

Images With More Than Two Dimensions

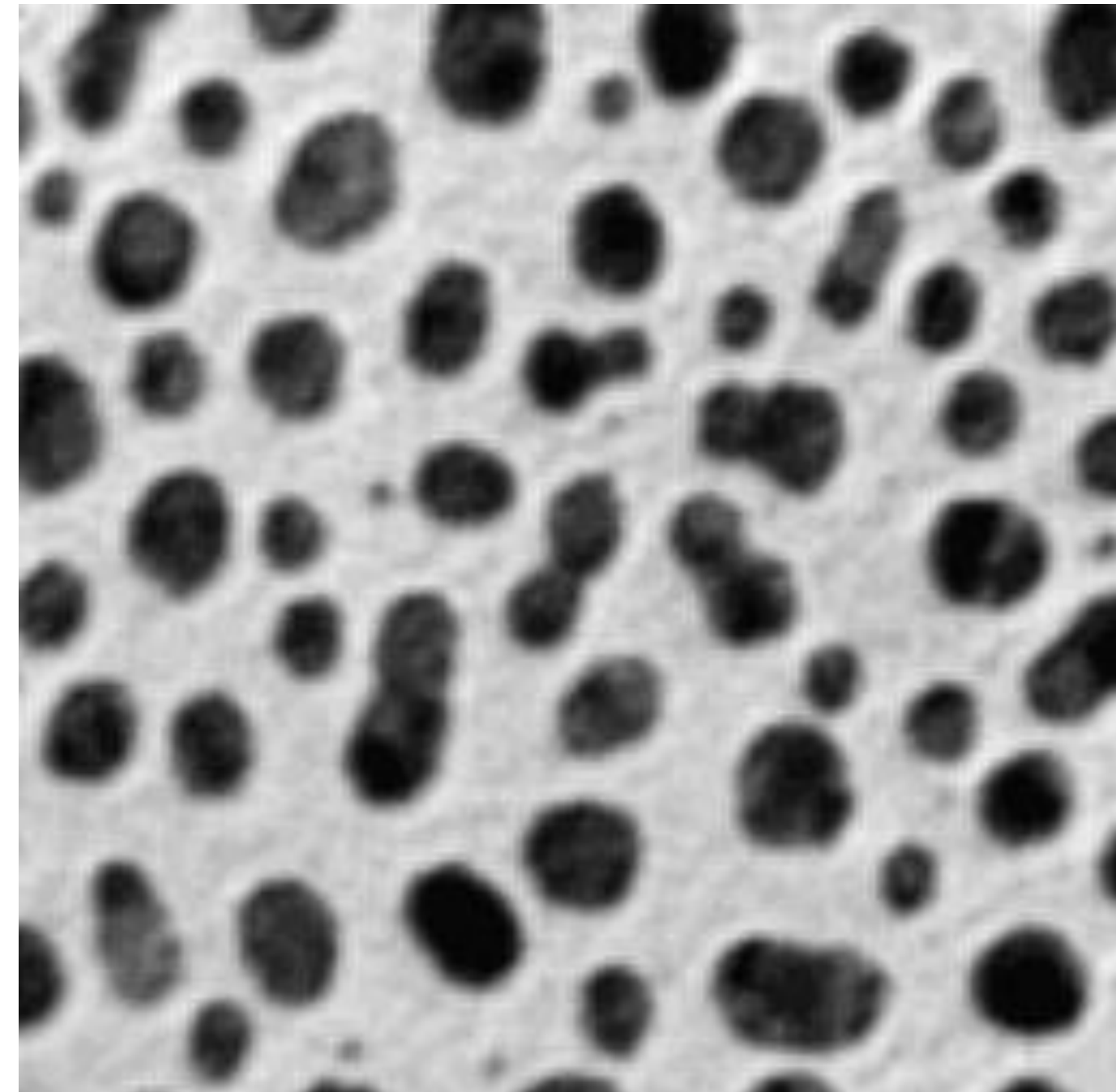
Image Processing & Analysis for Life Scientists

Olivier Burri, Romain Guiet & Arne Seitz

Images With More Than Two Dimensions

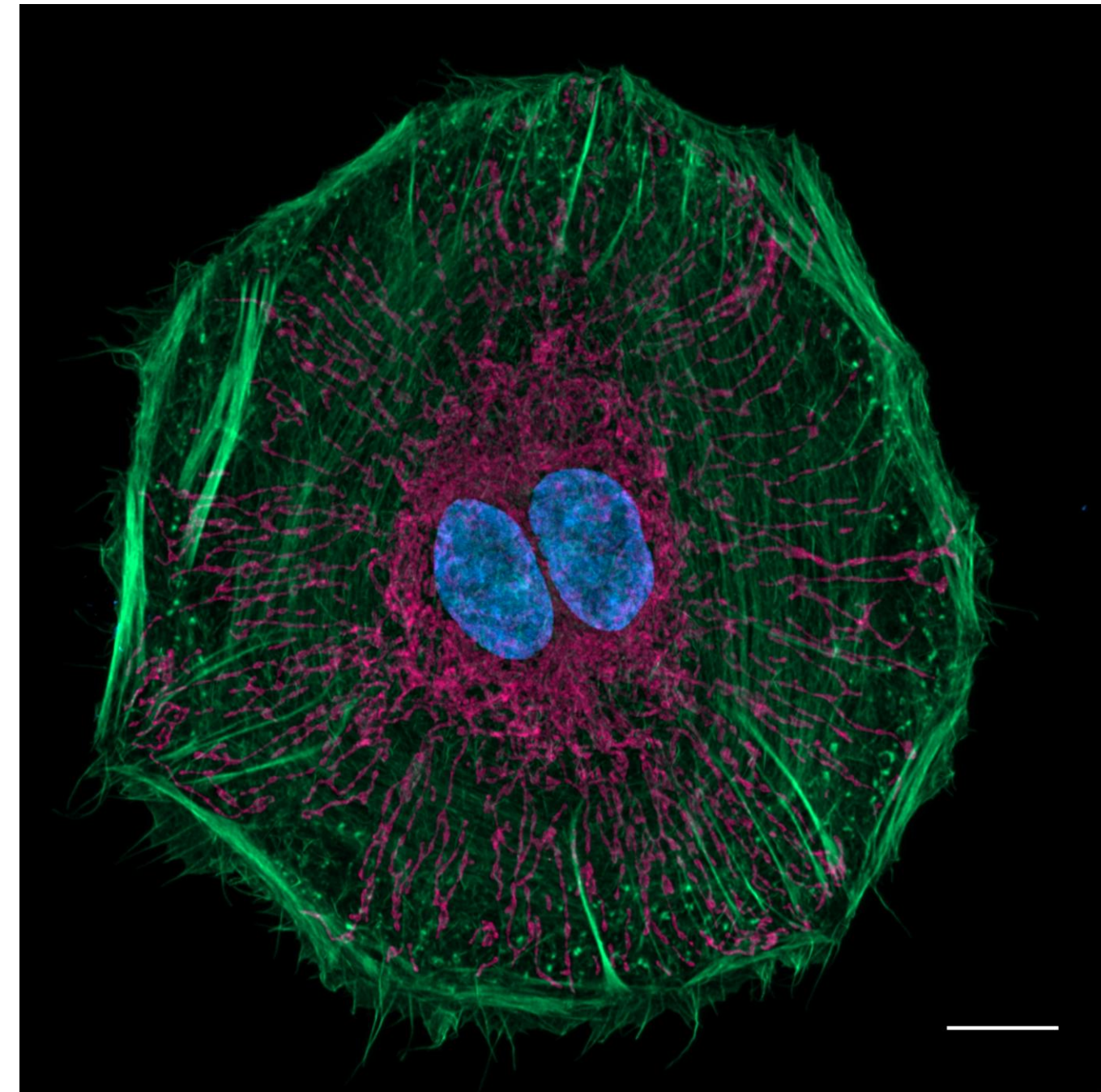
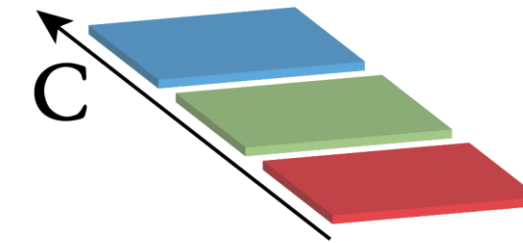
- Dimensions in Microscopy Images
- Handling Multidimensional Data
- Data Size
- Considerations for Image Acquisition

N Dimensions



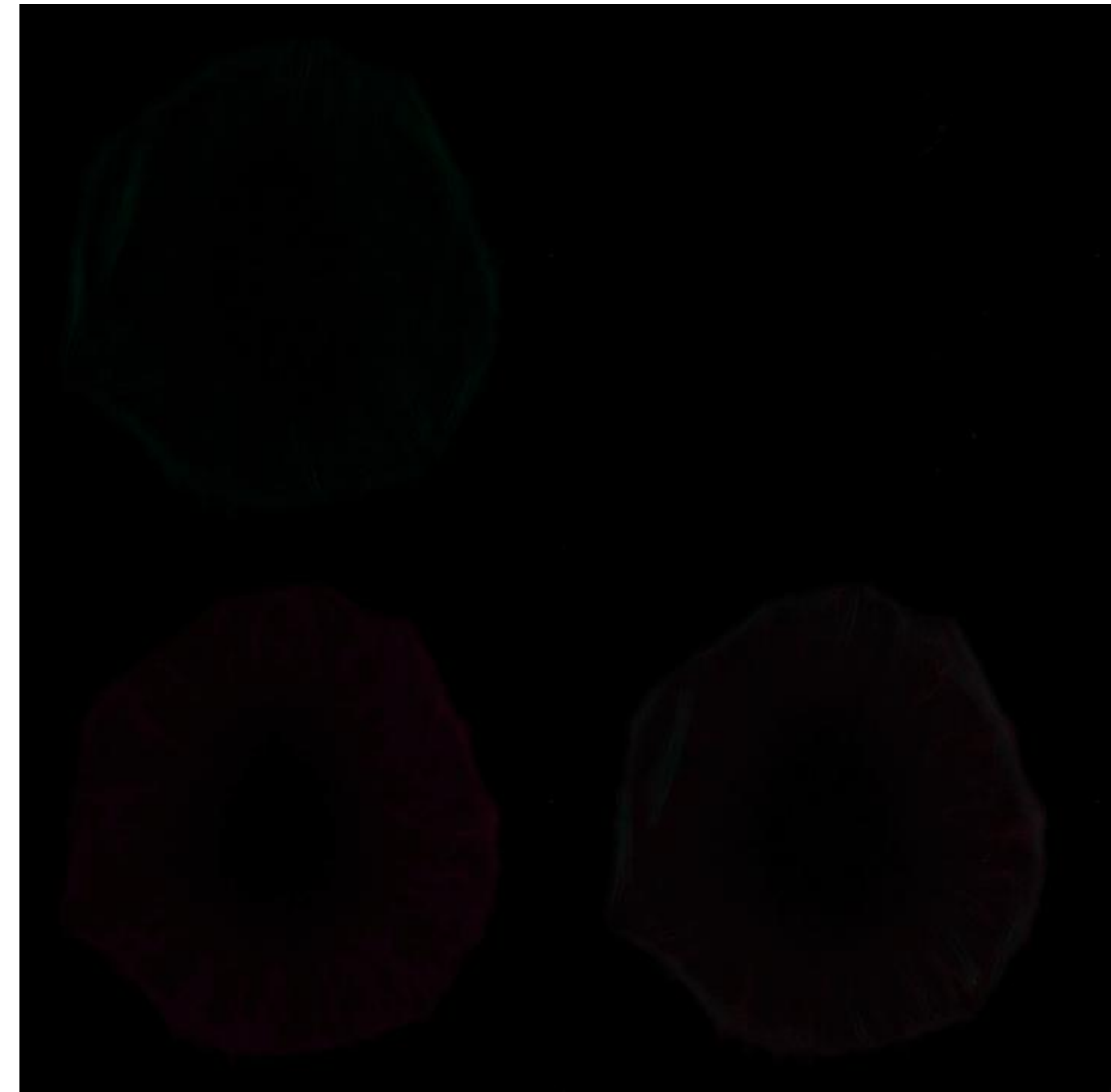
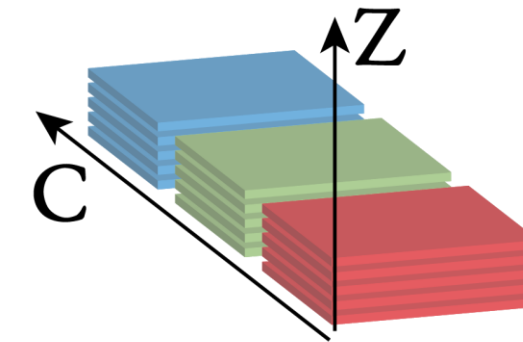
Width, Height

N Dimensions



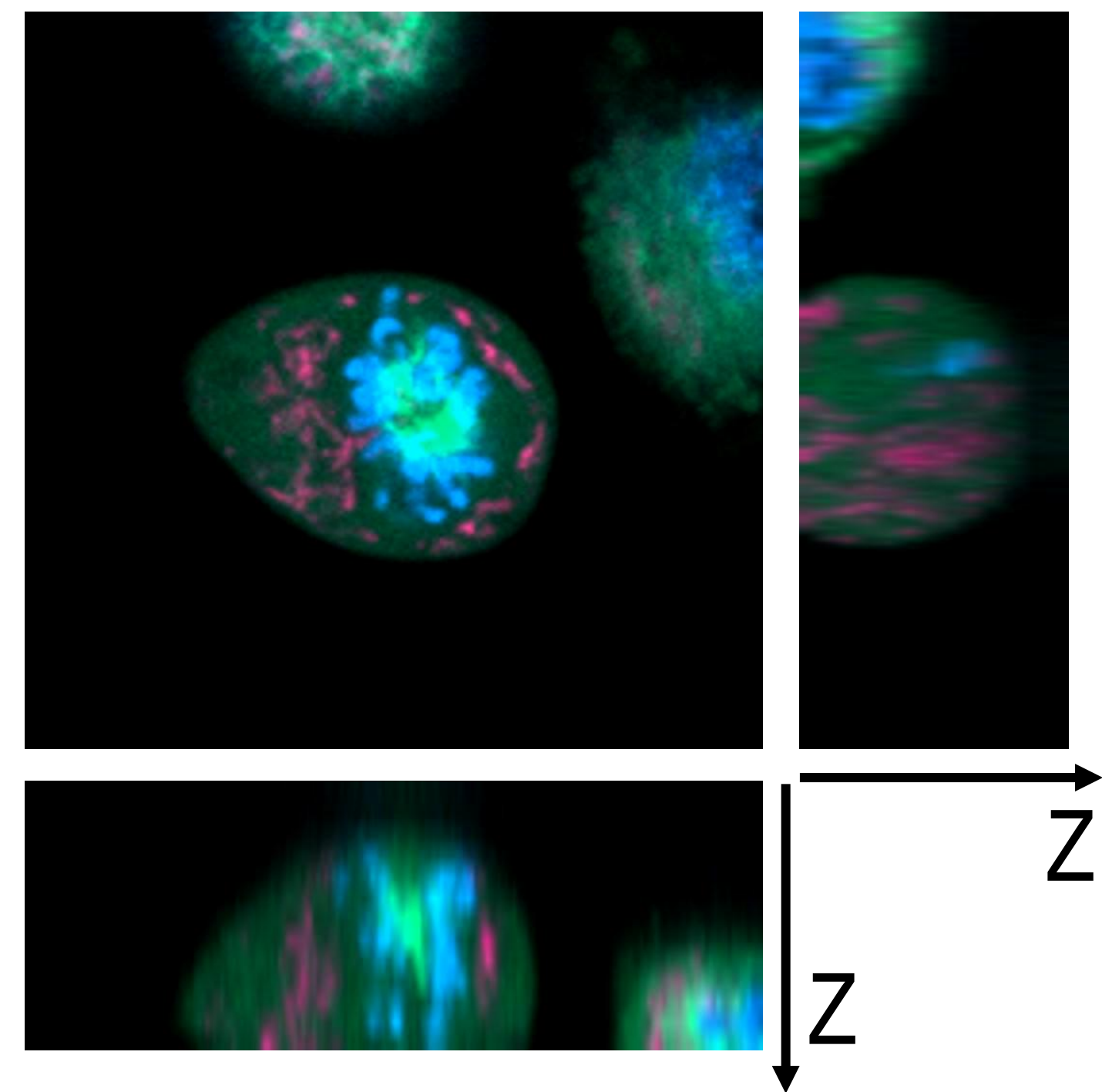
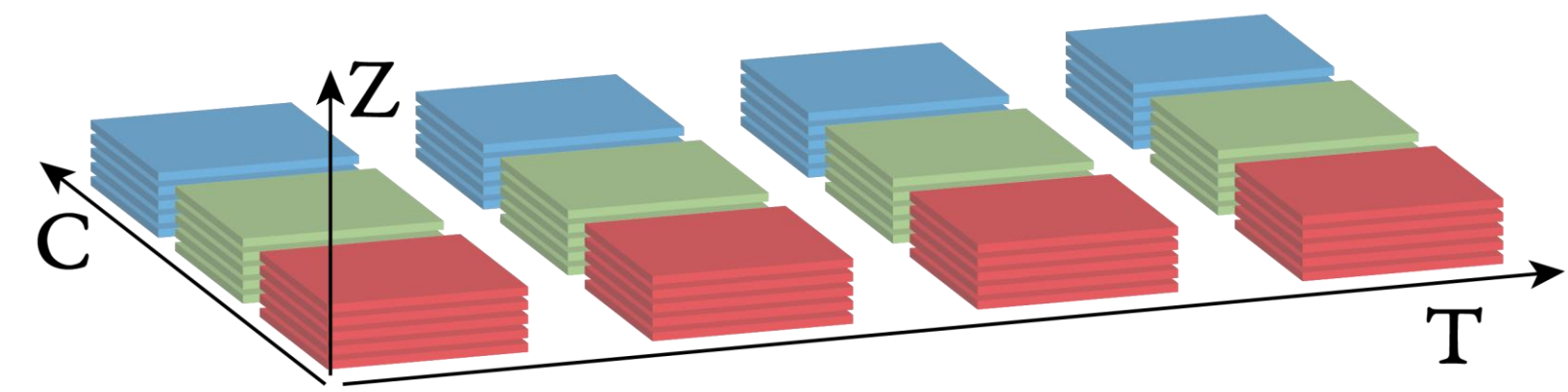
Width, Height, Channels

N Dimensions



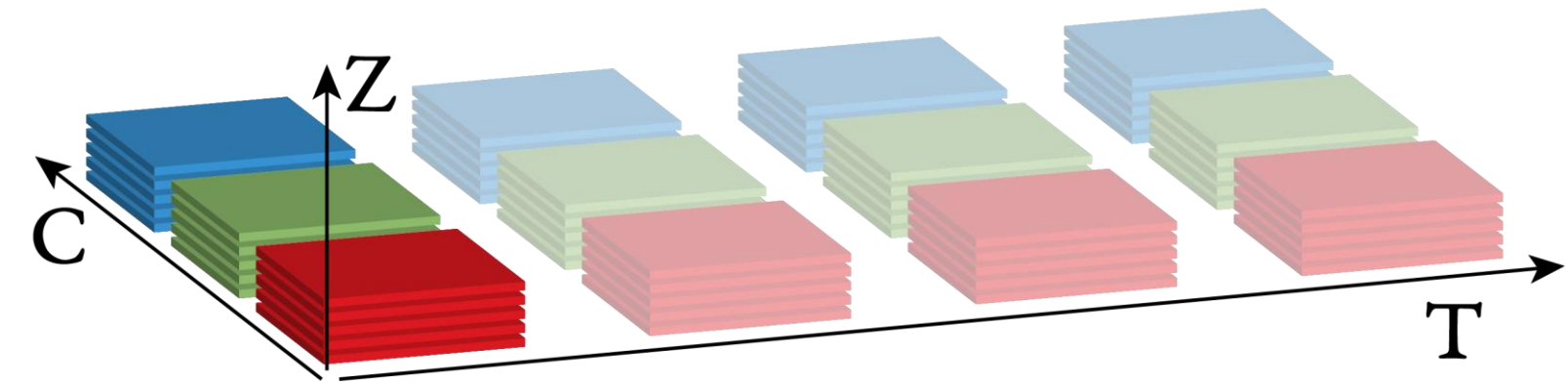
Width, Height, Channels, Slices

N Dimensions



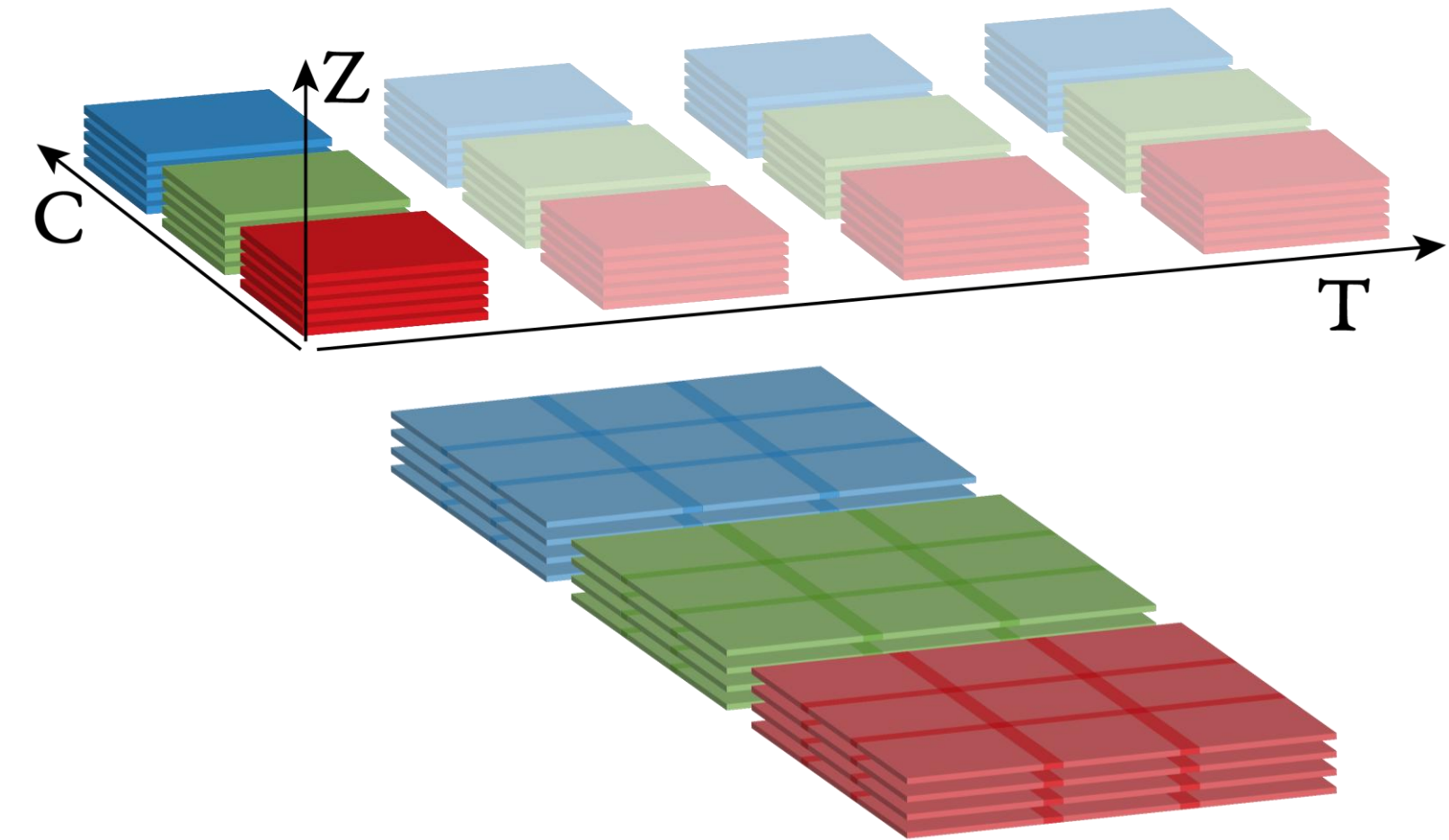
Width, Height, Channels, Slices, Time

N Dimensions



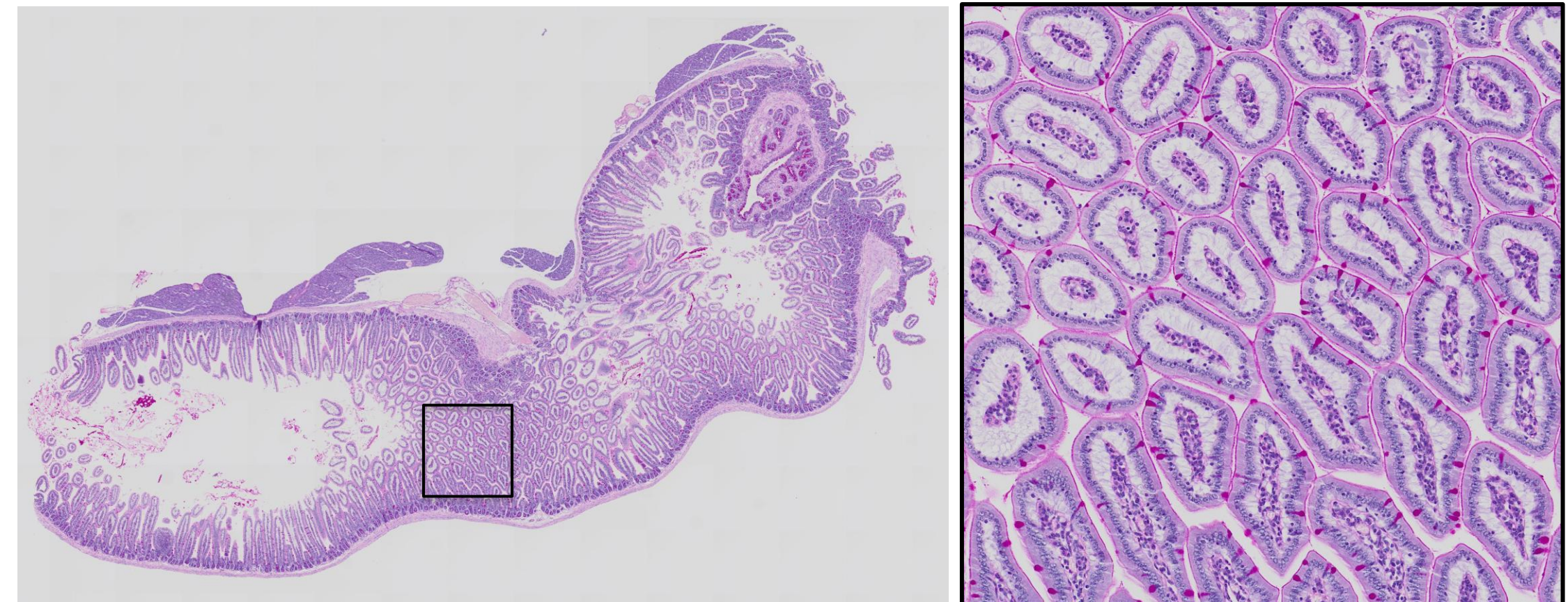
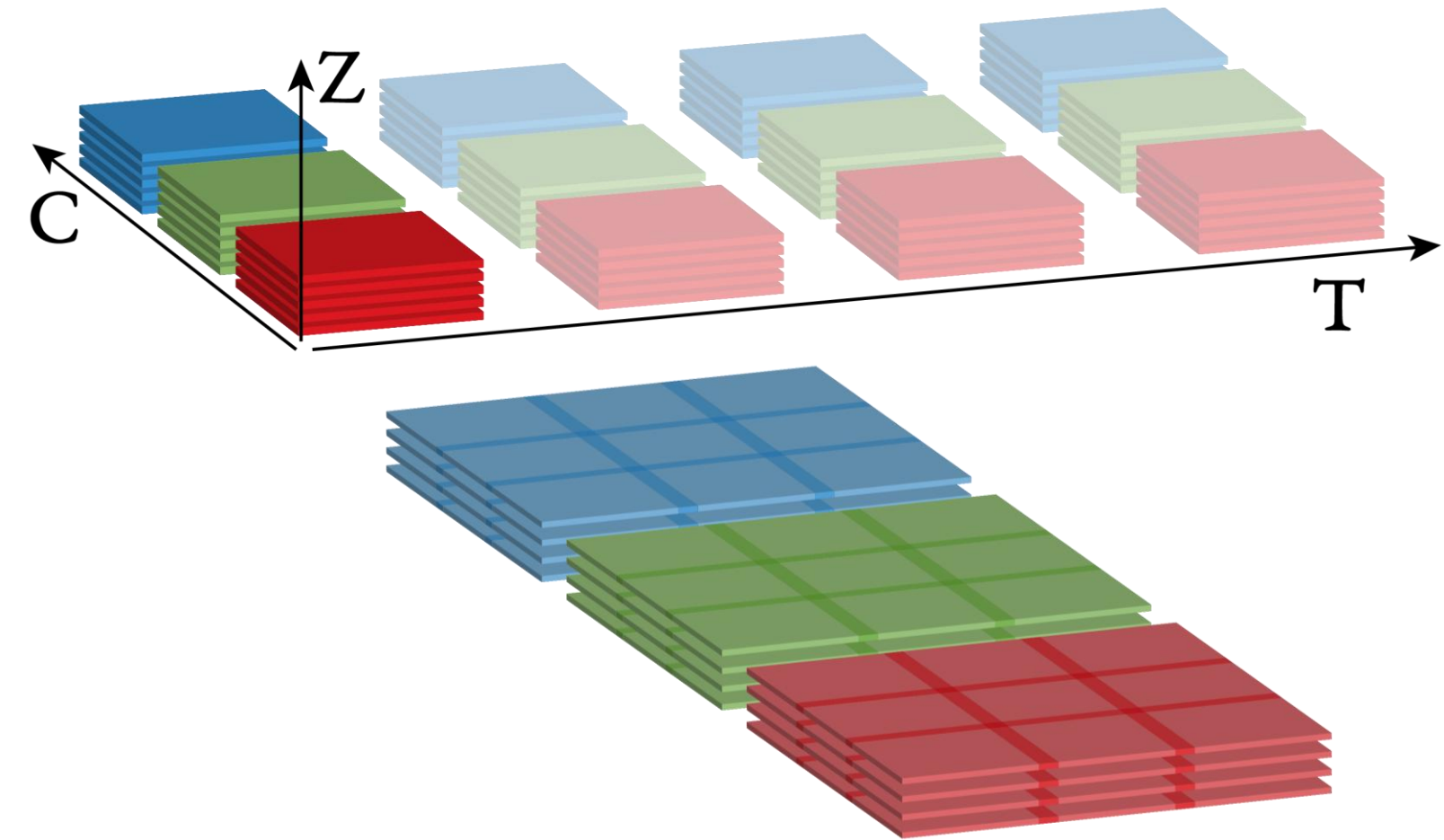
Tiled Images

N Dimensions



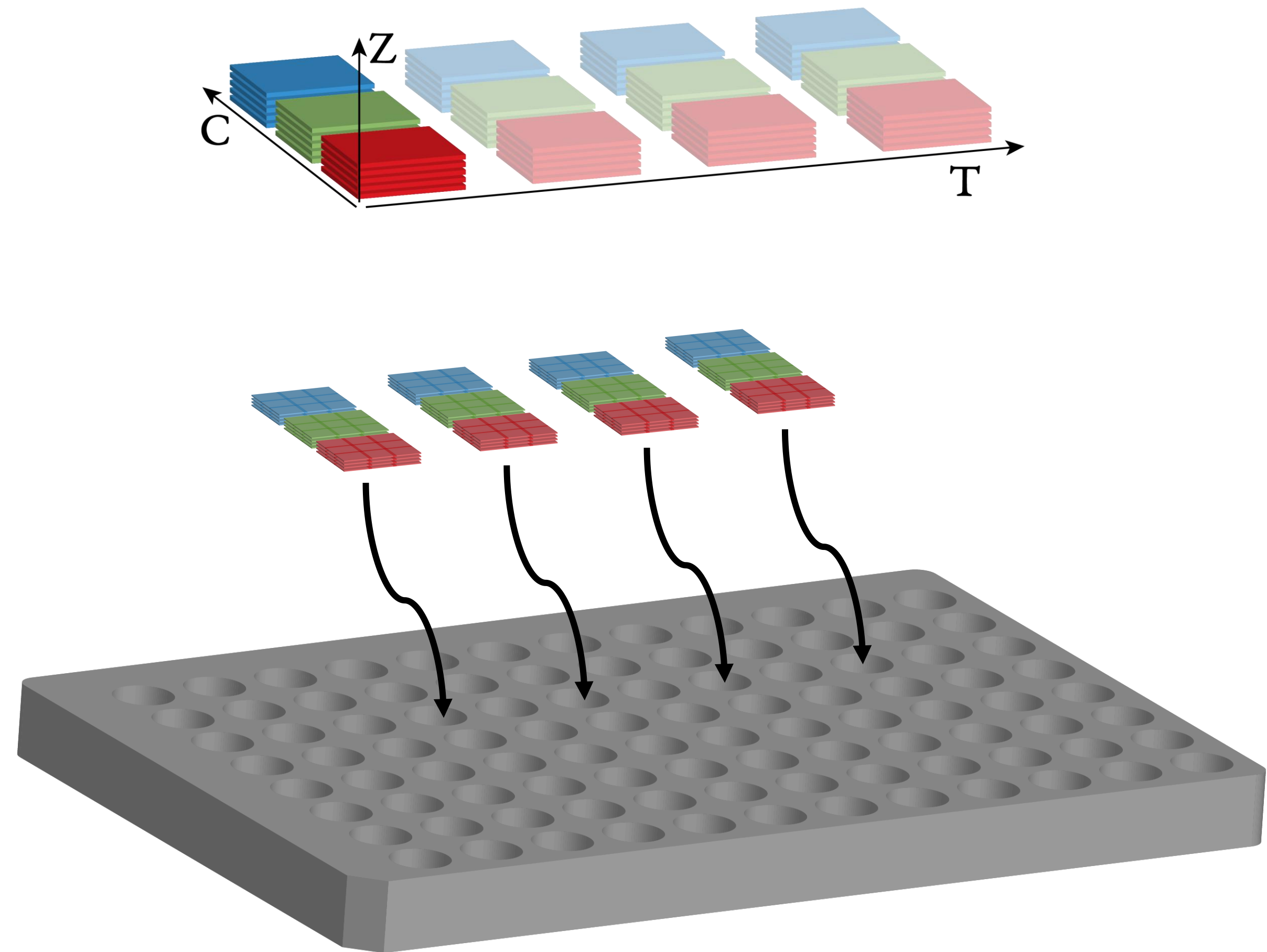
Tiled Images

N Dimensions



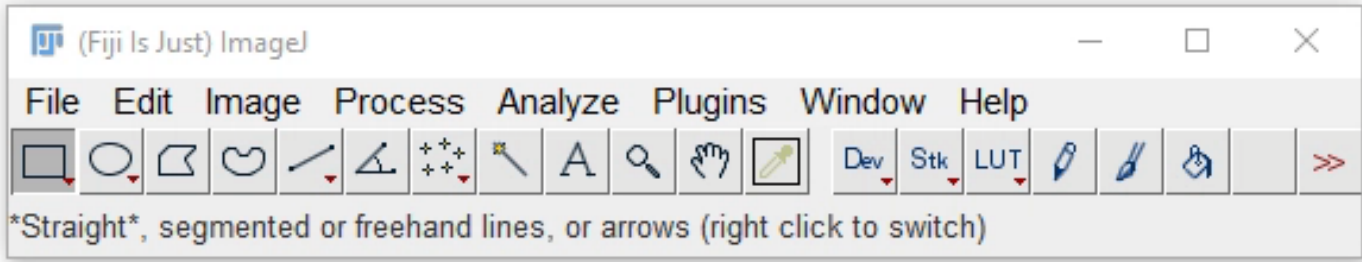
Tiled Images

N Dimensions



Multi Well Images

Working With Fiji



- Max 5 Dimensions
 - X Y C Z T
- Large Data: BigDataViewer

Let's Talk Image Size

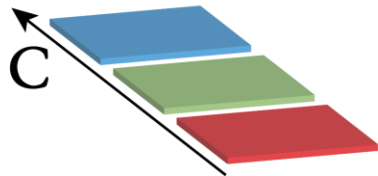
Let's Talk Image Size



Reference: 8-bit Image, 1024 x 1024

Dimensions	# Images	Size
XY	1	1MB

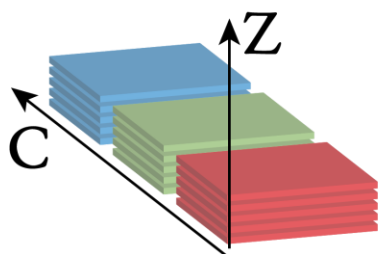
Let's Talk Image Size



Reference: 8-bit Image, 1024 x 1024

Dimensions	# Images	Size
XY	1	1MB
XYC	3	3MB

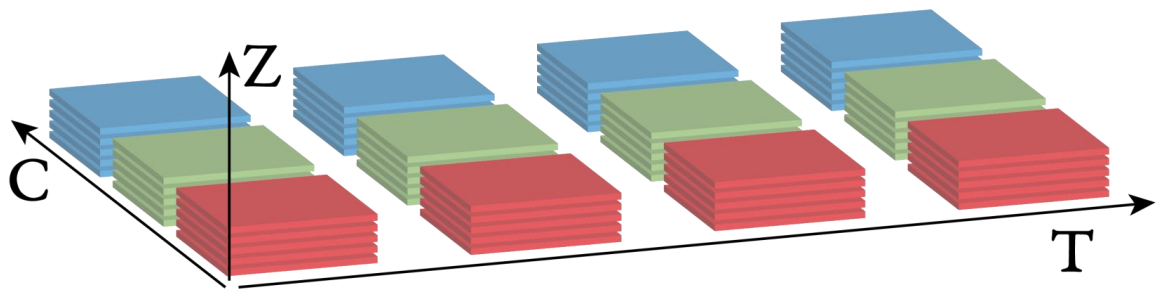
Let's Talk Image Size



Reference: 8-bit Image, 1024 x 1024

Dimensions	# Images	Size
XY	1	1MB
XYC	3	3MB
XYCZ	3 x 10	30MB

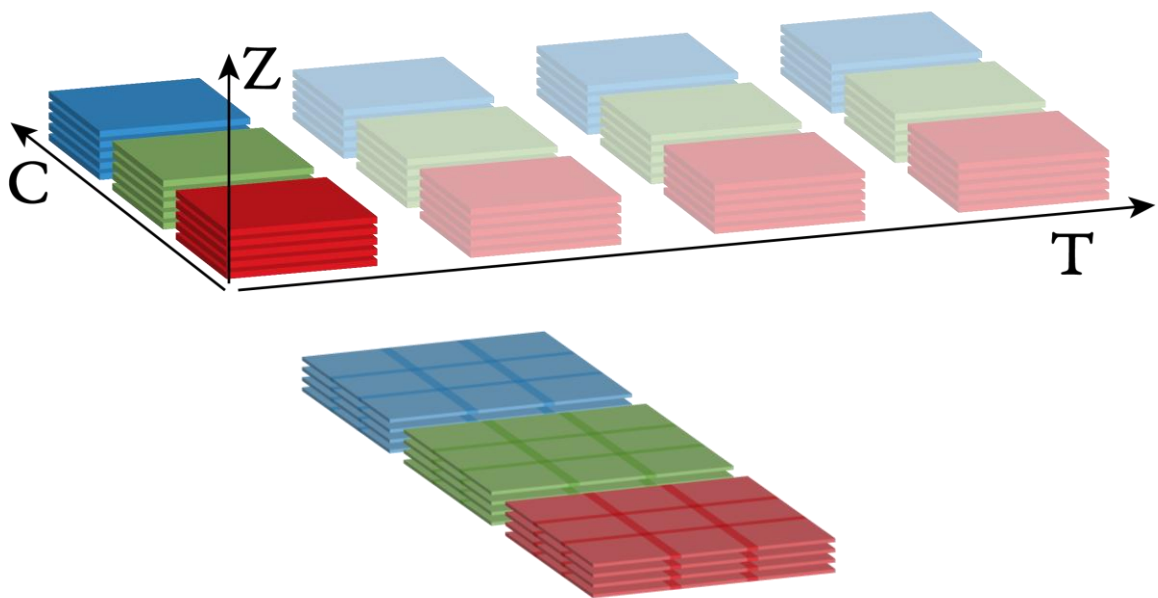
Let's Talk Image Size



Reference: 8-bit Image, 1024 x 1024

Dimensions	# Images	Size
XY	1	1MB
XYC	3	3MB
XYCZ	3 x 10	30MB
XYCZT	3 x 10 x 20	600MB

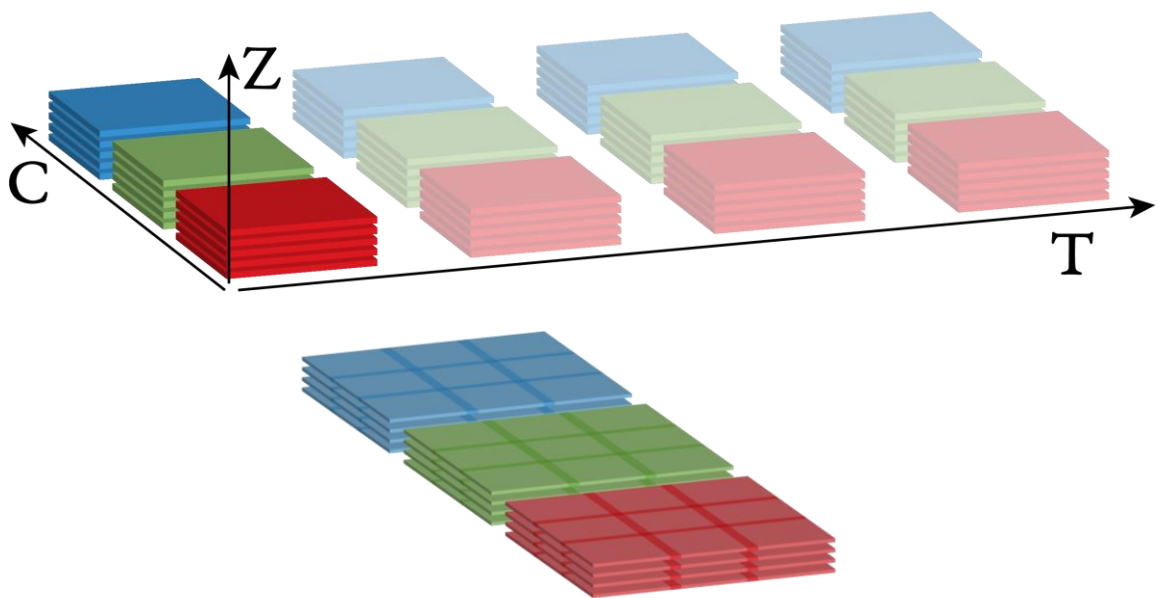
Let's Talk Image Size



Reference: 8-bit Image, 1024 x 1024

Dimensions	# Images	Size
XY	1	1MB
XYC	3	3MB
XYCZ	3 x 10	30MB
XYCZT	3 x 10 x 20	600MB
Tiled XYCZT	3 x 10 x 20 x 9	5.4GB

Let's Talk Image Size

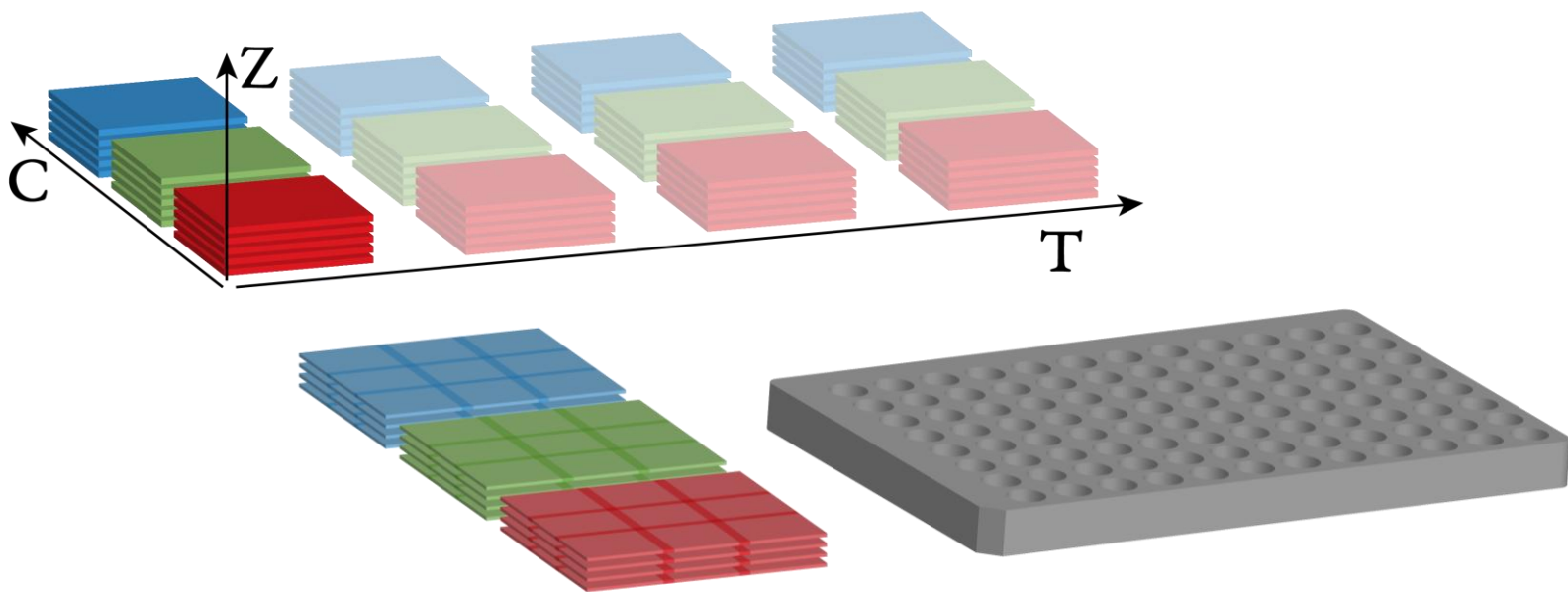


Reference: 8-bit Image, 1024 x 1024

Dimensions	# Images	Size
XY	1	1MB
XYC	3	3MB
XYCZ	3 x 10	30MB
XYCZT	3 x 10 x 20	600MB
Tiled XYCZT	3 x 10 x 20 x 9	5.4GB

- Biological Replicates x 3 : **16.2GB**

Let's Talk Image Size

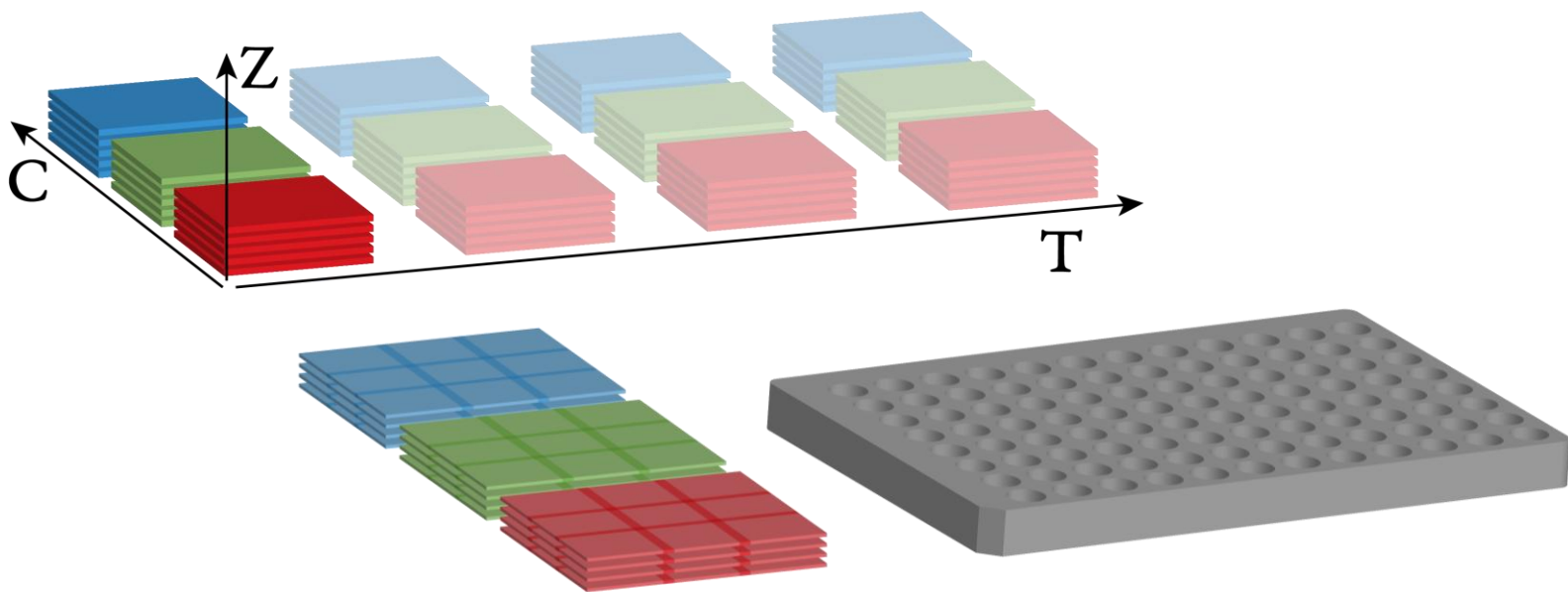


Reference: 8-bit Image, 1024 x 1024

Dimensions	# Images	Size
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XYCZT	3 x 10 x 20	600MB
Tiled XYCZT	3 x 10 x 20 x 9	5.4GB

- Biological Replicates x 3 : **16.2GB**
- In 96 Wells: **1.5TB**

Let's Talk Image Size

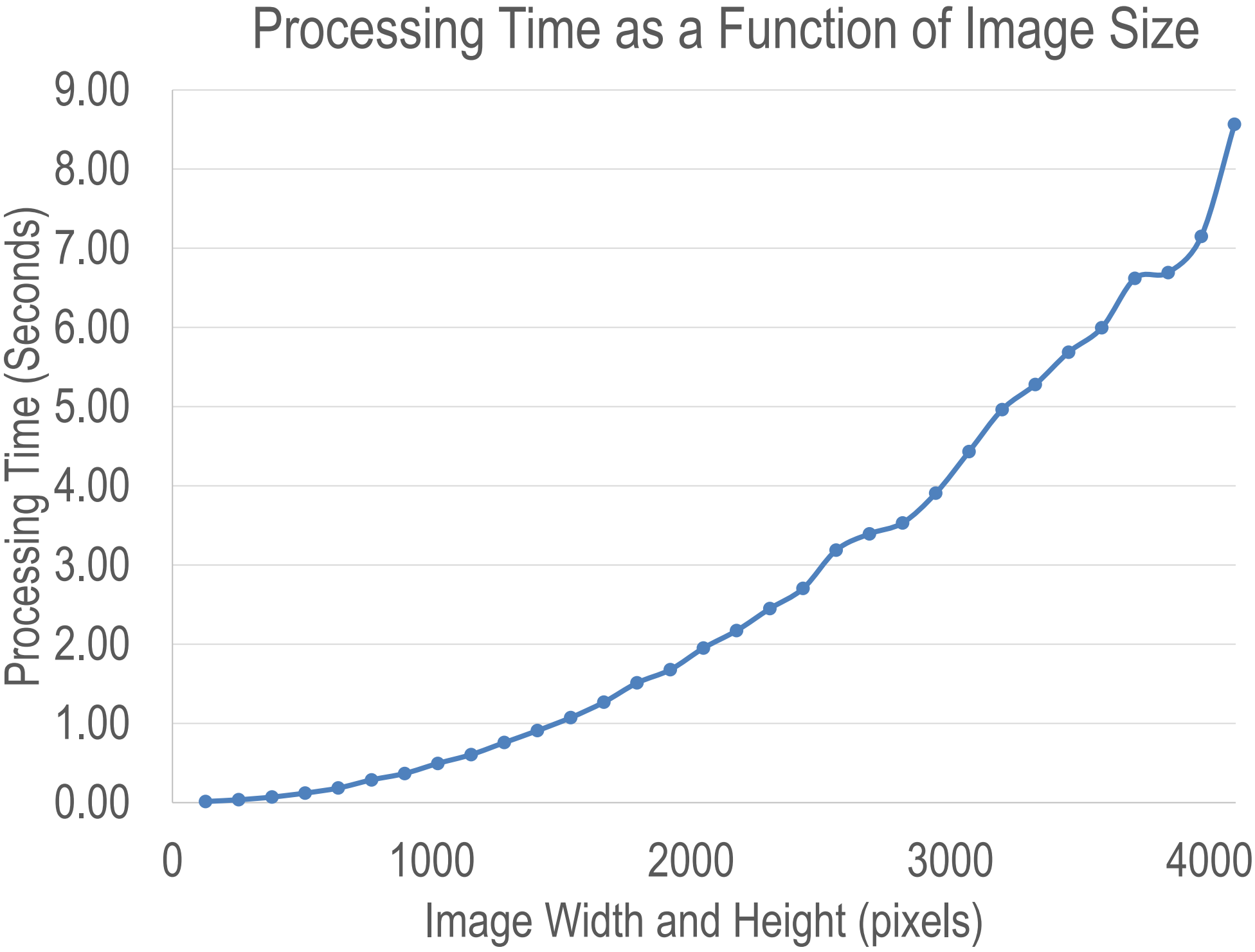


Reference: 8-bit Image, 1024 x 1024

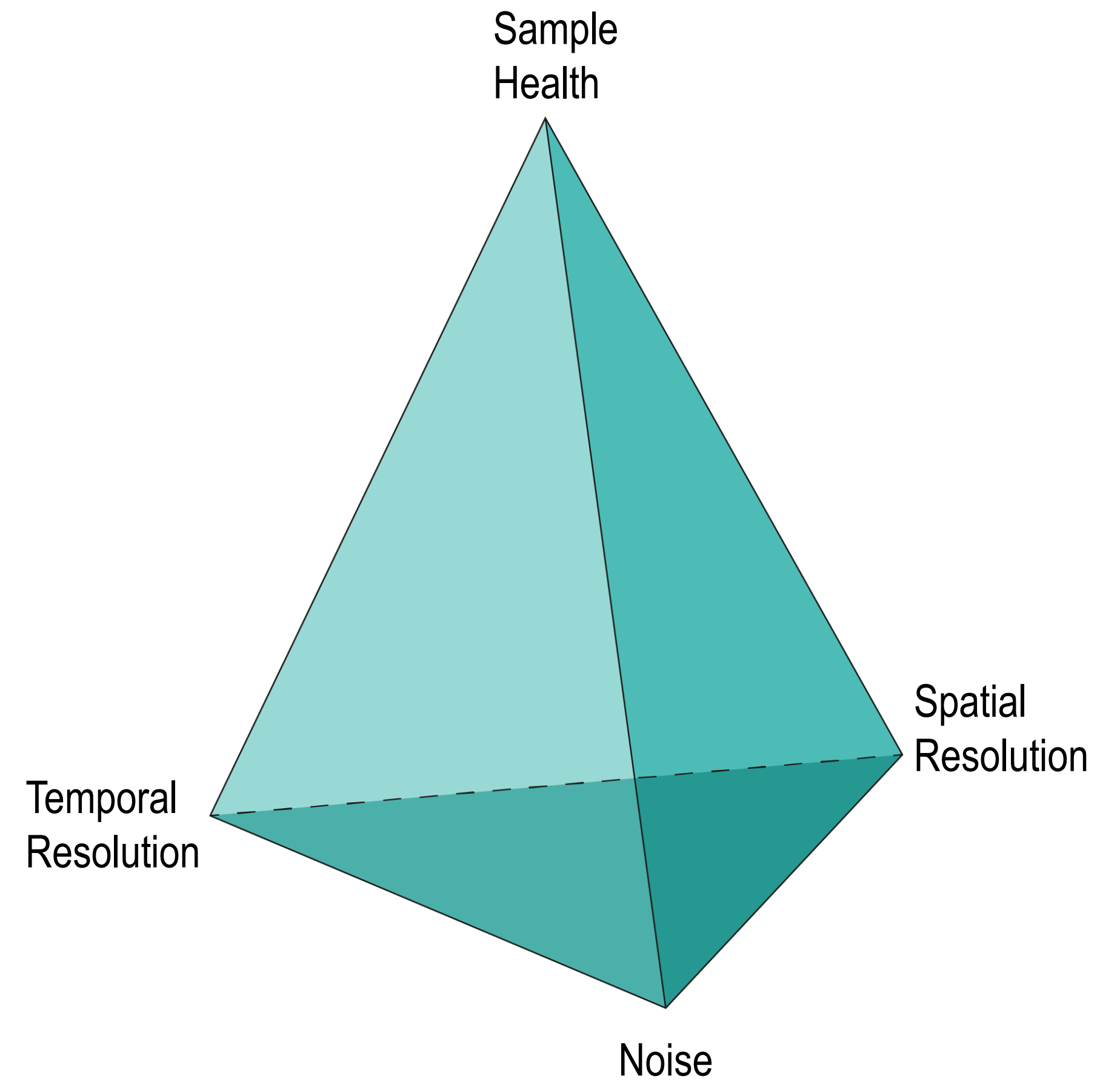
Dimensions	# Images	Size
XY	1	1MB
XYC	3	3MB
XYCZ	3 x 10	30MB
XYCZT	3 x 10 x 20	600MB
Tiled XYCZT	3 x 10 x 20 x 9	5.4GB

- Biological Replicates x 3 : **16.2GB**
- In 96 Wells: **1.5TB**
- Using a 16-bit Camera: **3.0TB**

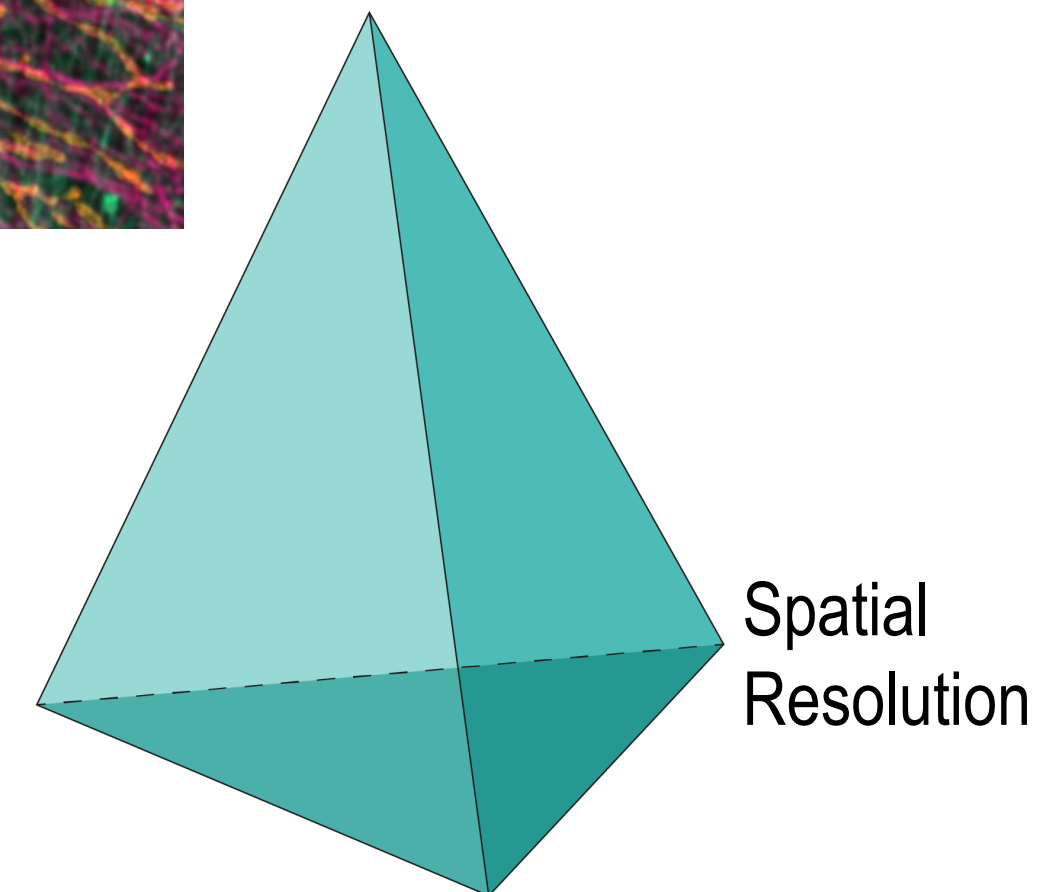
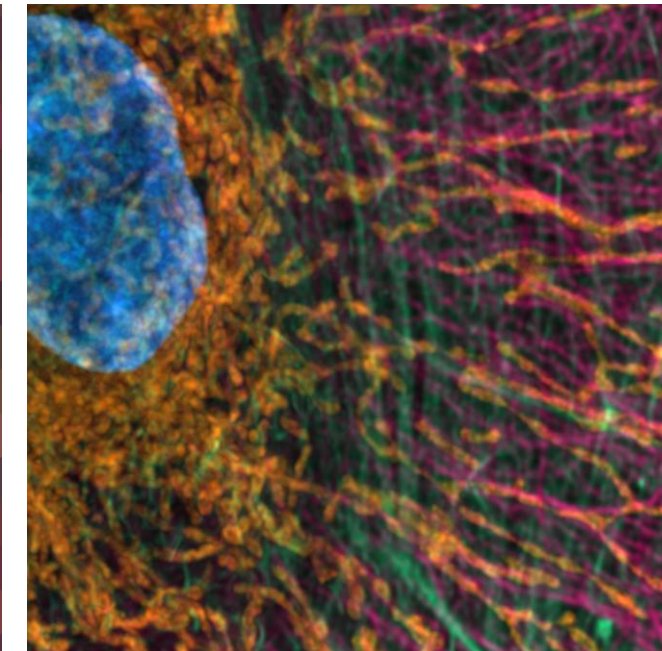
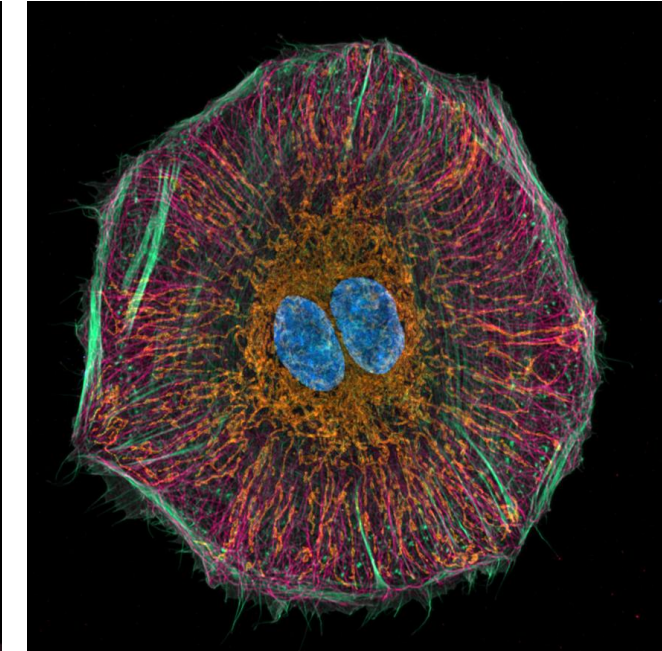
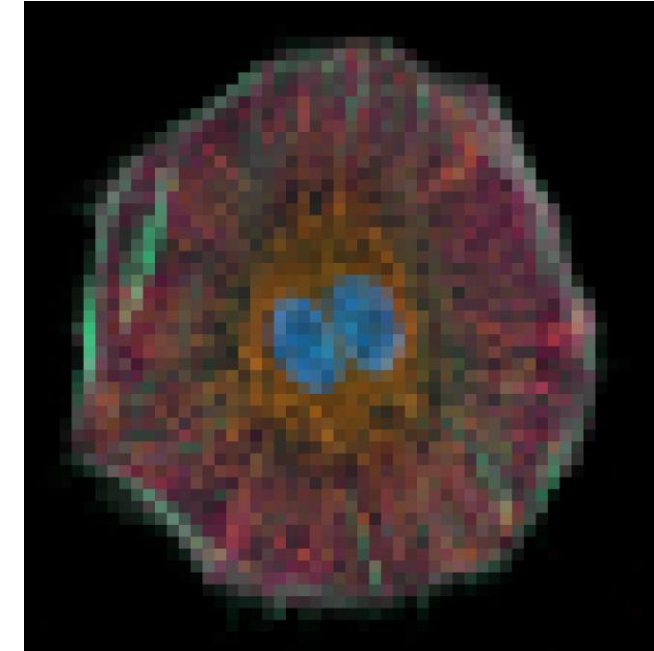
Processing Time



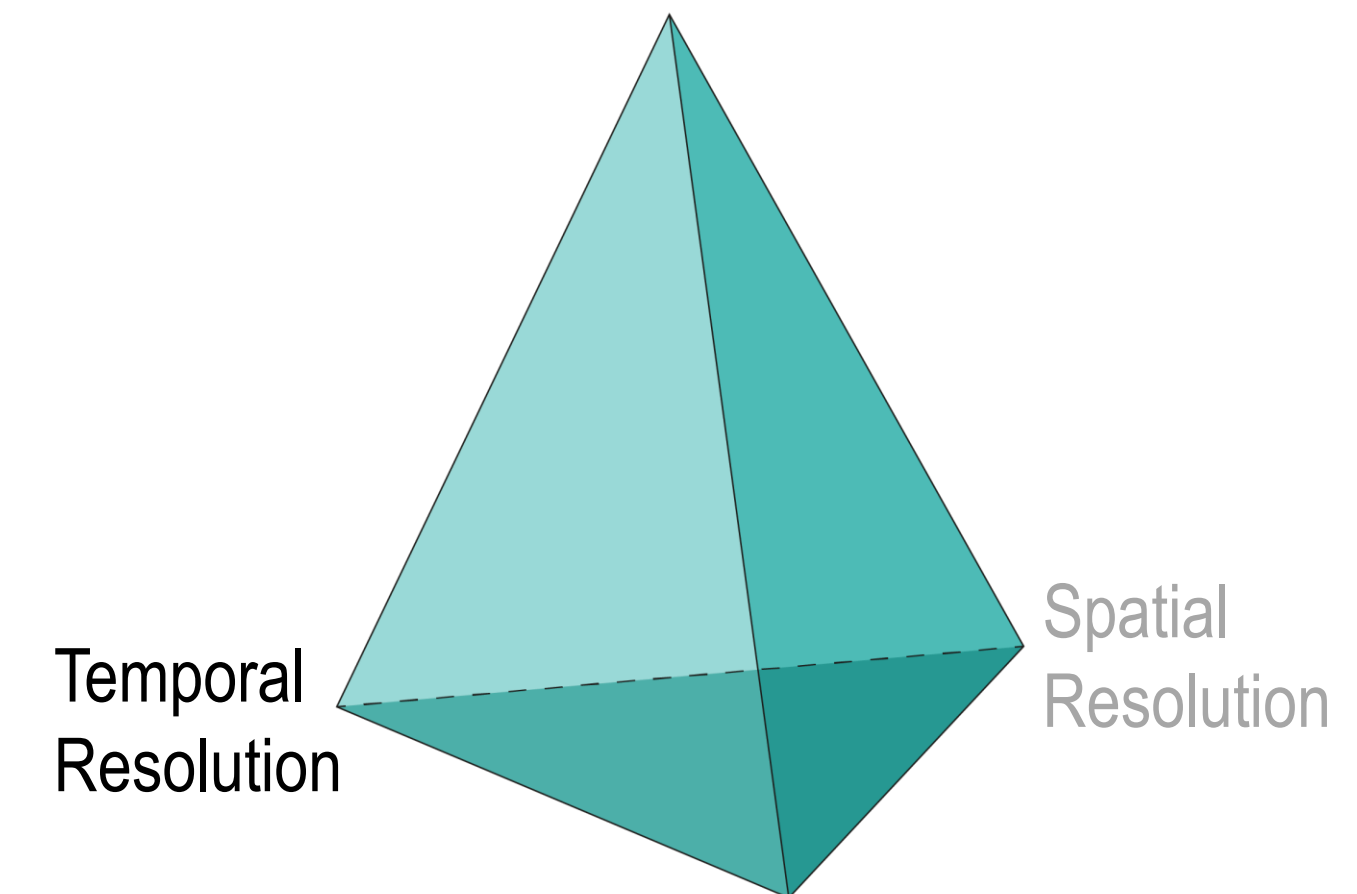
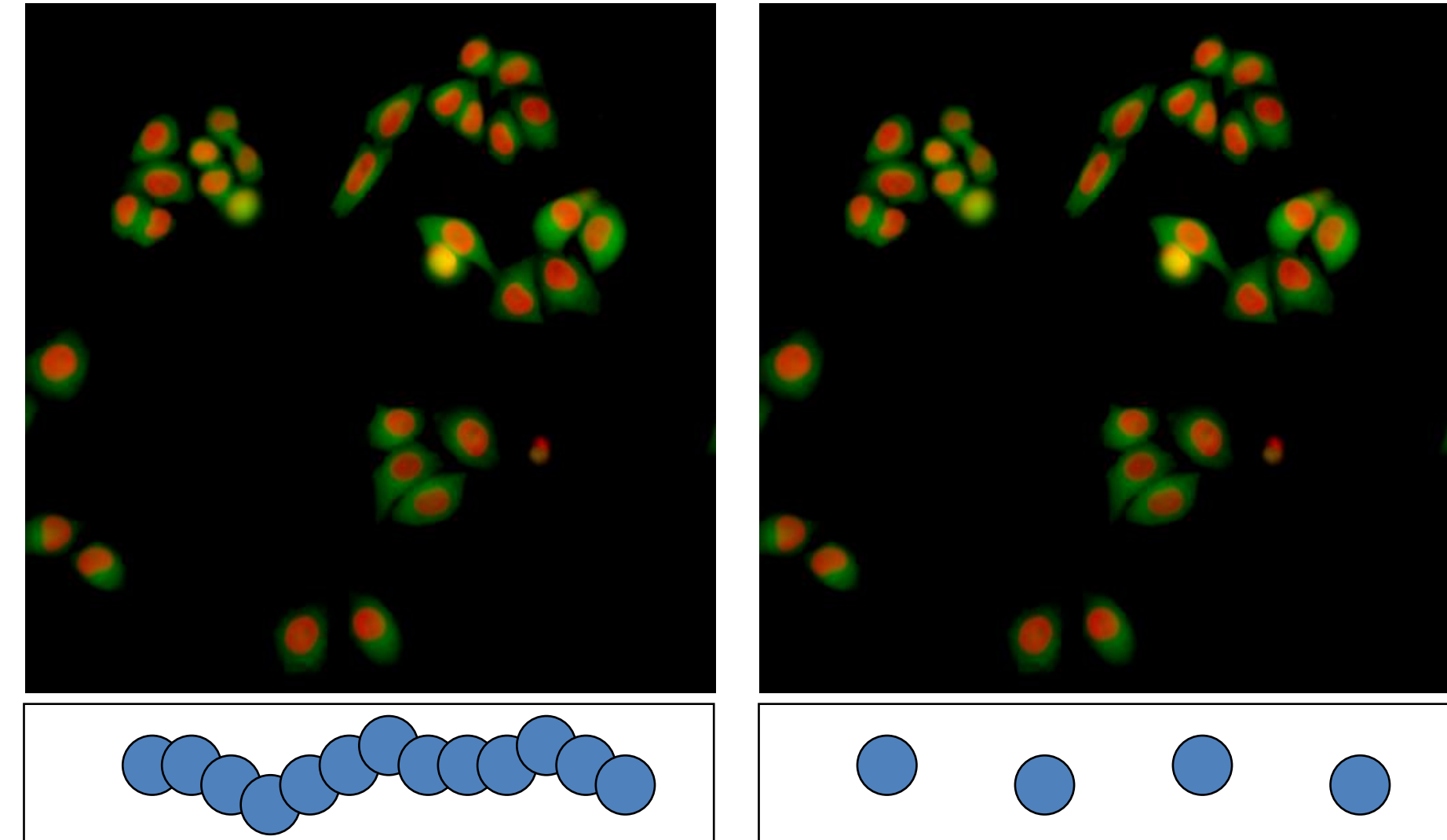
There is Always a Compromise



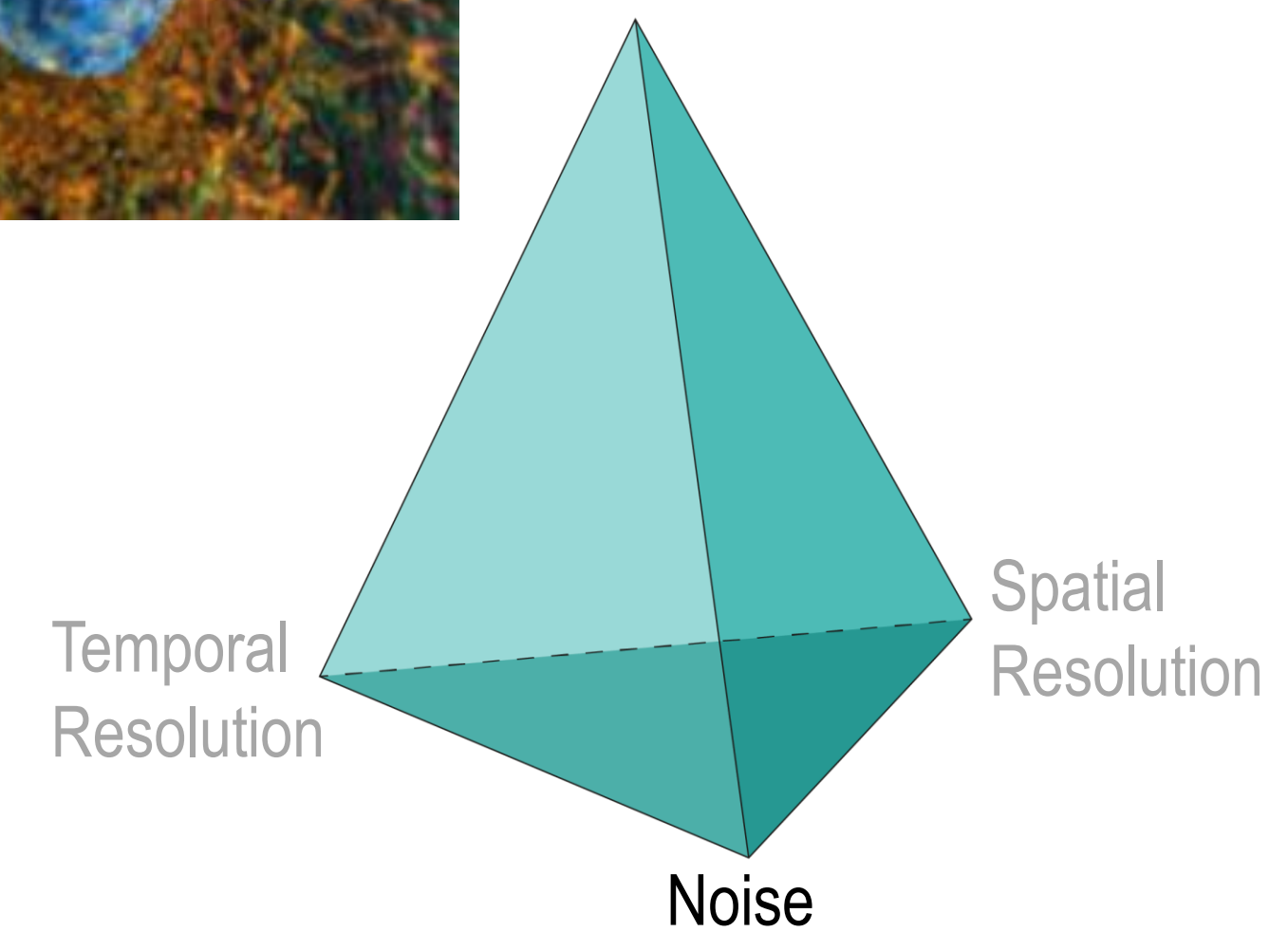
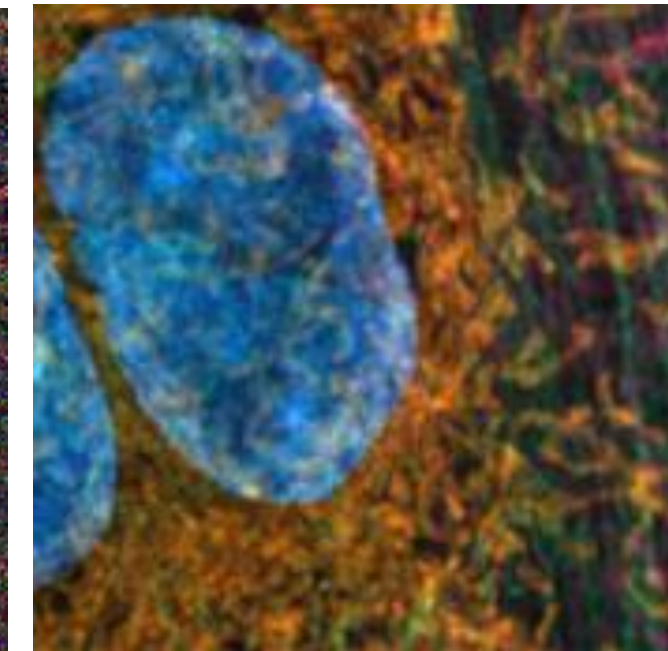
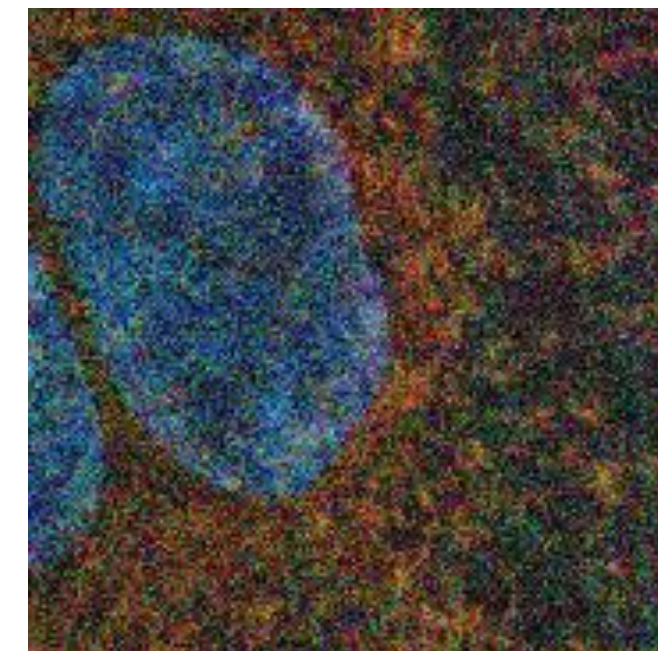
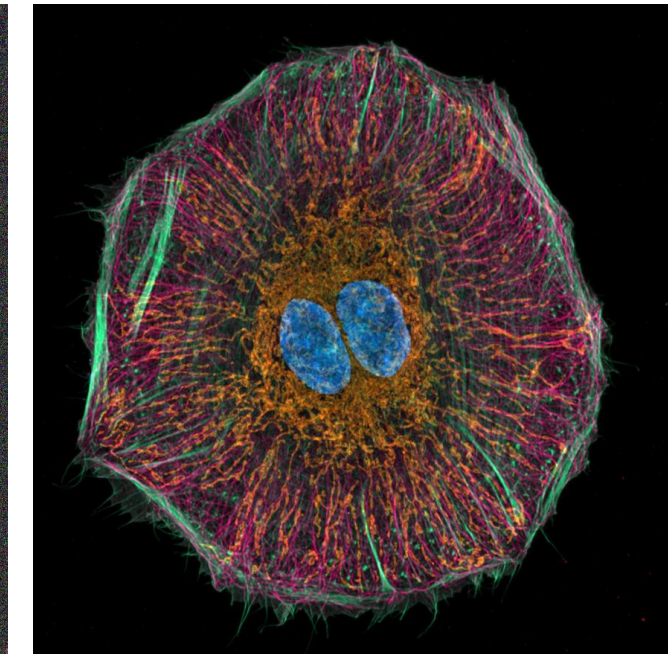
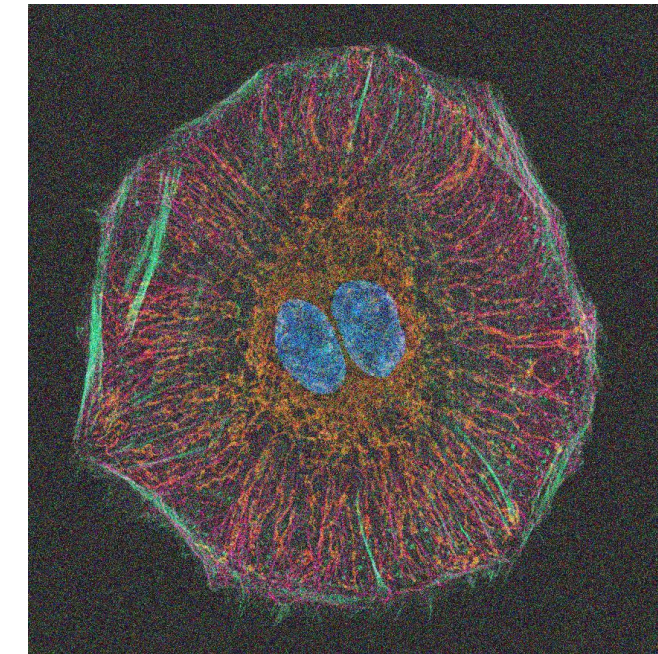
There is Always a Compromise



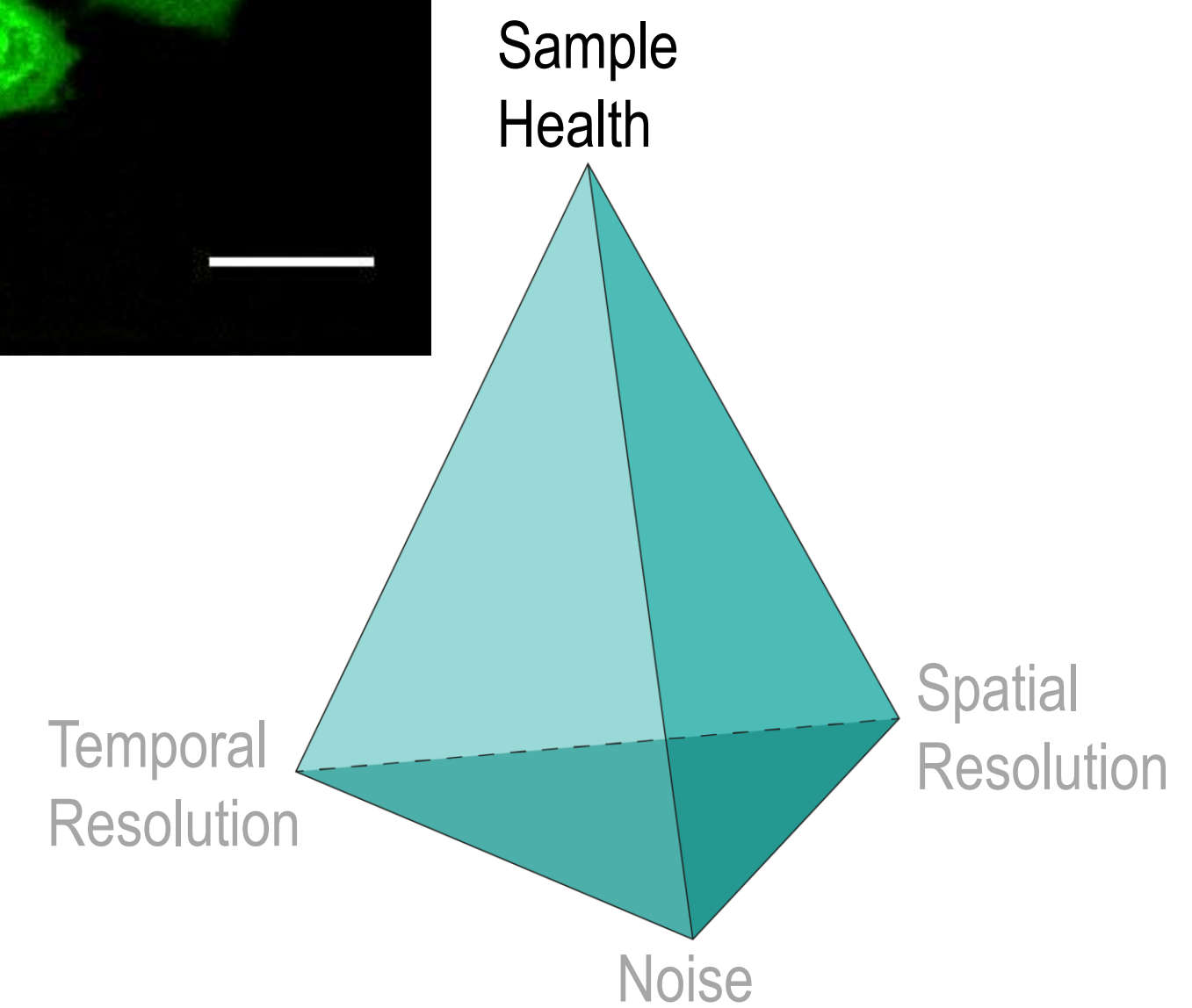
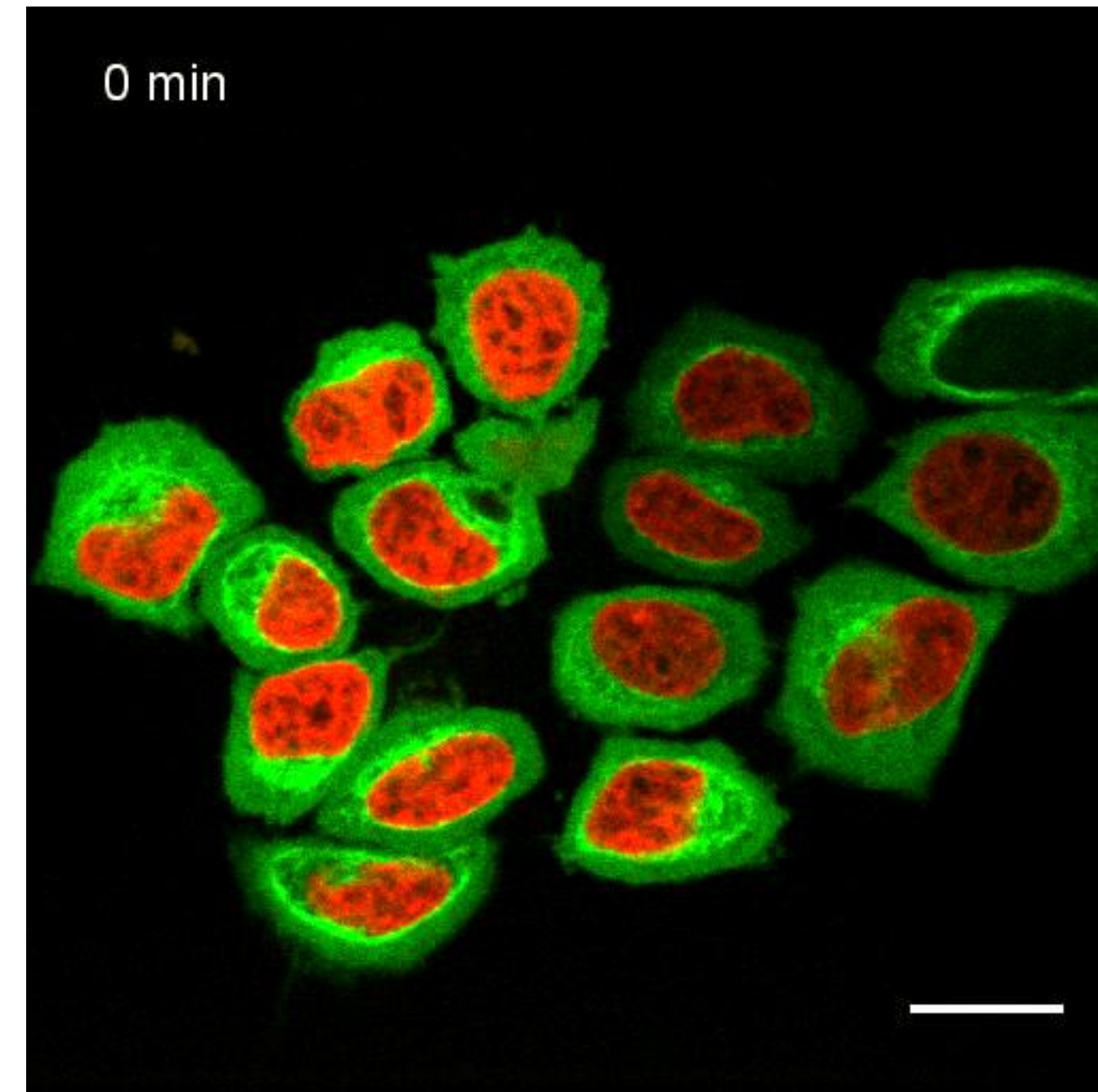
There is Always a Compromise



There is Always a Compromise



There is Always a Compromise



- Image are N-Dimensional
- Fiji provides Visualization Tools
 - Limited to 5 Channels
- Data Can Become Big Fast
- Everything is a Tradeoff
 - "Image what you *need*, not what you can"