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# **Contrast** - An Introduction

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Resolution is nothing  
without contrast

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A useful definition of contrast in the context of microscopy is Michelson contrast

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$$C_{\text{Michelson}} = \frac{I_{\text{max}} - I_{\text{min}}}{I_{\text{max}} + I_{\text{min}}}$$

$C$ ... contrast  
 $I$ ... intensity

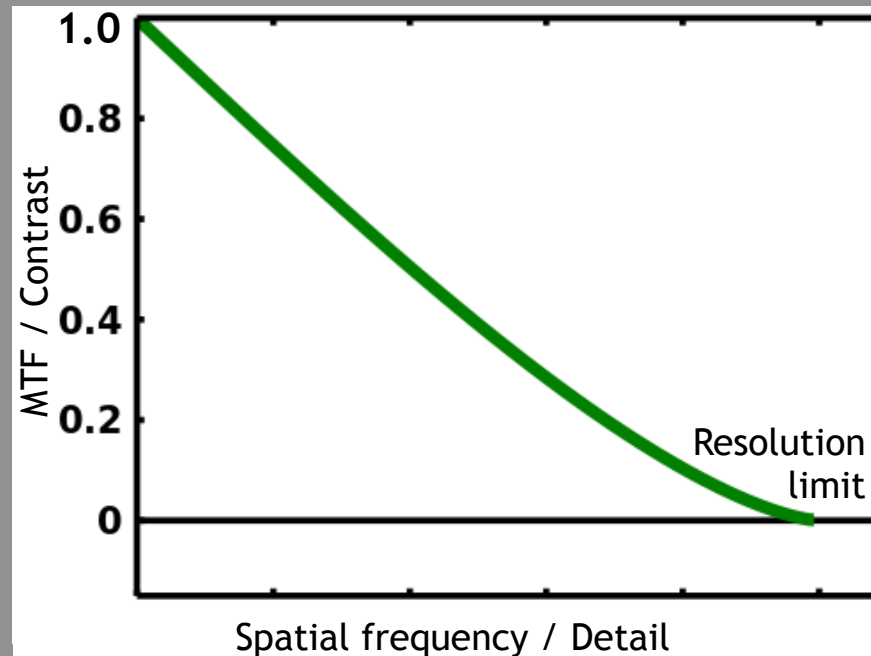
  $0 < C_{\text{Michelson}} < 1$  

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# The Modulation Transfer Function (MTF) describes how brightness contrast depends on spatial frequency



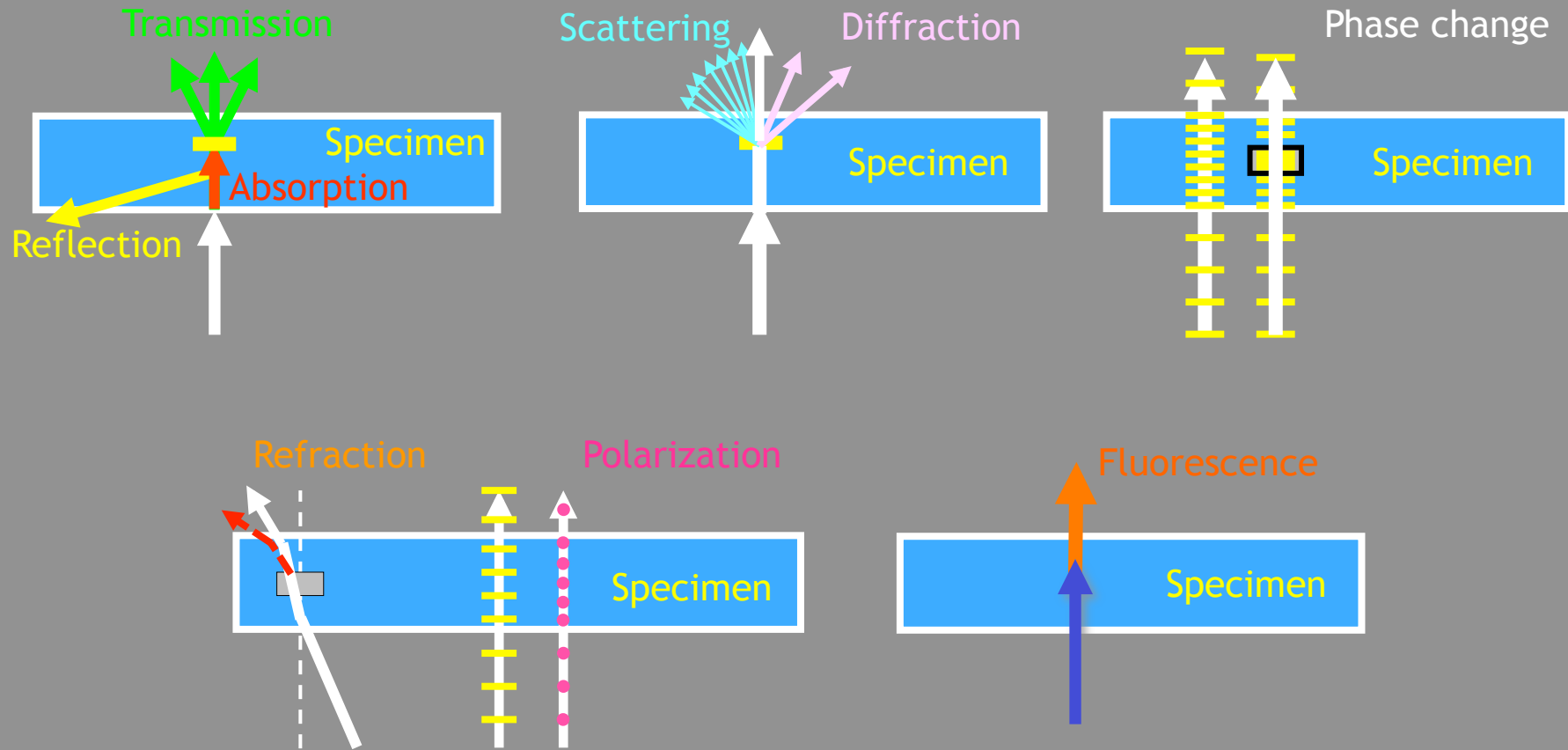
$$C_{\text{Michelson}} = \frac{I_{\text{max}} - I_{\text{min}}}{I_{\text{max}} + I_{\text{min}}}$$



[https://en.wikipedia.org/wiki/Optical\\_transfer\\_function](https://en.wikipedia.org/wiki/Optical_transfer_function)

# Various interactions between specimen and light generate and alter contrast

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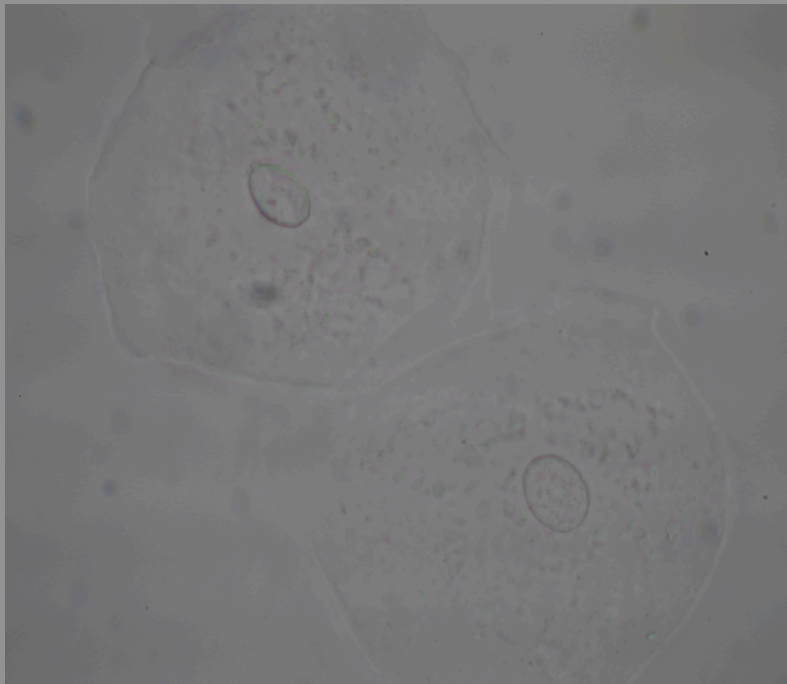
Adapted from Peter Evennett

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Our eyes can perceive contrast based on brightness or colour, but not on phase or polarization

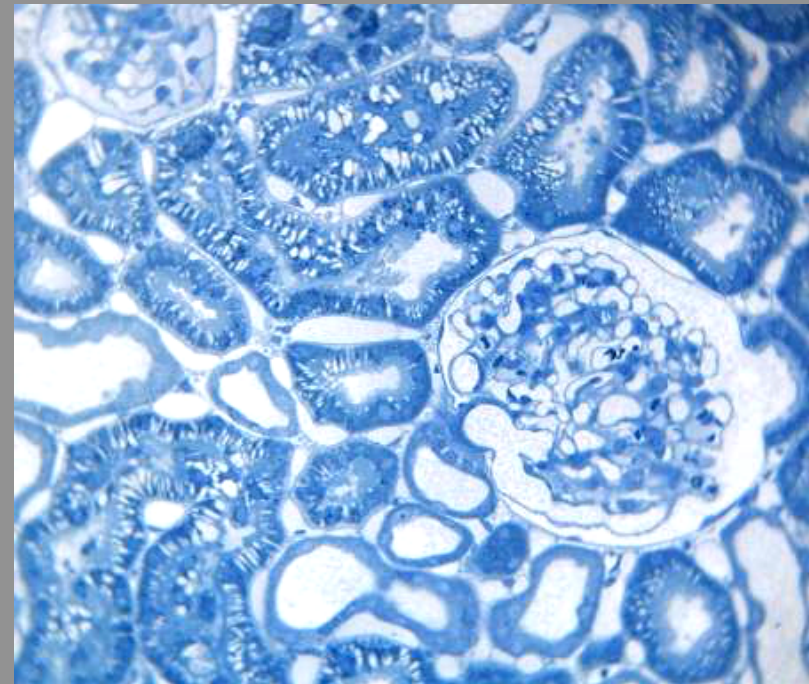
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**Brightness**



Buccal cells

**Colour**



Kidney section

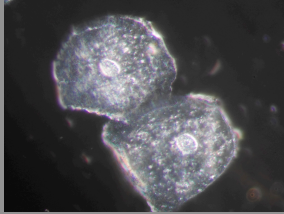
Images from Peter Evenett

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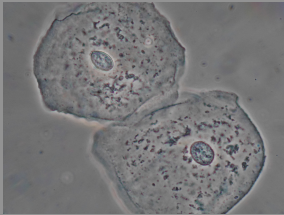


# The following contrast techniques for transmitted light imaging will be covered

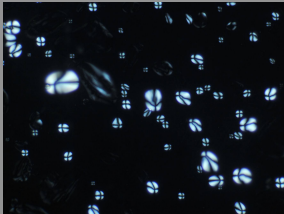
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**Dark Field - Jan**



**Phase Contrast - Davide**



**Polarized Light - Sebastian**



**Differential Interference Contrast - Britta**

Images from Peter Evennett

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