

Today's Outline

- Finish the discussion of why it was difficult to appreciate the existence of cells
 - Early microscopes - observations
 - Van Leeuwenhoek, Robert Hooke
 - Difficulties in the observations
- Development of technologies - thin sectioning, staining
- Resolution
 - What's the problem?
 - How do you solve it?

- More about resolution
 - Started talking about resolution as issue in your eye
 - Limits by the number of photoreceptor and the information that falls on a single photoreceptor
- Today talk about the limits based on the sample
 - Take this and discuss light, interference, Airy disk
 - Eventually lead to Abbe formula for resolution
 - Proof that you couldn't do any better than a certain limit of resolution
 - So... you must know how to defy the Abbe Limit
 - This will lead to sections of tissue - how to get them / how to make sense of them

- Example of resolution:



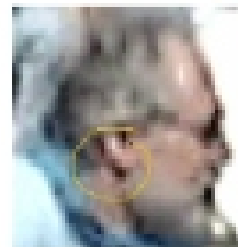
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- Using this picture, let's enlarge it further

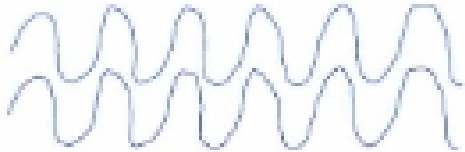
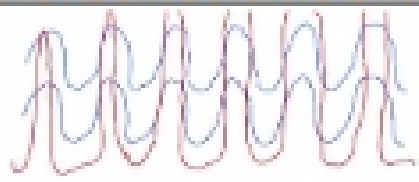



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- Is there a possibility that we missed an earring? Let's blow it up some more



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- At some point, the things that make up the image (the pixel) give you a limit and you cannot tell and get more information out of it
 - Empty magnification - when you reach an enlargement that provides no additional information about the sample
 - What about image that come in the microscope, what's going on there?
 - So the nature of the image itself can limit resolution. Is there anything intrinsic about images?
 - Why couldn't I just put big enough lenses to get it larger and larger to get more information (assuming everything else is clean)
 - What's holding it back?
 - The limitation is, from the nature of light itself
 - Interference
 - Imagine light as a wave (whole series of waves parallel to each other)
 - Light isn't a single wave that moves across the page, it is a whole series of waves that move parallel to each other
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- What happens when you line up these waves with respect to each other
 - Because they are identical, rise of one wave is the same as the rise of another
 - Energy adds up (constructive interference)
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- If you were looking at this phenomenon, you will see these light as brighter
 - Imagine light as a wave (whole series of waves not parallel to each other)
 - What happens when you take one of the waves and line them up on the opposite position
 - When you line these waves up where the fall of one wave matches with a rise of another
 - Energy falls down (destructive interference)
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- You will see a straight line
 - When you have two sources of light coming together,
 - Every point on a point comes from a source of light...
 - Coming off an object is a series of waves of light (different angles of the object gives off a wave at a different angle)

