From the Editor

Entering the Golden Age of Lab Automation

The Editors, *BioTechniques*
bioeditor@biotechniques.com

Anyone who has ever microinjected single cells or patch-clamped ion channels can tell you: some techniques can take years of practice to perfect. This is the reason that specialists are frequently sought out by investigators hoping to use their methodological talents and skills at the bench to answer different questions. But today, advances in robotics and instrumentation are lightening the demand on those of specific technical prowess, and allowing researchers to forego long hours and sleepless nights in the lab perfecting their skill sets as modern biology moves into an automated world.

It is not as if the implementation of automated solutions in the lab happened overnight—indeed, the roots of automation are decades old. Liquid handlers and robots with the capability to move plates have been around since the 1980s, and have often been used to set up basic reactions such as PCR or sequencing, or to pick colonies from agar plates. Without the development of these instruments, efforts such as the Human Genome Project could have taken significantly longer to complete. But we know now that these early efforts were only the starting point—the building blocks, in essence—that would lead to where we are now. Grown from these meager beginnings is a new question at the moment: is there an assay or technique that we *can't* eventually automate?

Crystallography has several steps where, in the past, experimental design and setup had been the realm of the specialist. Generating diffraction-quality crystals takes time and patience, and trial and error. But technology development through large-scale efforts such as the Protein Structure Initiative (PSI)—funded by the National Institutes of Health (NIH)—has led to the development of automated and high-throughput robotic platforms that can test hundreds of chemical conditions for the ability to generate crystals. And once they have their crystals, scientists are able to ship those crystals to automated beam lines (thousands of miles away in some cases) where diffraction data can be collected. Here, robotic arms remove single crystals from a liquid nitrogen–cooled container, place them in the correct orientation for the diffraction experiment, and collect all the necessary data. All the while, researchers can watch from their own lab via a live streaming video feed. It is this approach and innovation that has not only fueled PSI efforts and enabled hundreds of protein structures to be determined each year, but is providing other researchers the opportunity to try to generate a structure for their particular proteins of interest as well.

Even patch-clamping—the subtle, specialized technique that can take years for dedicated electrophysiologists to master—is now becoming automated. In this issue, our Tech News feature explores the changing landscape of ion-channel research now that conductance through ion channels can be surveyed en masse. A new automated approach to ion channel analysis is leading to new drug discovery efforts and high-throughput screening applications.

The bad news for some might be that the days where skills like patch-clamping and single-cell microinjection were considered an 'art' could be coming to an end. The good news, however, is that these innovations in laboratory automation are moving biology in new and unexpected directions, and revealing novel insights that only larger datasets can provide. The art is moving from the hands of the researchers into the minds of both researchers and developers who are finding new and inventive ways to automate even the most complicated and technical of experimental setups. At *BioTechniques*, we look forward to reporting on many more years of development and refinement to these approaches and systems. And we will continue to seek out and publish research articles describing novel instrumentation, methodologies, assays, or techniques that advance the art of automation and high-throughput screening. But you, as readers—who utilize current technology and are anticipating future applications—have the ideas that will be most germane to the direction automation will take. So let us know your views: which techniques or methods are not yet automated? Which ones need improvements to their current automated platforms? As always, post your thoughts and comments at our Molecular Biology Forums under "To the Editor" (http://molecularbiology.forums.biotechniques.com) or send an email directly to the editors (bioeditor@biotechniques.com). TGA

"You, as readers—who utilize current technology and are anticipating future applications—have the ideas that will be most germane to the direction automation will take."

BioTechniques 48:11 (January 2010)
doi 10.2144/000113335