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MORE THAN MICROSCOPY

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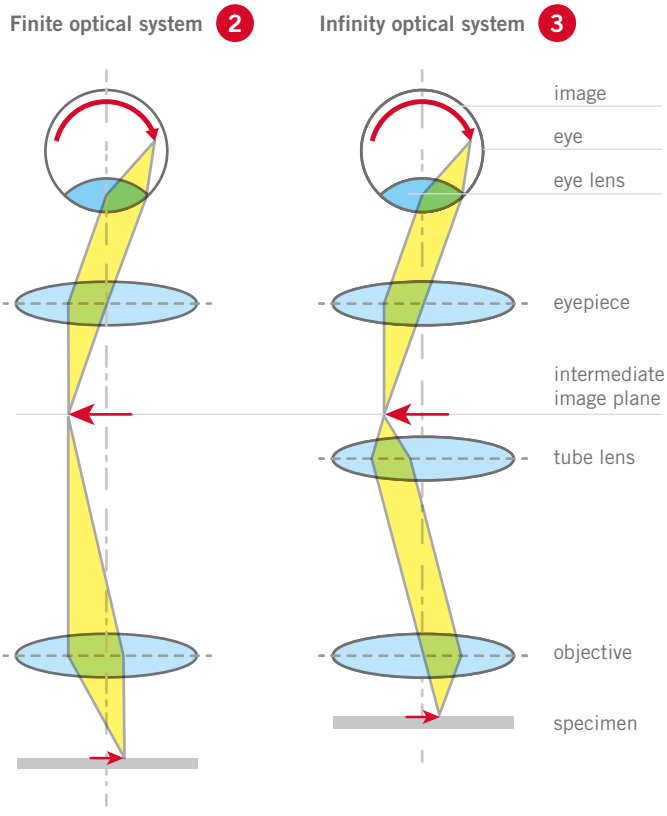
SUPPORT

BASIC MICROSCOPY CONCEPTS

UNDERSTANDING THE FIELD OF VIEW (FOV)



Finite **(2)** and infinite **(3)** optical system.
In the Infinity Concept please note the parallel rays between objective and tube lens.

UNDERSTANDING THE FIELD OF VIEW (FOV)

To judge the performance of a microscope, the FIELD of VIEW (FOV) is a criterion of interest. What is this "FIELD of VIEW"?

In a technical sense, we are talking about the diameter of the INTERMEDIATE IMAGE, created by the objective or, in infinity systems, by the cooperation of objective and tube lens. This intermediate image is enlarged by the eyepiece, acting as a magnifying glass. The labelling of the eyepiece shows the actual FOV in combination with its magnification, e.g. 10X/23 for a standard 10X eyepiece with FOV 23 **(1)**.

Especially in stereo microscopy, where large samples come as standard, a large FOV is appreciated for a better sample overview before going into details. But how much "more" do I see at a glance in a FOV 23, in comparison with a FOV 20? Is it worth to choose a more expensive model, or is the less expensive solution sufficient?

Trying to answer this question, we first have to calculate the area of the intermediate image by applying the formula for the circular area $A = \pi \times r^2$ for both cases.

A = area of circular intermediate image (unit: mm2)
r = radius of circular intermediate image = 0.5 x FOV
$A_1 = \pi \times r_1^2$
$A_2 = \pi \times r_2^2$
$A_1 / A_2 = \pi \times 11{,}5mm^2 / \pi \times (10mm)^2 = 1{,}322$

This calculation reveals a 32.2% larger intermediate image in the FOV23; 32.2% more information in comparison to a FOV20 setup.

Now it comes to the sample itself. "My sample has a diameter of 30mm, is it possible to see it in total"? With a given FOV, every microscope user is able to work out quite easily the visible sample area with a particular objective.

FØ = visible sample area (Ø in mm)
FØ = FOV / MagObj.

4

Eyepiece	Zoom position	Magnification	F ømm
10X / 23	0.75	7.5	30.7
	1	10.0	23.0
	2	20.0	11.5
	3	30.0	7.7
	4	40.0	5.8
	5	50.0	4.6

Based on this formula, the microscope manufacturer present detailed information about the visible sample area F (Ø in mm) **(4)**.

Following this chart, the standard configuration of Motic's SMZ171 offers an area of 30.7mm Ø at a glance. The total magnification in this case is 7.5X. By adding auxiliary objectives < 1X magnification, this area can be enlarged up to an area of 102mm Ø.

This kind of approach is also valid for compound microscopes. Motic's BA410E, combined with the low power objective EC-H PL 2X/0.05 displays a sample area of 22/2 = 11mm Ø, roughly the size of a thumbnail. For pathology this is interesting, but also in botany or zoology this combination may be useful as it represents a "missing link" between macro and micro observation.

Humans tend to follow the idea "the more the merrier". Basically this idea is also applied for the FOV. But there are limitations. A FOV 28 may be impressive from the technical side (think about the field flatness), but overburdens the human eye: the eyes have to "roll" in order to cover the whole visible area.

In a modern sense, this is far away from being ergonomic and will exhaust the eyes quite soon.

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