# CAREERS

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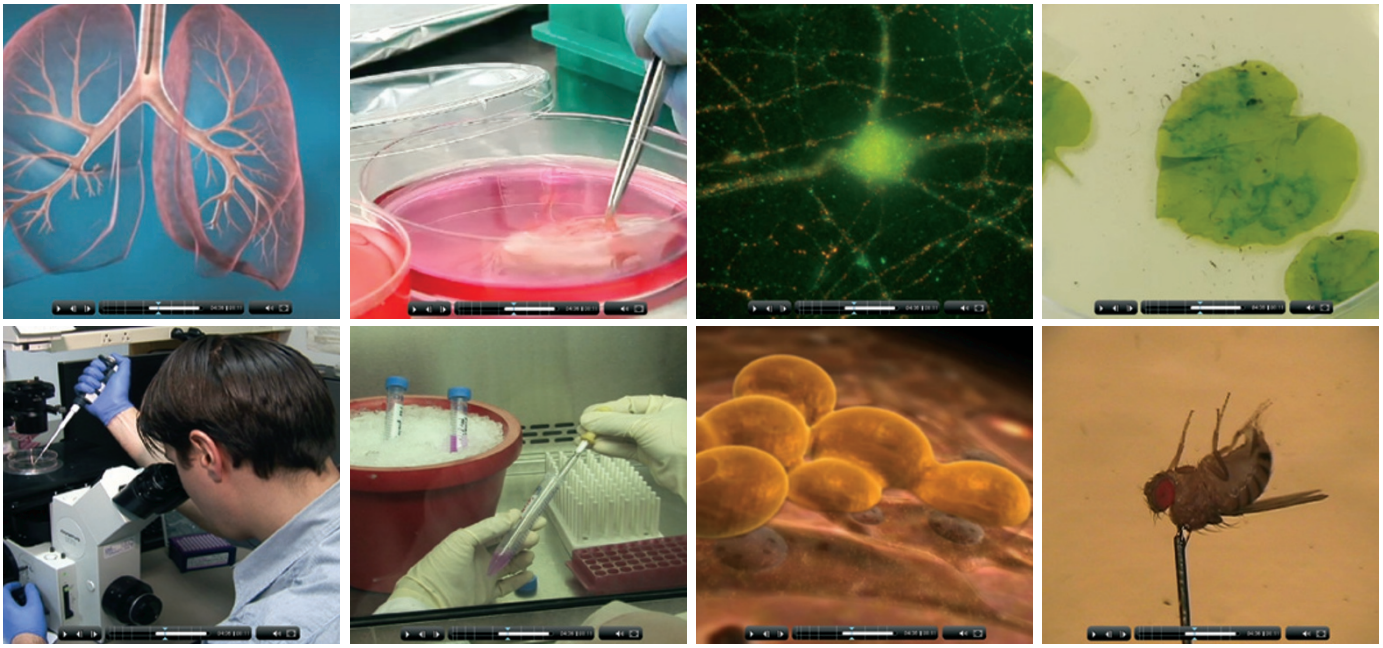
JOVE



**Online videos can show researchers details of a technique that they could never glean from written descriptions in journal articles.**

LEARNING TOOLS

# Visual aids

*Internet-based tools and videos are making it easier to perfect lab techniques and tasks. But they augment, rather than replace, conventional guidance in person.*

**BY KATHARINE SANDERSON**

During her PhD, neuroscientist Maria Toledo-Rodriguez needed to use the single-cell reverse-transcription polymerase chain reaction, a specialized technique that combines electrophysiology with molecular biology. But only a handful of labs in the world had experts in this technique, and she could not manage to visit them. Toledo-Rodriguez, who is now an academic fellow at the University of Nottingham, UK, spent two years struggling to master the technique by following written instructions.

She wishes that she'd been able to take advantage of a now-flourishing type of tutelage: watching a video of someone performing the technique. "There are very stupid things like when you remove the pipette, in order to avoid bursting the neuron, you have to give it a little kick," she says. This is not the kind of detail that researchers generally put in a methods paper — and Toledo-Rodriguez says that seeing the technique in action gives a much better feel for the nuances than reading a description of it.

Videos that demonstrate how to run experiments, including all those 'stupid' little tricks, are appearing online. They could save time and money for researchers, and allow them to master techniques outside of their subfield.

## THE TACIT TOUCH

Mentors and experienced hands aren't always able to offer the time and attention that it takes to teach a 'technique rookie' the nuances and tacit skills that make hands-on science smoother, so videos are becoming a major asset to those hungry for an expanded laboratory skill set. Lab mates and collaborators, with their capacity for relating the feel of a successfully executed technique, can never be replaced entirely, but film clips go a long way.

Video protocols can be especially helpful when a researcher is switching fields, or delving into new research territory. For example, when Rachel Schecter moved from researching yeast as an undergraduate to examining the neuroscience of autism as a PhD student at the Massachusetts Institute of Technology (MIT) in Cambridge, she had to learn a whole new set of practical techniques. "I found it especially hard when I was starting out because the people in the lab who can teach you these things are often the busiest with their own stuff," says Schecter. "So you really have to maximize the time they have to offer you."

Schecter became a fan of benchfly.com, a website that collects and organizes videos of laboratory techniques. The clips proved useful as tutorials, or as introductions to a method before she worked on it in person with someone from the lab. They cover everything ▶

from basic practical techniques, such as how to work in a sterile hood or use a pipette, to more technical procedures, including making primary neuron cultures, implanting electrodes or running a two-photon microscope. The videos help Schecter to get the "best use of the mentoring in the lab", she says. And they allow her to double-check her technique after her initial training. "I find reading journal article methods sections incredibly frustrating. They don't have the detail," says Schecter, likening the experience to following a cake recipe that says only to mix the ingredients, without describing exactly how much mixing to do or how vigorous it should be.

BenchFly's videos also offer tips on problems facing lab newcomers, including the most common reason that a centrifuge won't switch on (a switch that starts the centrifuge only after a delay gets flipped accidentally). The site is organized by discipline and technique. And each video has a comment facility. As on sites such as YouTube, videos can be uploaded by anyone, from academics to students and lab-equipment companies.

Alan Marnett founded BenchFly after a frustrating experience as a chemistry doctoral student at the University of California, San Francisco. "I constantly changed fields," says Marnett. "I was faced at every step with the challenges of a new environment." After his PhD, he pursued a postdoc at the Picower Institute for Learning and Memory at MIT, studying how neurons grow. As he tried to bone up on new techniques, he found that he received inconsistent training. "It is only as good as the people around you," he says. Marnett launched BenchFly in July 2009. The site sustains itself with money earned through advertising and video production services.

***"I find reading methods sections incredibly frustrating. They don't have the detail."***
Rachel Schecter

Video tutorials save not only time and effort from mentors, but also money and even travel, as Moshe Pritsker realized. As a PhD student working on stem cells at Princeton University in New Jersey, Pritsker was asked to recreate a method of culturing embryonic stem cells that had been reported by researchers in Edinburgh, UK. "I tried to follow the steps in an article," he says. But try as he might, the experiment wouldn't work.

His supervisor — keen to have someone in the lab who could reliably do the technique — flew Pritsker to Edinburgh for a two-week reconnaissance and learning mission with the group that had invented it. On the return flight, Pritsker started to question the necessity of what had just happened — flying across the Atlantic Ocean to watch someone else do an experiment. "This is not the twenty-first century, this is the Stone Age," Pritsker recalls thinking.

His solution was to "bring the 'show me' effect" to scientists through videos of experiments. But to sell the concept, he decided to present the clips in the form of a peer-reviewed journal. "I realized we needed an incentive for scientists to watch and make videos," he says. The result was the *Journal of Visualized Experiments* (*JOVE*), which Pritsker created in 2006 after finishing a postdoc at Harvard Medical School in Boston, Massachusetts.

Whereas BenchFly tends to show basic techniques, or small tricks to get something going, *JOVE* demonstrates detailed, specific and recently developed protocols. And in contrast to BenchFly's do-it-yourself approach, *JOVE*'s videos are filmed and produced by an international network of trained camera operators and producers. Production takes place after a text account of the video's technique is peer-reviewed and accepted for publication. Learning the craft and technical aspects of science is what takes up most of a lab's time and money, says Pritsker — and videos can help to curb such excesses.

They may also be able to facilitate student comprehension. Videos are a great resource for exploring the finer technical points of a topic, says Alice Rushforth, a programme manager at the Center for Emergent Behaviors of Integrated Cellular Systems (EBICS) at MIT. She used BenchFly to teach undergraduates in her previous job as an MIT biology instructor. Rushforth notes that it's not always possible to show every student every technique individually — it's both expensive and time consuming, and videos can fill the gap.

Rushforth hopes to use BenchFly to make a package of videos for EBICS summer-school students. Toledo-Rodriguez notes that videos are especially helpful for scientists who teach general university courses involving techniques that aren't necessarily within their area of expertise.

## IN LIVING COLOUR

Of course, videos have their limitations. "There is no better way to learn a new technique than to stand beside an experienced practitioner and watch them work", says Chris Surridge, editor of *Nature Protocols*. And it's hard to replicate the benefits of a colleague's scrutiny and correction. Toledo-Rodriguez has used *JOVE* videos to learn methods for dealing with stem cells, but says that sometimes it is not enough. "The videos go very fast, so for little details such as solution concentrations, you need the numbers, and it's always better to have the paper," she says.

And then there's the possibility that the video protocol will be wrong. Marnett says that BenchFly does exert quality control, trying to make sure that erroneous techniques don't slip through. "We will take a video down only if it incorrectly demonstrates a technique or if we feel it's unnecessarily dangerous," he says. So far, there have been no such cases. But there are often several correct ways of performing any given technique, so BenchFly must be careful not to be too strict about what it allows. "If a video is posted that isn't exactly how we would do it, but it is scientifically sound, then we would certainly leave it there," says Marnett.

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***Training in person "is only as good as the people around you".***
Alan Marnett

Videos that accompany peer-reviewed articles are likely to be more accurate than those that are posted with minimal quality control, and some print journals are starting to request more videos. *Nature Protocols* has a section on its website (go.nature.com/bcjwzs), that hosts videos included with the supplementary information accompanying papers — but such submissions remain rare, says Surridge.

The journal also has a YouTube channel (go.nature.com/alxr4h) dedicated to videos from papers or from the protocol exchange, an open-access repository run by *Nature Protocols*. Scientists can use the resource to share their own tips and videos of techniques: they sign up to be part of an online 'lab group', then they can post protocols, which must follow a required format and aren't necessarily videos. The chemistry journal *Angewandte Chemie* also allows researchers to submit video supplements.

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But video supplements can be difficult to find, as they're not usually collated in a central location on journal websites, and they don't necessarily show experimental techniques; rather, they might demonstrate a colour change in a chemical reaction, or another visual result of the study with which they are associated.

For an increasing number of researchers, however, videos provide a way to get up to speed in a new field and can supplement the unpredictable technical know-how of lab mates and supervisors. "Becoming a great scientist," says Marnett, "is just as much about learning the tips and tricks that increase quality and reproducibility of data as it is about learning the science behind the experiments." ■

**Katharine Sanderson** *is a freelance writer based in Toulouse, France.*