

Cellular Imaging: Neuronal Complexity Workflow

NeCTAR Project Team

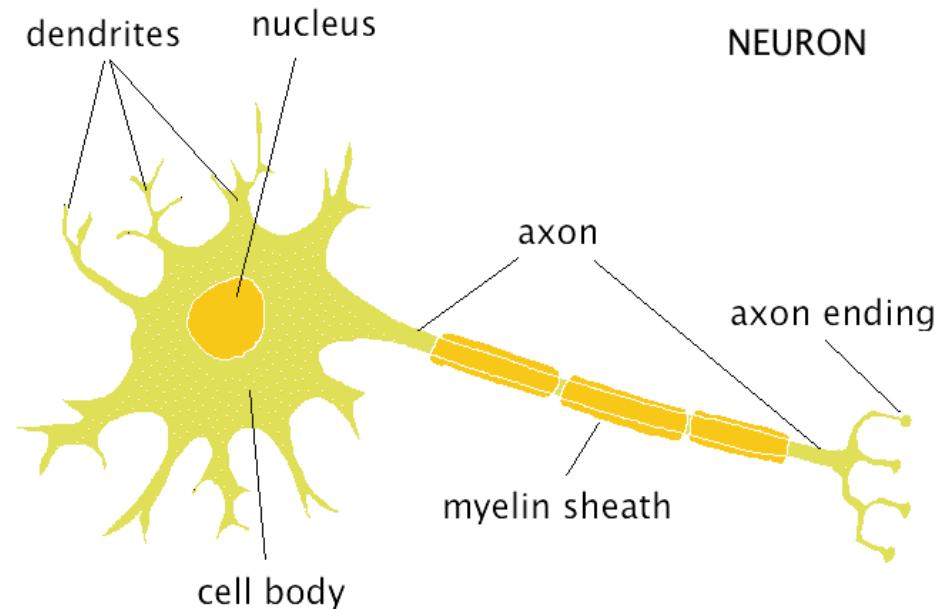
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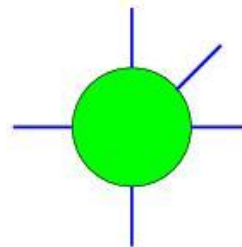
Background Biology

- Neurons are cells which transmit information through electrical or chemical signals
- They are core components of the nervous system (brain and spine)
- Neurons are made up of:
 - A cell body (sometimes called a soma or neuron body)
 - Dendrites
 - An axon
 - NB. Collectively, dendrites and axons are called neurites

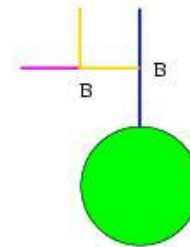


Neuronal Complexity

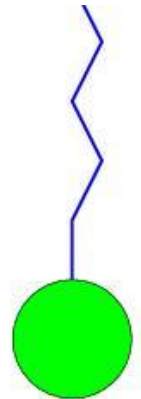
- The impact of a drug on a neurites ability to transmit information is of interest for neuropathological conditions such Alzheimer's disease
- One measure way to measure this is to quantify the complexity of neurites
 - Length of neurites
 - Number of intersection points
 - Number of primary neurites



Cell 1



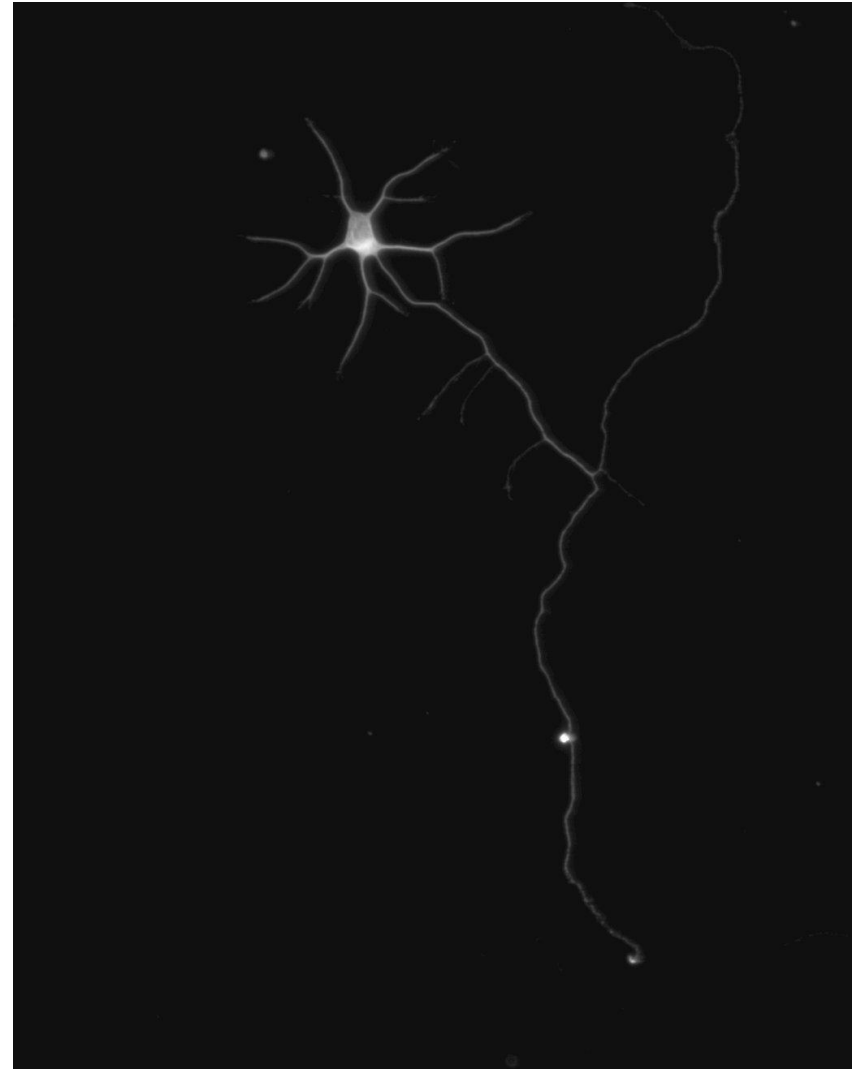
Cell 2



Cell 3

Load and Display File

- **Get data**
 - Upload file
 - File browse “mNM11.tif”
 - Execute
 - View the image with the “eye” icon



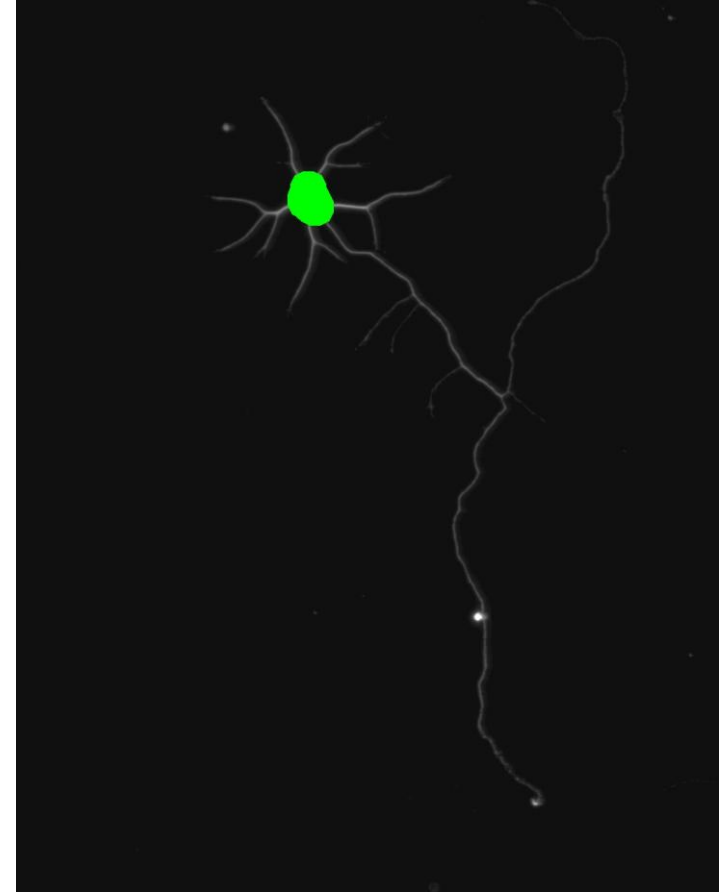
Neuron body detection

- Here we would like to isolate the neuron body
- **Cellular Imaging**
 - Detect neurons
 - Input image = “mNM11.tif”
 - Smoothing size = 0 (this image is not noisy)
 - Execute
 - View
 - Detected parts of neurites and bright dots
 - Run this job again
 - Set minimum radius of neuron body = 30
 - Execute
 - View



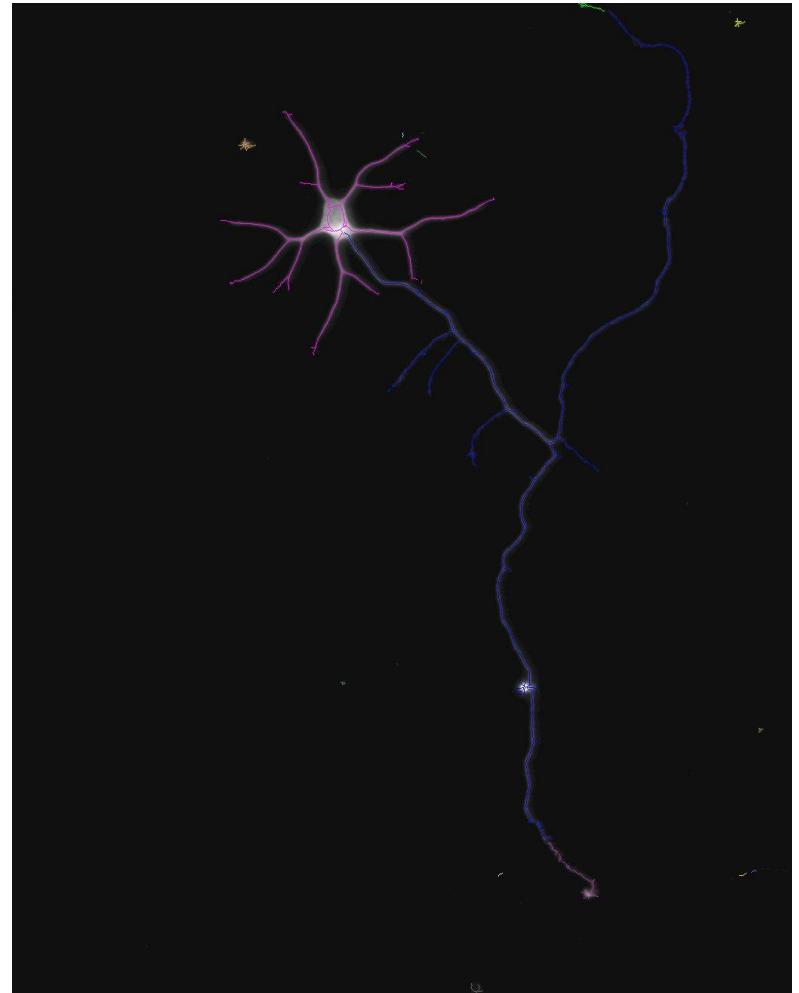
Overlay neuron body

- Want to check we are getting a good outline
- **Cellular Imaging**
 - Overlay image with labelled mask
 - Input image = “mNM11.tif”
 - Mask image = “neuron bodies binary mask”
 - Execute
 - View



Detect neurites

- Want to detect the linear structures called neurites (both axons and dendrites)
- **Cellular imaging**
 - Detect neurites
 - Input image = “mNM11.tif”
 - Execute
 - Overlay image with labelled mask
 - Input image = “mNM11.tif”
 - Mask image = “neurites detected in”
 - Execute
 - View



Create donut around the neuron body

- Want to create an area of interest around the edge of the neuron body
- **Cellular imaging**
 - Create donut around a nucleus
 - Input image = “Neuron bodies binary mask ...”
 - Donut size = 10
 - Execute
 - View - output includes the neuron body, need to exclude
 - Logical operations with two images
 - 1st input image “Cells binary mask ...”
 - 2nd input image “Neuron bodies binary mask ...”
 - Operation = XOR

Create donut around the neuron body

- Now to view it
 - Overlay image with labelled mask
 - Input image = “mNM11.tif”
 - Mask image = “Result of XOR”
 - Execute
 - View

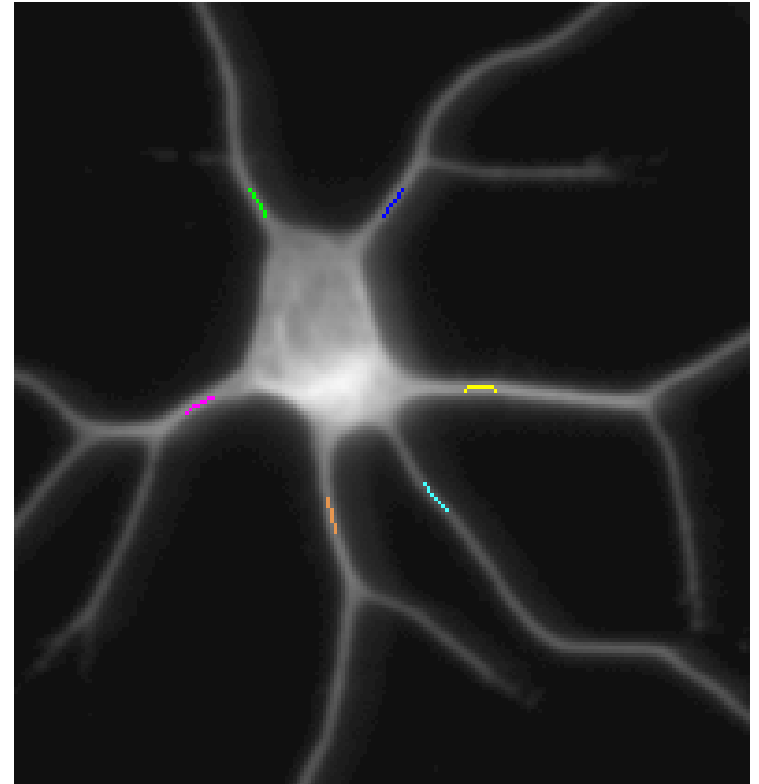


Isolating the touching points

- Now isolate where the neurites touch the neuron bodies

- **Cellular Imaging**

- Logical operations with two images
 - 1st input image “Neurites detected ...”
 - 2nd input image “Result of XOR ...”
 - Operation = AND
 - Execute
- Overlay image with labelled mask
 - Input image = “mNM11.tif”
 - Mask image = “Result of AND”
 - Execute
 - View
 - Zoom



Count the number of lines

- **Cellular imaging**
 - Statistics for lines
 - Input image – mNM11.tif
 - Lines binary mask – “Result of AND”
 - Cells binary mask – “Result of XOR ...”
 - Execute
 - The number of primary branches is 6!

Create a workflow

- Now we want to save the steps
- Gear symbol
 - Uncheck overlays possibly
 - Extract workflow
- Workflow name can be changed
- Create workflow
- Go to **Workflow** tab
 - Click on your workflow
 - edit
 - **Workflow canvas** is a visualisation of your workflow
 - Click on blocks to edit parameters

Thank you

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