Advancing Cancer Diagnostics
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Top Considerations When Buying a Camera for a Clinical Microscope

The need to document the results of a clinical diagnosis – be it in histopathology, cytology, hematology, clinical microbiology or other applications, has significantly increased over the past few years.

High quality images from pathology samples can be used for many purposes. (e.g. second opinions, and tumor boards etc.) Further, high-quality images, captured with a suitable camera, can eliminate the need to carry or ship slides. Teaching, as well as creating images for publications, are other common uses where a camera can increase efficiency and support your daily tasks.

A high quality, simple to use camera is almost a standard accessory to any routine microscope. Selecting the right model can be daunting with the array of specifications and technical details available. When searching for the most appropriate camera for your microscopy application, asking yourself a few simple questions relating to critical features will guide you to the most appropriate camera to suit your needs. Below are top tips to arriving at your ideal microscopy photography partner!

1. Consider the contrast techniques you use

As the main guiding principles, the following would apply:

- If you only want to capture brightfield images, a high-quality color camera is recommended
- If you still want to capture fluorescent images on an infrequent basis, the brightfield option might be the best choice
- If you are going to use the camera for a mixture of brightfield and fluorescent images then consider a dual camera option, as this will ultimately give you the best performance
- For Fluorescent images only, a monochrome camera is recommended for better results

2. Determine what resolution level is needed for your application in brightfield

In microscopy, the requirements for a camera are quite different compared to the requirements you might have when choosing a consumer camera. Plenty of megapixels alone will not deliver a decent microscopic image, factors like pixel size, chip size, and frame rate can be more important:

- **Lower magnification:** Are you capturing images in routine applications of tissues or cells in objective magnifications up to 40x in brightfield? A medium range pixel size and at least three- megapixel camera chip will deliver suitable results for your application, cooling is not mandatory
- **Highest magnification:** Are you interested in high-end resolution, e.g. of nuclei details in 100x oil, like in hematology, or to observe protists and bacteria in microbiology? If yes, a camera with an optimized pixel size, and a moderate number of megapixel might be the best option
- **Live imaging:** Do you need a fast, live image, e.g. for live tumor board discussions or teaching, using a monitor with or without computer or a tablet? A high frame rate (frames per second, fps) will facilitate a smooth movement of the microscopic image on the screen, at least 30 fps can be recommended. There are also cameras available which can connect directly to a screen, without the need to use a computer

3. Define what you need to consider when capturing fluorescence images

Fluorescence applications are per se low light applications. Very often weak signals on a black background shall be observed, therefore the camera chip must deliver a high sensitivity.

- What kind of fluorescence samples do you want to capture? Routine immunofluorescence investigations could be covered with an entry level fluorescence camera, exposure times depend on the staining intensity in the sample but also on the fluorochrome, and should be in the range of 20-1500 msec. For advanced analyses or dot counting, a high-end fluorescence camera is the better choice, and exposure times should be adjusted according to sample type and fluorochrome to minimize bleaching
- Cooling of the camera chip is important to avoid background noise in all applications. Look at the technical specifications of the cameras to learn if the chip is cooled. This is especially important, if you are considering the purchase of just one camera to cover your imaging needs in brightfield and fluorescence

4. Decide upon which interfaces your ideal camera should provide

Microscope cameras can connect to computers via USB 2.0, the faster USB 3.0 or firewire. Your computer should have the matching sockets (or should be upgradable). It should deliver a sufficient performance to cope with the imaging tasks. Some cameras can connect directly (with or without computer) via cable or wirelessly to a screen and/or allow to capture images on an SD card

- Do you want to use the live camera image for teaching or discussion directly on a screen? Then your ideal camera should have HDMI connection to connect to your monitor and it should feature a very fast live image (high fps, frames per second)

- Is capturing images without a computer important to you? We recommend the cameras with an SD card slot
- Does the camera distribute the microscopic image wirelessly, e.g. to tablets? For this requirement, there are dedicated camera models and accessories

5. Learn more about technical details of the camera chip

Cameras can have different chip types – both with pros and cons. CMOS (Complementary metal-oxide-semiconductor) and CCD (Charged Coupled Device) are the most common ones in microscopy cameras. In the past, CMOS sensors had significant disadvantages, e.g. they were less efficient in converting the incoming light into electrical signals. CCD sensors were therefore often more appreciated, especially in low light applications. On the other hand, due to their architecture, CMOS chips allow a higher framerate, which is beneficial for all live image applications, and have a higher capacity of repletion, which prevents blooming, in case of sufficient to abundant light. CCD chips tend to bloom, if the light intensity is not low enough, and this results in deteriorated image quality.

- Do you need a CMOS or CCD camera? In general, both are suitable in clinical applications. Is fast frame rate (CMOS) or highest sensitivity (CCD) more important to you? A sCMOS (Scientific CMOS) camera can seem expensive. However, it may be the right choice for you. sCMOS sensors are rated as next generation CMOS, low noise, fast frame rate, wide dynamic range from low light to brightfield, and large field of view. If image capture at the highest level is a huge part of your daily work, you might want to consider such a camera

Choose a microscope camera brand that is reliable and proven

It can be frustrating, if the camera fails when urgent and important images must be captured. Sometimes it is an advantage to buy microscopes and microscope cameras from the same supplier. However, in some cases you might want to keep your existing microscope and just upgrade the camera. Therefore, you should choose the camera vendor carefully.

- How long is the vendor in the market? Does he have a long pedigree with supplying cameras for microscopy applications?
- Is your preferred vendor an expert in adapting cameras also to existing microscopes?
- Does the vendor react quickly to service requests for cameras? Does the vendor have the ability to offer you a replacement in case of service and repair needs?

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