida](https://www.mbfbioscience.com/neuroLucida) (<https://www.mbfbioscience.com/neuroLucida>)

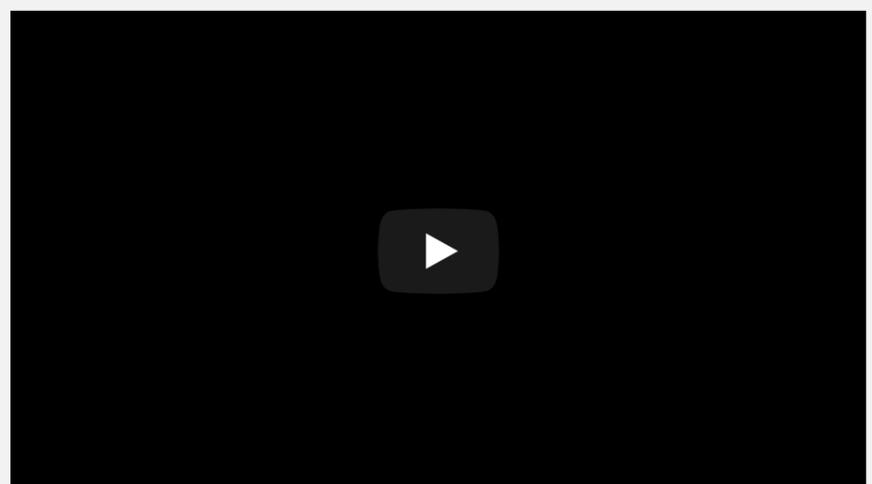
## Comprehensive Quantitative Analyses

Our rigorously tested analyses provide accurate and robust results that you and others can trust in publications.

Use [NeuroLucida Explorer](http://www.mbfbioscience.com/neuroLucida-explorer) (<http://www.mbfbioscience.com/neuroLucida-explorer>), NeuroLucida 360 companion analysis software, to perform sophisticated analyses that help answer your research questions.

We provide dozens of analyses that analyze and graph hundreds of metrics and parameters, including:

- Structure
- Distribution
- Orientation
- Colocalization



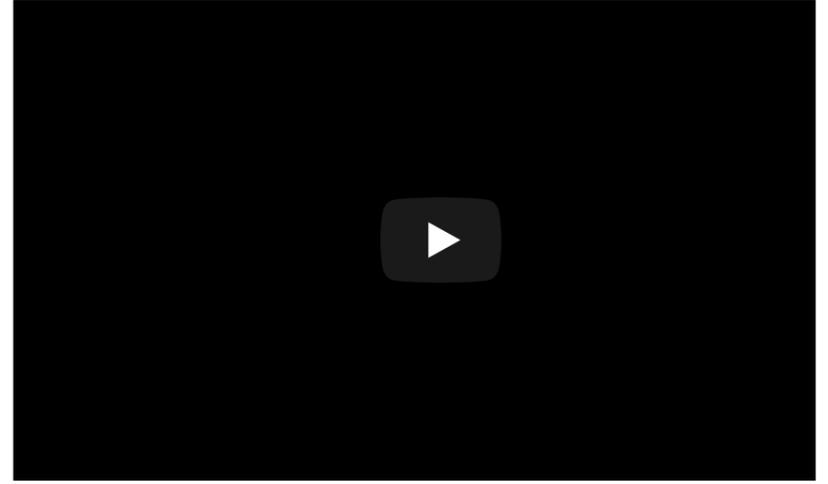
## Real-time Interactive 3D Visualization

As you work with increasingly bigger and more complex image data, high performance 3D visualization has become indispensable to effective data interpretation.

Our software includes a highly versatile 3D visualization environment suitable to most microscopy images with state-of-the-art functionalities to support your analysis and publication needs.

- ✔ Visualize large, complex 3D images (including multichannel images) and reconstructions
- ✔ 2D and 3D image data from two-photon, confocal, brightfield or light sheet microscopy
- ✔ 3D volume, image slicing, and simultaneous views
- ✔ Multiple projections: XY, YZ, XZ, alpha, minimum, and maximum
- ✔ Transparency, rendering (wireframe, centerline, surface, texture) and other display options for image and traces that can be adjusted on the fly
- ✔ Create dynamic movies
- ✔ Export options including exporting 3D graphics to third-party applications
- ✔ Loads complex surfaces in seconds
- ✔ Works with the most advanced "gaming class" graphics cards to deliver high performance at an affordable price
- ✔ Supports almost all [file formats](https://www.mbfbioscience.com/sites/default/files/fileFormats2020.pdf)

(<https://www.mbfbioscience.com/sites/default/files/fileFormats2020.pdf>)

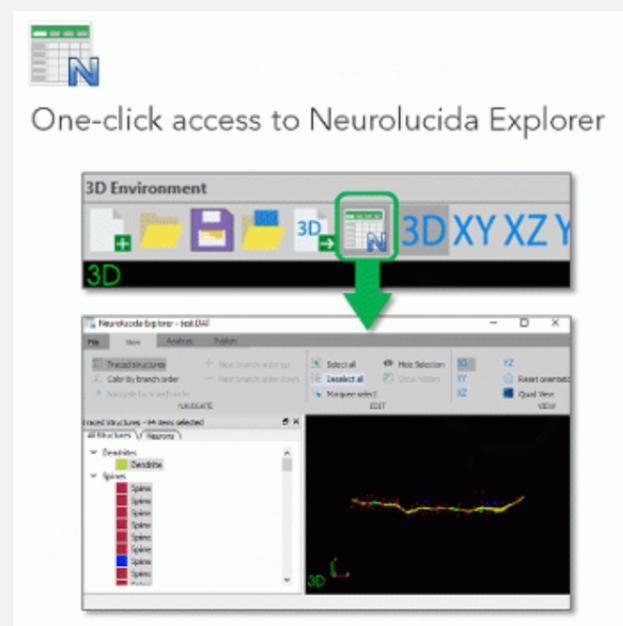


## Designed by Neuroscientists for Neuroscientists

Developed with support from the National Institute of Mental Health (NIMH), NeuroLucida 360 was specifically conceived for the neuroscience community by neuroscientists who understand the challenges and breadth of neuroscience research. We are constantly pushing the technological boundaries of our software to support your needs in addressing cutting-edge research questions. Our scientists are regularly in dialogue with our customers, incorporating their suggestions into the design of NeuroLucida 360 to aid discoveries in neuroscience worldwide.

NeuroLucida 360 is an invaluable tool to advance connectomics and handle the "big data" necessary to map neural pathways at the level of synaptic connections comprehensively. It can also be automated to perform repeated neuronal analyses.

Consult with our staff neuroscientists to determine the best course of action to make sense of your data.



## Learn How to Best Prepare and Image Neurons for Analysis

Our scientists collaborated with researchers from the Icahn School of Medicine at Mount Sinai in New York to develop a set of guidelines on preparing and imaging confocal image data for NeuroLucida 360. The guidelines, published in Current Protocols in Neuroscience, will help you get the best results for spine quantification and neuron reconstruction.

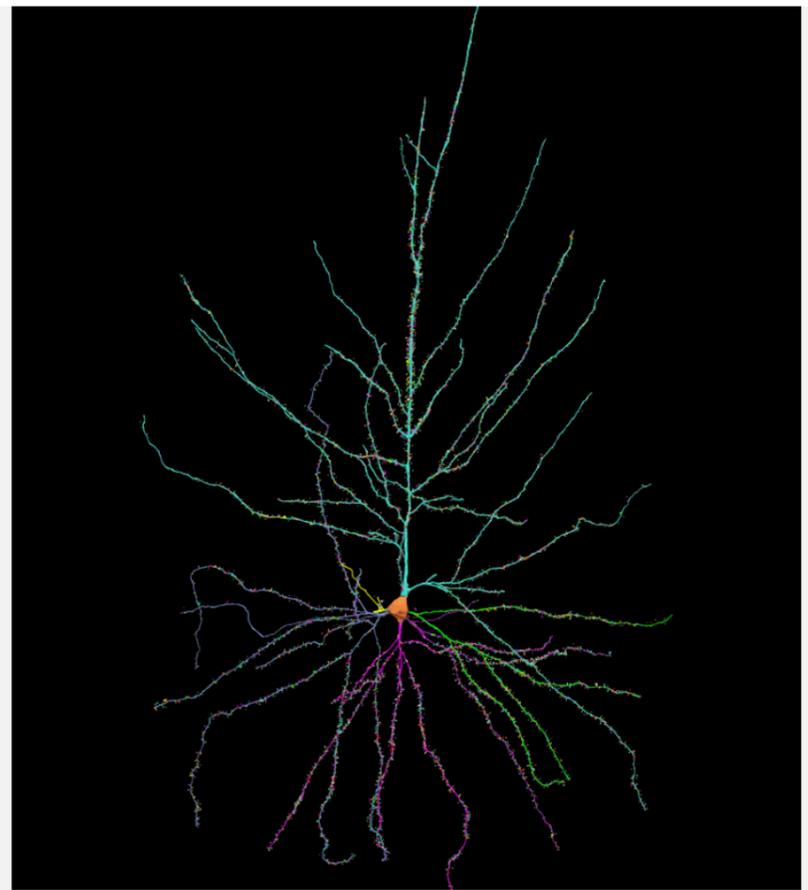
[+ Read the publication \(https://www.ncbi.nlm.nih.gov/pubmed/27696360\)](https://www.ncbi.nlm.nih.gov/pubmed/27696360)

## How can NeuroLucida 360 help you?

- ✔ Run analyses that exactly match your research questions
- ✔ A ready to use solution with no need for programming skills or the creation of supplementary scripts (e.g., MatLab)
- ✔ Use it on a wide range of research specimens, from the sub-micrometer level (synapses) to the macrolevel (mapping projection neurons)
- ✔ Use the stains and visualization techniques that fit your research paradigm including Golgi, 2D, expansion microscopy, clarity, iDISCO, uDISCO, confocal, two-photon
- ✔ Work with a equipment in your facility, virtually all microscope image formats are supported.
- ✔ Consult with our expert neuroscientists to get recommendations on the best means to analyze your experimental data.

*Image courtesy (right): Neuron Tracing of confocal microscopy image of a human neocortical neuron*

injected with Lucifer Yellow, showing 3D-reconstructed dendrites and spines superimposed on the confocal image. Authors: Ruth Benavides-Piccione, Isabel Fernaud, Asta Kastenauskaite and Javier DeFelipe.



## Affordable Packages

Our three most popular packages are NeuroLucida 360 Lite, Essentials, and Studio.

There are different options to set up NeuroLucida 360 in your lab: a one-time upfront cost for the software, an annual subscription plan, mobile licenses to move NeuroLucida 360 from one computer to another, and more.

	NeuroLucida 360 <b>LITE</b>	NeuroLucida 360 <b>ESSENTIALS</b>	NeuroLucida 360 <b>STUDIO</b> <i>Best Value</i>
Automatic tree tracing		✓	✓
User-guided tree tracing	✓	✓	✓
Smart manual tree tracing	✓	✓	✓
User-guided soma detection	✓	✓	✓
▲ Big image data capability			
Large volume reconstruction			✓
Dense area visualization tool	✓	✓	✓
Dense area automatic tracing		✓	✓
Batch image filters	✓	✓	✓
Create and share movies	✓	✓	✓
Automatic soma detection		✓	✓
Automatic spine detection and classification			✓
Automatic synapse detection			✓
Automatic varicosity detection			✓
Image montaging			✓
Batch mode		✓	✓
3D editing	✓	✓	✓
Automatic trace evaluation			✓
Professional technical support	✓	✓	✓

+ [Learn more about the differences between NeuroLucida and NeuroLucida 360 \(http://www.mbfbioscience.com/what-are-differences-between-neuroLucida-and-neuroLucida-360\)](http://www.mbfbioscience.com/what-are-differences-between-neuroLucida-and-neuroLucida-360)

## Try it Out!

We offer both a free evaluation and a free trial copy of NeuroLucida 360. During your trial, you'll also have the opportunity to talk to us about your hardware, software, or experimental design questions with our team of Ph.D. neuroscientists and experts in microscopy, neuron tracing, and image processing.

[Request a Free Trial](http://www.mbfbioscience.com/neuroLucida-360-free-trial-request-form)

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- Free evaluation: Submit some of your image data and let us evaluate how NeuroLucida 360 can match your research experiment.
- Free 14-day trial copy: Download of a copy of NeuroLucida 360 and use the tips and suggestions from the free evaluation to find out how easy it is to use and how quickly you can obtain useful data.

## Professional Technical Support

When you call us you will speak with a person - not an automated system. Talk to us about your hardware, software, or experimental design questions. Our team includes Ph.D. neuroscientists and experts in microscopy, stereology, neuron tracing, and image processing; ready to help you over the phone or online.

## Customer Reviews

"MicroBrightField has THE BEST customer service in the industry. The staff at MBF go above and beyond basic customer service, time and time again."

-Meaghan Wilkin, Ph.D. Candidate

Queen's University, Ontario, Canada



## Contract Services for Neuron Reconstruction

Our Neuron Reconstruction services gives your lab the ability to have industry-leading experts create a 3D digital reconstruction of individual or multiple neurons, for your research. MBF Labs will reconstruct your neurons giving you a breadth of quantitative information. The process is simple and practical. Provide us with slides or images, and MBF Labs experts do the rest.

[Request More Information](https://www.mbfbioscience.com/request-more-information-mbf-labs)

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## MBF Bioscience Forum

Get answers to your most pressing research and technical questions from MBF scientists and fellow researchers.

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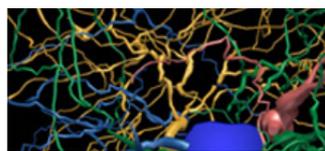
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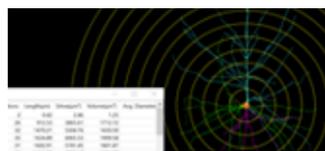
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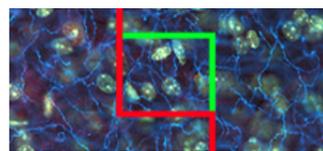
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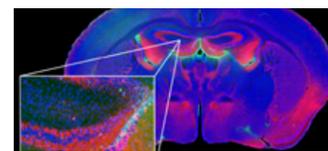
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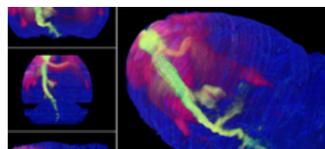
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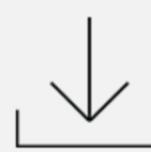
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[Read the protocol for imaging and analyzing neurons with NeuroLucida 360 in Current protocols in Neuroscience \(http://www.mbfbio.com/sites/default/files/NL360%20paper.pdf\)](http://www.mbfbio.com/sites/default/files/NL360%20paper.pdf)



[What's New in NeuroLucida 360 \(https://www.mbfbioscience.com/whats-new-neuroLucida-360\)](https://www.mbfbioscience.com/whats-new-neuroLucida-360)



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[Current NeuroLucida customers are eligible for a significant discount on NeuroLucida 360. Contact us for more information \(http://www.mbfbio.com/contact-us\)](http://www.mbfbio.com/contact-us)

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