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Is A DIY Microscope For You?

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Any professional's work is affected by their tools: hockey players seek a specific curve or flex in their sticks, mechanics know when a socket wrench is preferable to a box-end wrench, and microscopists demand exactitude from their instrumentation.

In the case of the latter, turnkey microscope solutions — engineered to excel in specific applications — perform established techniques extremely well. Inherent issues arise when you repurpose a technique to do something a little different, or you wish to explore a new area of research that requires an innovative microscopy technique.

This article helps readers determine whether a do-it-yourself (DIY) microscope is the appropriate solution for their application. It then details how to procure an instrument that meets both current and future application needs while remaining cost effective.

Why a DIY Microscope?

Perhaps your current microscope is adequate, but you don't have as much control over its tools as you would like; you're left with the feeling that you could have done a task better, or that it would be simpler to complete in a different way. Or, in a more clear-cut scenario, you're trying to accomplish something not well-suited to equipment that's generally commercially offered.

This scenario may affect individual researchers, as well as research groups, in both academic and commercial settings. Such researchers may not be convinced that the application is a major part of their research infrastructure, so they're seeking a cost-effective method.

Consider, too, that standard instruments aren't necessarily designed for alterations; it's ill-advised to take a functional microscope that, at one point, you paid a lot of money for, and literally start cutting holes in its side.

Your specific application will dictate where on the spectrum of DIY microscope solutions your needs fall: whether the work demands a full component buildup or (relatively) simple modifications to existing instruments.

First, think about both your current application and what you plan to do with the instrument in the future: what are you trying to accomplish? For example, you may currently be exploring microscopy techniques requiring single molecule microscopes, but you're planning — maybe two or three years in the future — to do some studies using atomic force microscopes.

This awareness is vital because it informs manufacturer design considerations relevant to a DIY instrument's flexibility; this versatility is at the heart of cost effectiveness.

In this same vein, a DIY customer both takes risks with their time and guards against setbacks. Perhaps the technique initially envisioned doesn't work out for them, or they change direction and need this instrument to be repurposed for something else. A well-designed DIY microscope creates a clear path for that course of action.

Getting Started

An analysis of builders' needs and outputs lays the groundwork for a DIY solution's success. Critical to this introspective step is clear-eyed acknowledgement of what the builders do not know — areas where they'll have to expand their team or seek third-party expertise.

Most DIYers understand thoroughly their application and its goals — for example, how the microscopy technique will be used and its limitations. This information is used to create a checklist: "I can do that part, but I've got no idea about this part." Then, evaluate "which things on the checklist can we absolutely do? Which things can we learn to do? Which things will require somebody else's insight?"

The manufacturer is trying to glean from this analysis how well the builder understands what they want to achieve — not just from a research objective, but in terms of the technique's relevance and its intricacies. Indeed, understanding how to create an instrumentation environment that allows a technique to succeed is very different from implementing the technique.

Builders might consider elements including how to focus light on specific areas of interest, for instance. They may want to ensure that they don't see distortions along the way, or they wish to angle light at their sample from a particular angle. A partner like Mad City Labs connects the dots between the builder's concept of the application and an understanding of how to enable that technique when building it from scratch.

Identifying "Hidden" Parameters

Exploring new instrumentation is exciting, but don't overlook the exercise's pitfalls in your enthusiasm. If you're not used to measuring at the nanometer scale, several parameters exist that you may not have previously considered. These elements can represent the difference between success and failure at the nano scale.

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Is a DIY Microscope for You?

For some advanced microscopy and nanoscopy techniques it becomes necessary to modify existing instrumentation or build an instrument from scratch. This article helps readers determine whether a do-it-yourself (DIY) microscope is the appropriate solution for their application. It then details how to procure an instrument that meets both current and future application needs while remaining cost effective.

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