Image restoration with deep learning

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# Pyramid of frustration

A successful live-cell fluorescence microscopy experiment will need to balance spatial/temporal -resolution, sample viability, and image quality which collectively form the “pyramid of frustration”.

If the camera exposure time is too long, then motion blur becomes a problem. Shortening the exposure time will mean sacrificing image quality–unless the laser power is increased (and the fluorophore can handle it). But higher laser power leads to increased risk of phototoxicity (compromising the experiment) and photobleaching (limiting how many images can be taken in addition to contributing to phototoxicity)

# Image restoration with deep learning

Deep learning image resolution techniques can handle images with very low signal-to-noise ratios. Since raw image quality can be worse than before, researchers can get better image quality and/or more images.

## 3DRCAN

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| A comparison between raw (top-right) and 3DRCAN-processed (bottom-left) endoplasmic reticulum tubules |