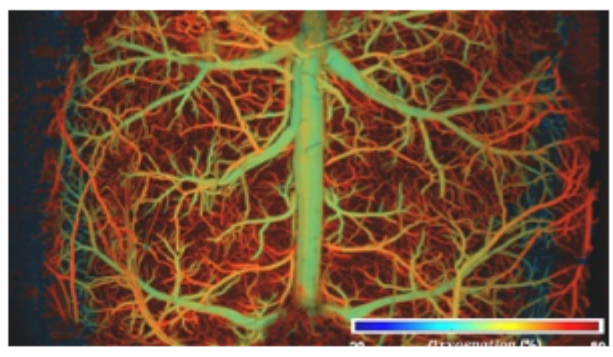
Tuesday, October 18, 2022

MICROSCOPY TECH PULSE

Microscopy Tech Pulse is a special edition newsletter from Photonics Media and Mad City Labs covering key developments in microscopy technology.

Photoacoustic System Enables Real-Time Neurovascular Imaging

A photoacoustic imaging tool accommodates the need for speed and comprehensive detail in neurovascular imaging. The imaging modality enables an approach to visualize whole-brain hemodynamics and oxygenation in real time. It also tracks fast pathophysiological activities at the micro-vessel level. The approach breaks speed and resolution barriers in brain imaging technologies, and could lead to insights into stroke, dementia, and acute brain injury.



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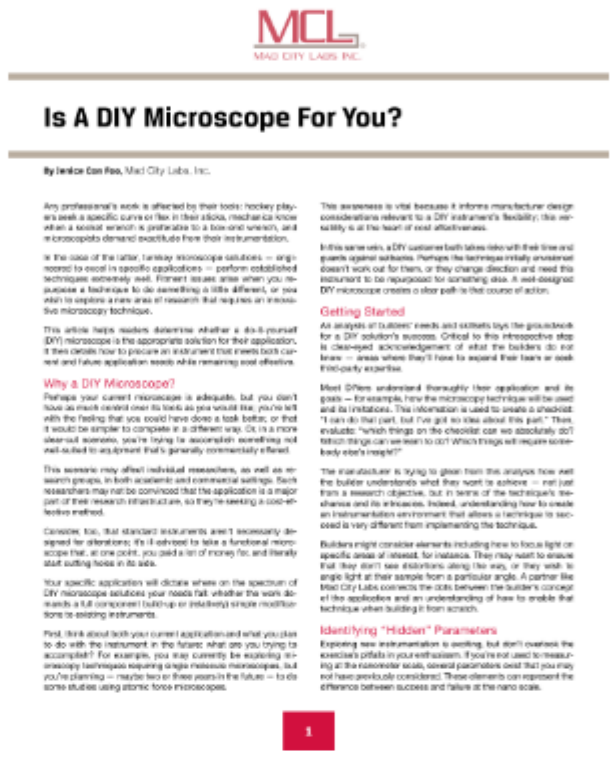
Mad City Labs Inc. - Is a DIY Microscope for you?

Recently, it has become very popular for researchers to explore building their own microscopes. Budgetary and technical specifications are among the motivations for this approach. However, there is a spectrum of solutions within the DIY microscope space. This article helps readers determine whether a do-it-yourself (DIY) microscope is the appropriate solution for their application and how to procure the right instrument.



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MAD CITY LABS INC.

Is A DIY Microscope For You?

By Jenica Con Foo, Mad City Labs, Inc.

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 is 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 build-up 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 most attractiveness.

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 to that course of action.

Getting Started

An analysis of builders' needs and skillsets 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 inherent 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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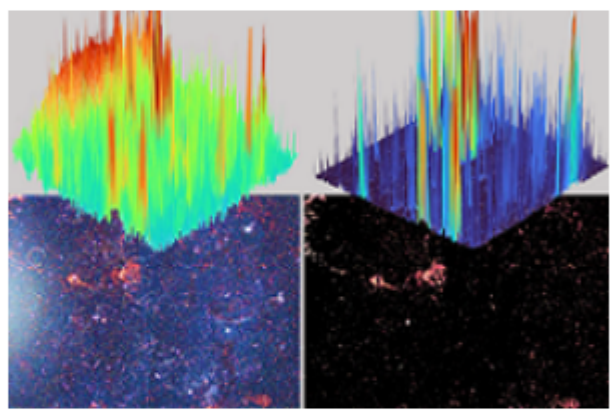
Nanotechnology, Deep Learning Help Detect Pediatric Tuberculosis

A technique for diagnosing tuberculosis (TB) in children takes advantage of the optical properties of gold nanoparticles to detect the disease. The technique uses an artificial intelligence (AI) algorithm to enhance the sensitivity of the test, as well as low-magnification dark-field microscope (DFM) image analysis.



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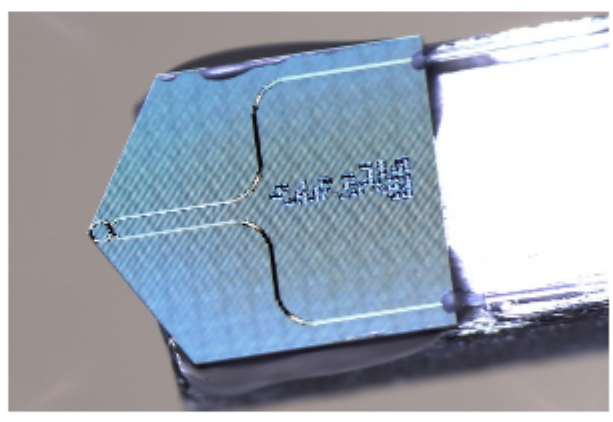
Quantum Advancement Combines Free Electrons and Photons

A collaboration between Swiss and German researchers demonstrated the generation of electron-photon pair states for the first time in a controlled way, using integrated photonic circuits on a chip. Using a new technique, they precisely detected the involved particles. The experiment could enable quantum-enhanced electron microscopy and adds free electrons to the toolbox of quantum technologies.



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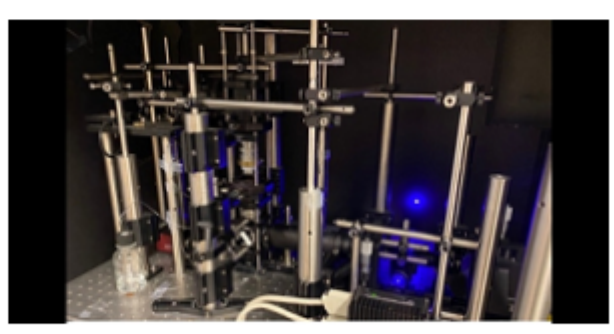
Internal Reflection-Based Microscopy Images Single Protein

A team from Arizona State University has introduced evanescent scattering microscopy (ESM), a label-free method for sensitive imaging of biomolecules, including proteins. The single-molecule microscopy technique is based on total internal reflection, an optical phenomenon that occurs when light passes from a high-refractive medium, like glass, into a low-refractive medium, like water.



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