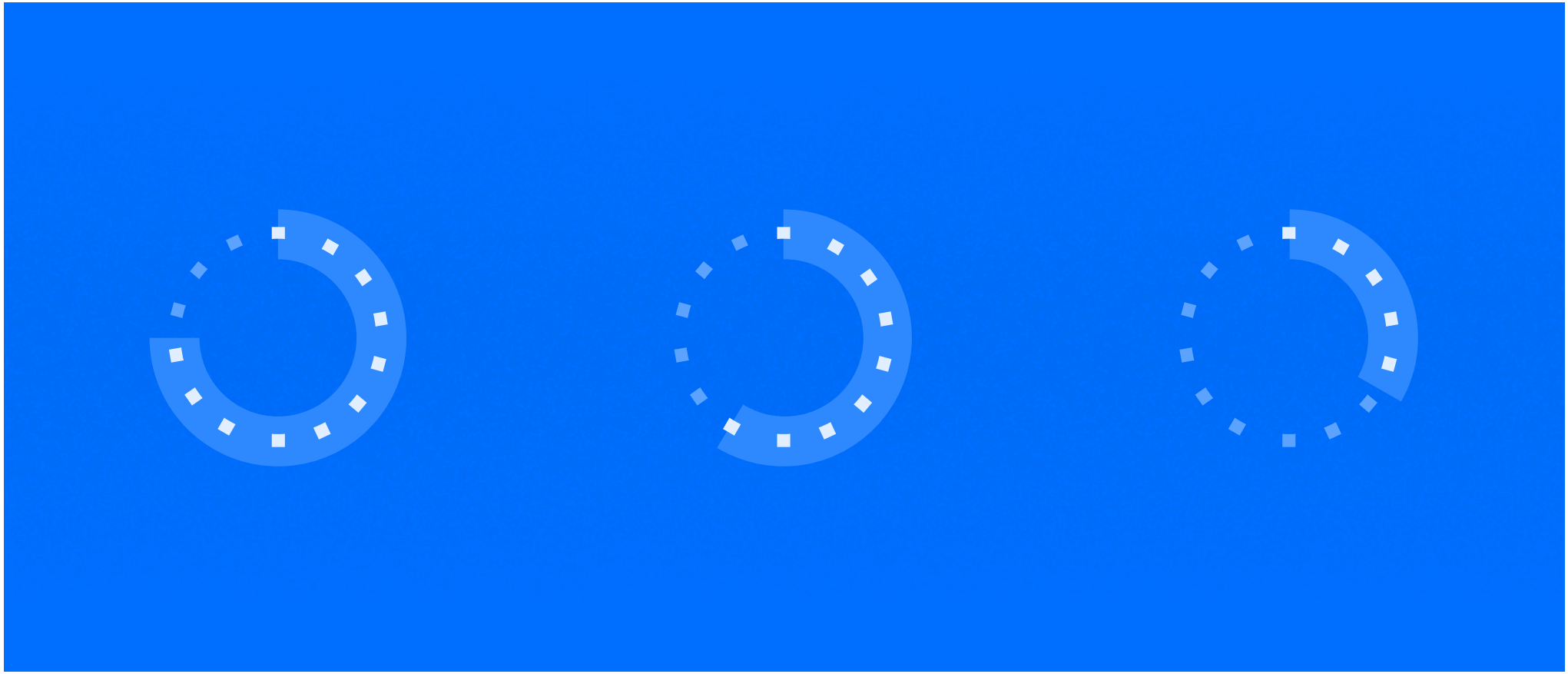
How To Save Time In The Lab With An Automated On-Deck Thermocycler

Written by
Opentrons



INTRODUCTION

The Time-Saving Evolution of PCR Technology

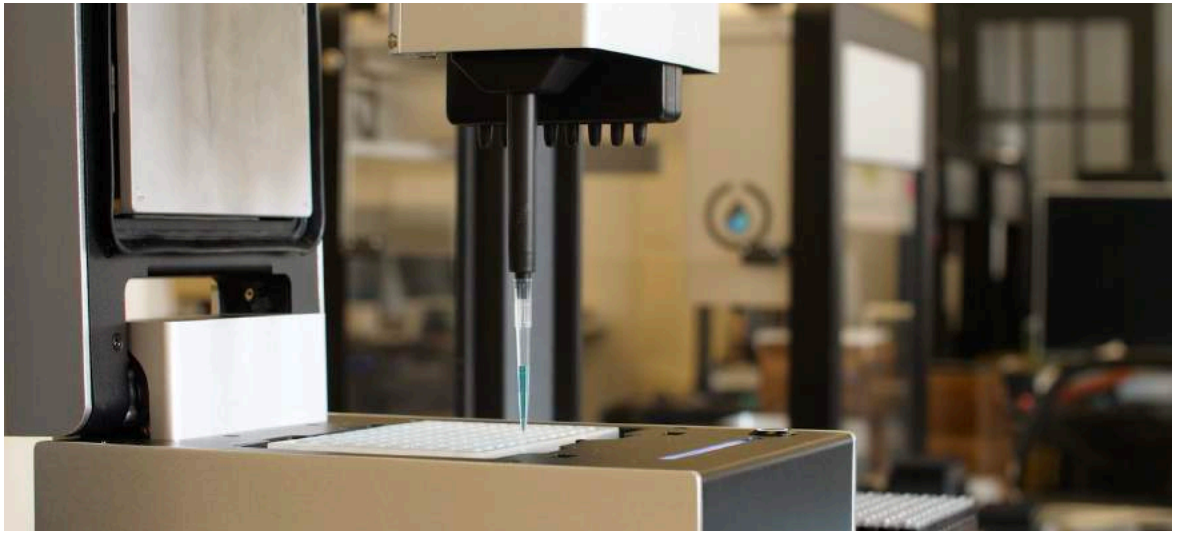
The difference between using an automated thermocycler on- and off- the deck of your liquid handler is reclaimed time.

What would you do with six extra hours in your lab?

Much like life itself, modern biotechnology is based on the ability to precisely copy DNA. Biologists have hijacked the nucleic-acid replication machinery built into cells to create Polymerase Chain Reaction (PCR)—a cornerstone method of modern molecular biology that allows them to copy DNA themselves.

In 1983, Nobel Prize Winner Kary Mullis showed that you could manipulate the replication of a target DNA sequence by orchestrating your samples through a precise temperature sequence. Those days, performing a PCR experiment meant scientists would spend hours moving tubes to and from different temperature water baths by hand to achieve these temperature cycles.

In 1988, Celtis and Perkin-Elmer launched a device called a thermocycler to automate the precise temperature changes required for PCR experiments. It was faster and more efficient than the water bath method, but it cost over $100,000—far out of reach for most biologists. It wasn't until the mid 90's when companies like ML Laboratories started manufacturing more affordable machines with heated lids that thermocyclers became accessible to most labs.



INTRODUCTION

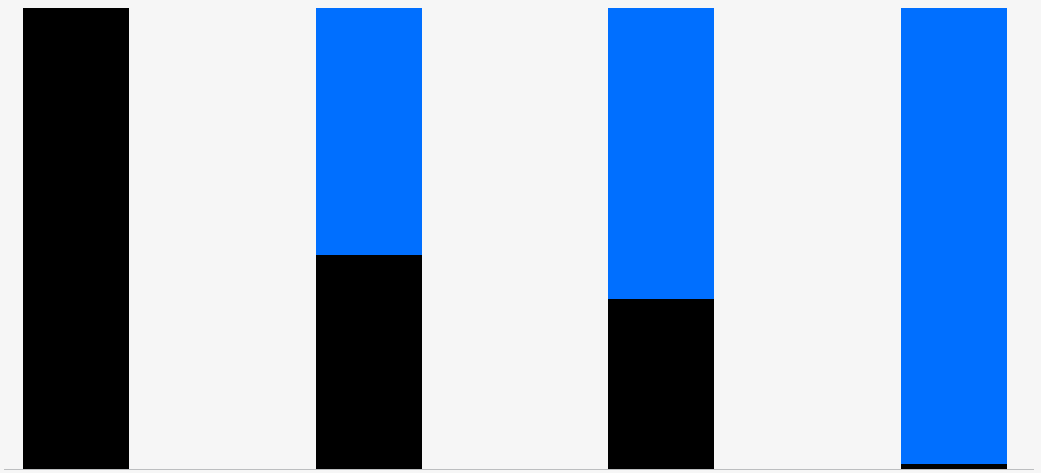
The Time-Saving Evolution of PCR Technology

Today, the time-saving innovations of PCR seem stagnant. Though new types of PCR—like quantitative and digital PCR—have been created, there have not been big strides in time-saving since the mid 1990s. Most biologists still work with thermocyclers technically similar to ones created 20 years ago, and still spend hours every week preparing reactions by hand.

The Opentrons Thermocycler represents the next big leap in time-saving for PCR users.

FIGURE 1

Timeline Graphic



PART 1

Why Saving Time Is So Important

Robots let you parallel work to get more done faster—especially robots with on-deck thermocyclers, which can handle longer workflows.

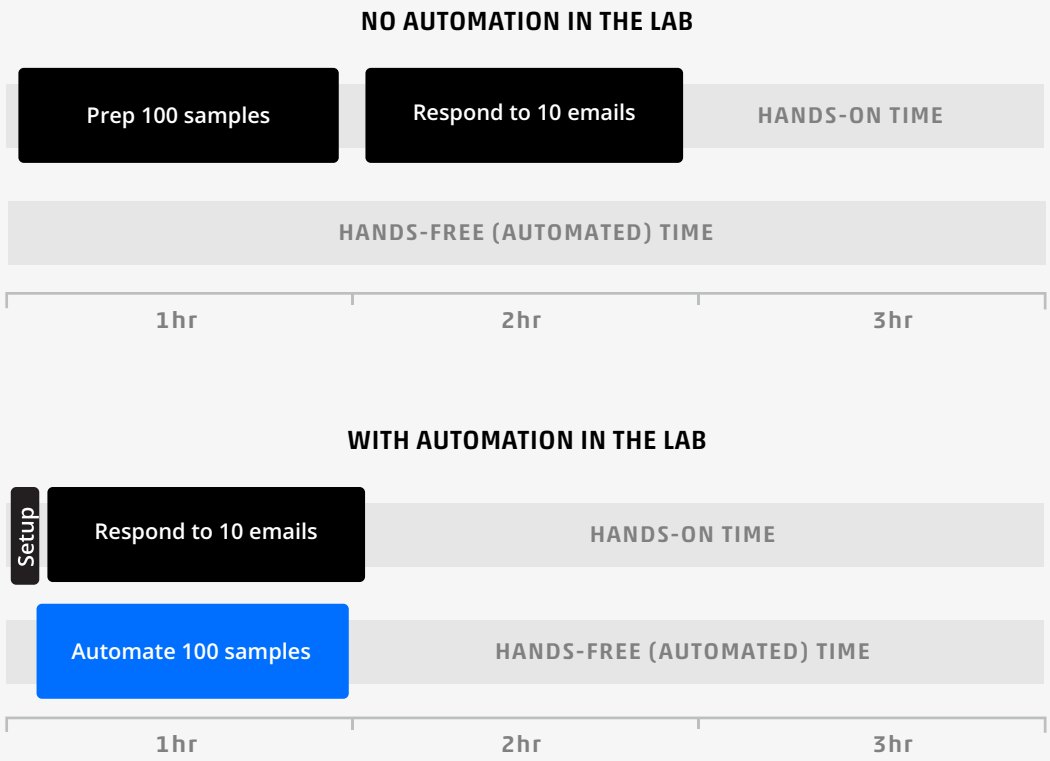
The first type of time saving is a basic one-for-one task completion kind of benefit. If a person can prep 100 samples in an hour, and answer 10 emails in an hour, they need 2 hours to do both tasks. But if they have a robot do the sample prep, they can do *both* tasks in 1 hour—which is a fairly simple way to double productivity.

But time savings compounds when you look at longer chunks of time. Let's say you have 600 samples to prep, at the same rate of 100 samples per hour-long robot run. There is also a six-hour conference you have the opportunity to present at. Can you automate your sample prep and go to the conference?

In theory, sure: 6 hours x 100 samples / hour = 600 samples. But who is going to load and unload the robot? Who is going to set up the automation between runs? You can automate all 6 hours of sample prep, but you can only do it in six one-hour

FIGURE 2-1

How Automation Saves Time in the Lab



long blocks. So even though you can save yourself six hours of productivity, you can't go to the conference.

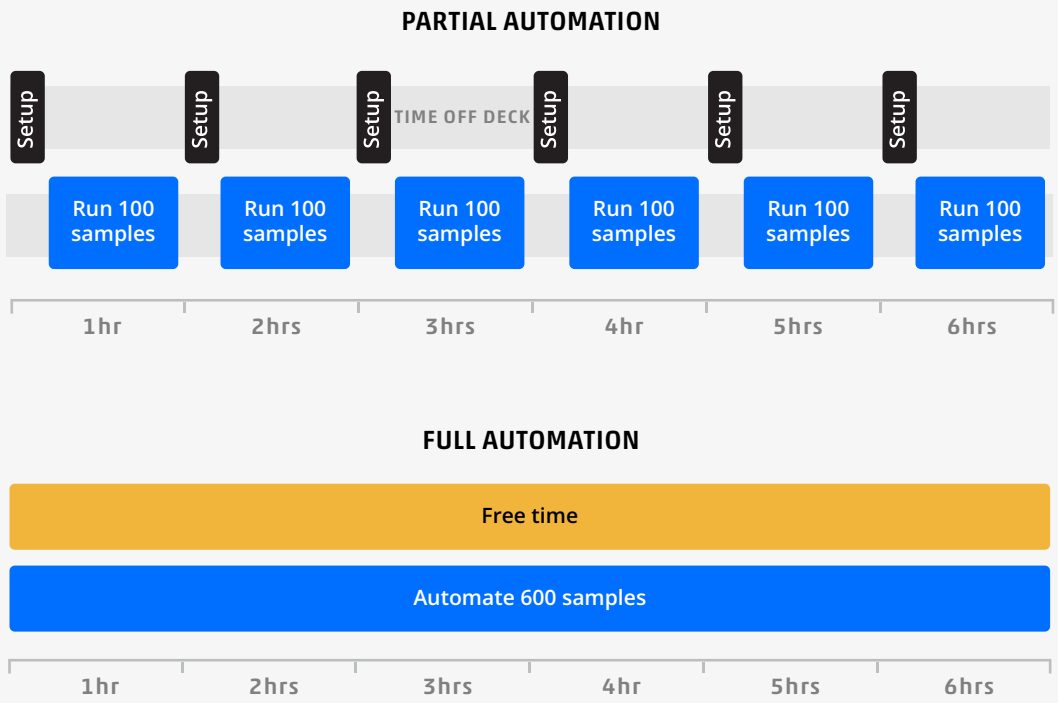
What you need (in this example) is a robot that can do all 600 samples in a single run. That way you can hit 'go' and come back after presenting at the conference six hours later and have all your lab work done.

The difference between one six-hour block and six one-hour blocks can be the difference between meaningful work and busy work.

Plus, some jobs just require long blocks of uninterrupted time to complete. In the essay **Maker's Schedule, Manager's Schedule,** Paul Graham points out that some creative tasks like writing an essay or programming an algorithm are best completed in this way: one-hour is just not enough to focus and make meaningful progress. With only two hours to dedicate to complex tasks like these, you barely have enough time to get in the groove—and, what's worse, you're forced to quit once you've hit your flow state.

FIGURE 2-2

How Automation Maximizes Time in the Lab



PART 2

How On-Deck Thermocyclers Save You The Most Time

If your lab is already automating workflows ranging from genotyping and sequencing to cloning and gene-editing, adding an on-deck thermocycler to your liquid handling robot can increase your free time by a factor of 3x.

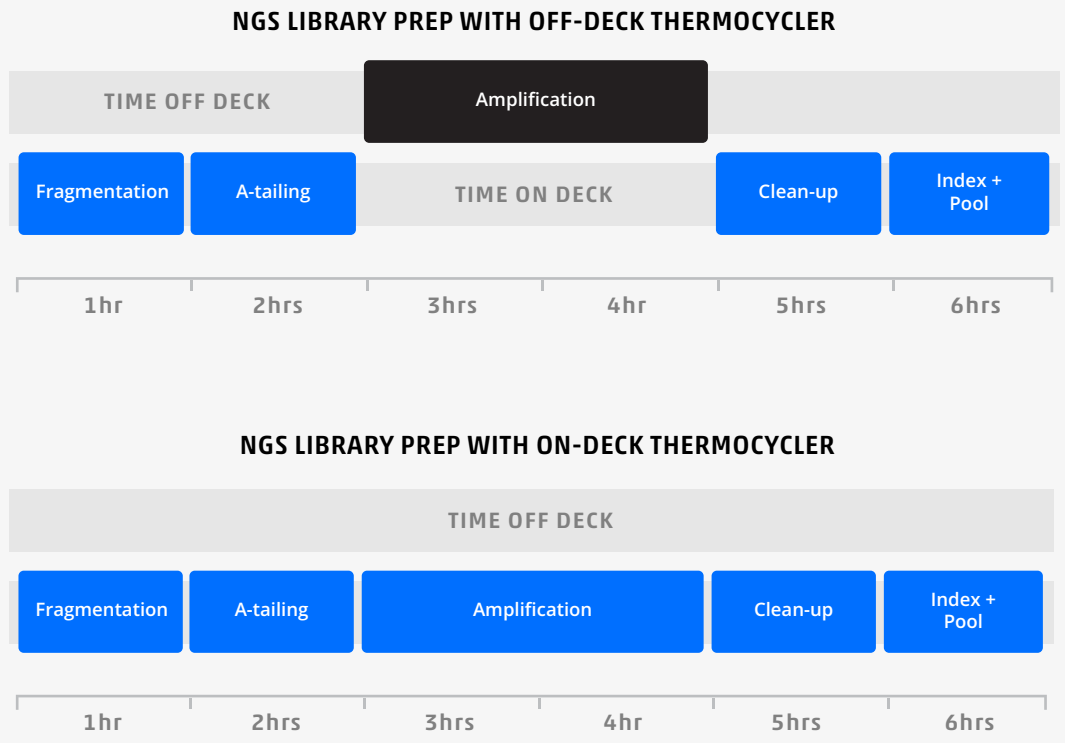
The protocols that get the most out of integrating a thermocycler are complex, involving multiple sub-protocols before and after an incubation or PCR step. Let's look at a next-generation sequencing (NGS) library preparation protocol as an example.

By automating only the pipetting and magnetic bead handling steps in the workflow, you take approximately 2/3rds of the work off your hands. That's the enzymatic prep (fragmentation + a-tailing, etc.), cleanups, indexing, and pooling steps, which can be done by the OT-2 robot with the Magnetic Module.

Without a thermocycler on the deck of your robot, a person (or another, more expensive robot) has to physically move the prepared reactions into the thermocycler. After the amplification is complete, they also need to physically retrieve the samples—taking them off of the thermocycler and putting them back on the robot for the final magnetic and pipetting steps.

FIGURE 3

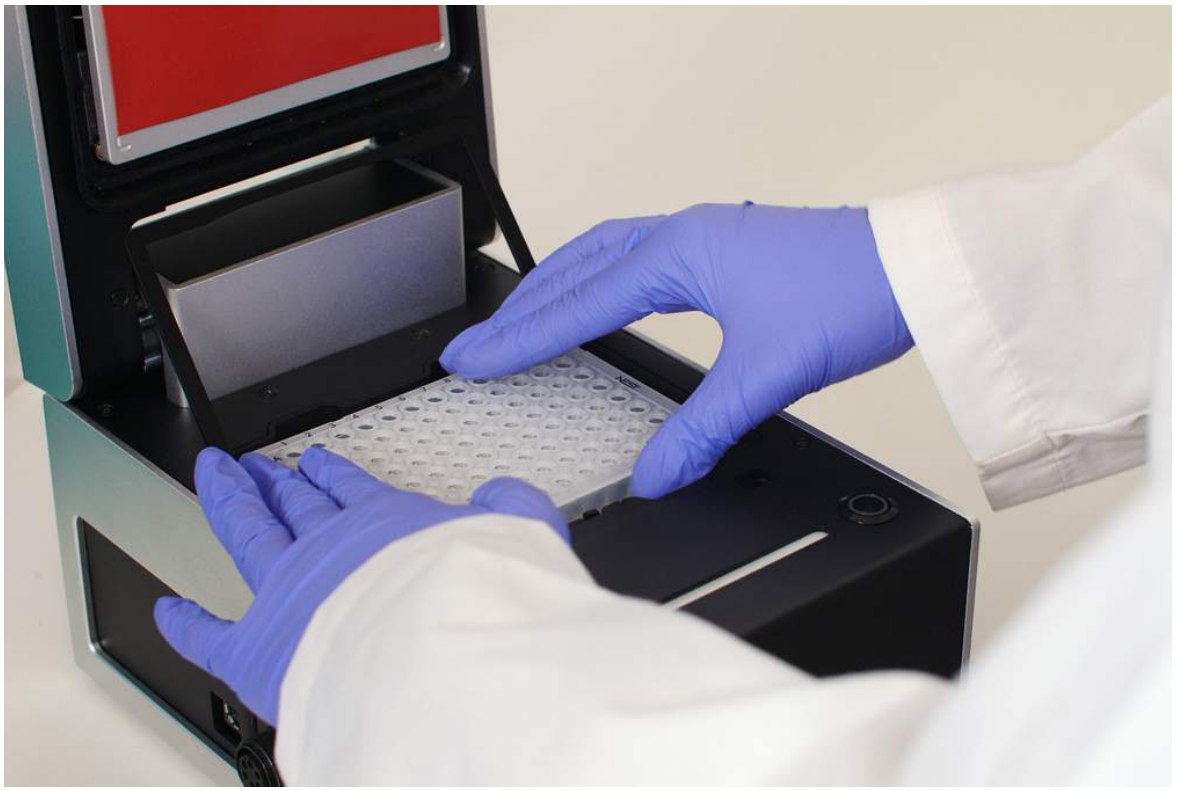
Workflow Diagram of NGS Library Prep



PART 2: WHY ON-DECK THERMOCYCLERS SAVE YOU THE MOST TIME

While each of the three blocks of two-hour processes is automated, there is required human intervention between the automated steps, preventing you from benefiting from all your saved time at once (see: Figure 2).

Adding an on-deck thermocycler for the amplification step in the middle of NGS library prep process removes the need for human intervention between steps creating an end-to-end automated workflow. Fragmentation, A-tailing, ligation, amplification, and clean-up + pooling are all automated in one run (see: Figure 3), giving you a single six-hour block of uninterrupted free time.



CONCLUSION

What Will You Do With More Time?

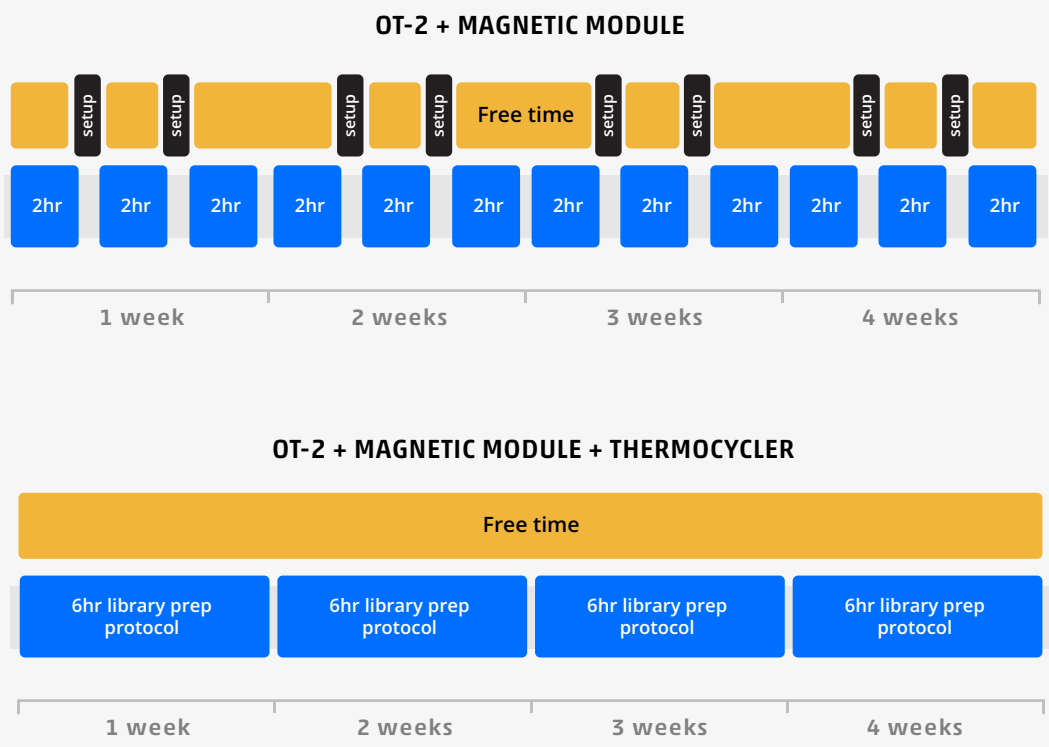
Ultimately, everyone working on further advancing scientific knowledge could use more time. The continued growth of our biological understanding requires that scientists have more time to think, communicate, and analyze the complicated knowledge they are producing. And that is why new tools like the Opentrons Thermocycler are so important—they give biologists the time they need to advance science.

Every year, scientists contribute novel findings to our knowledge of the fundamental molecular machinery of life. We are at a time when the tools to explore genomes and the power of DNA are opening up possibilities that we barely dreamed of even a decade ago... and these tools are just the beginning.

What would you discover with more free time to think?

FIGURE 4

One Month of NGS Library Prep Time Saving



APPENDIX

Resources

RESOURCES

Maker's Schedule, Manager's Schedule

ACKNOWLEDGEMENTS

Mike May

SPECIAL THANKS TO

Will Canine

Kristin Ellis

Mel Mencarelli

Matt Monsees

Alfie Umbhau

Laurie Vázquez

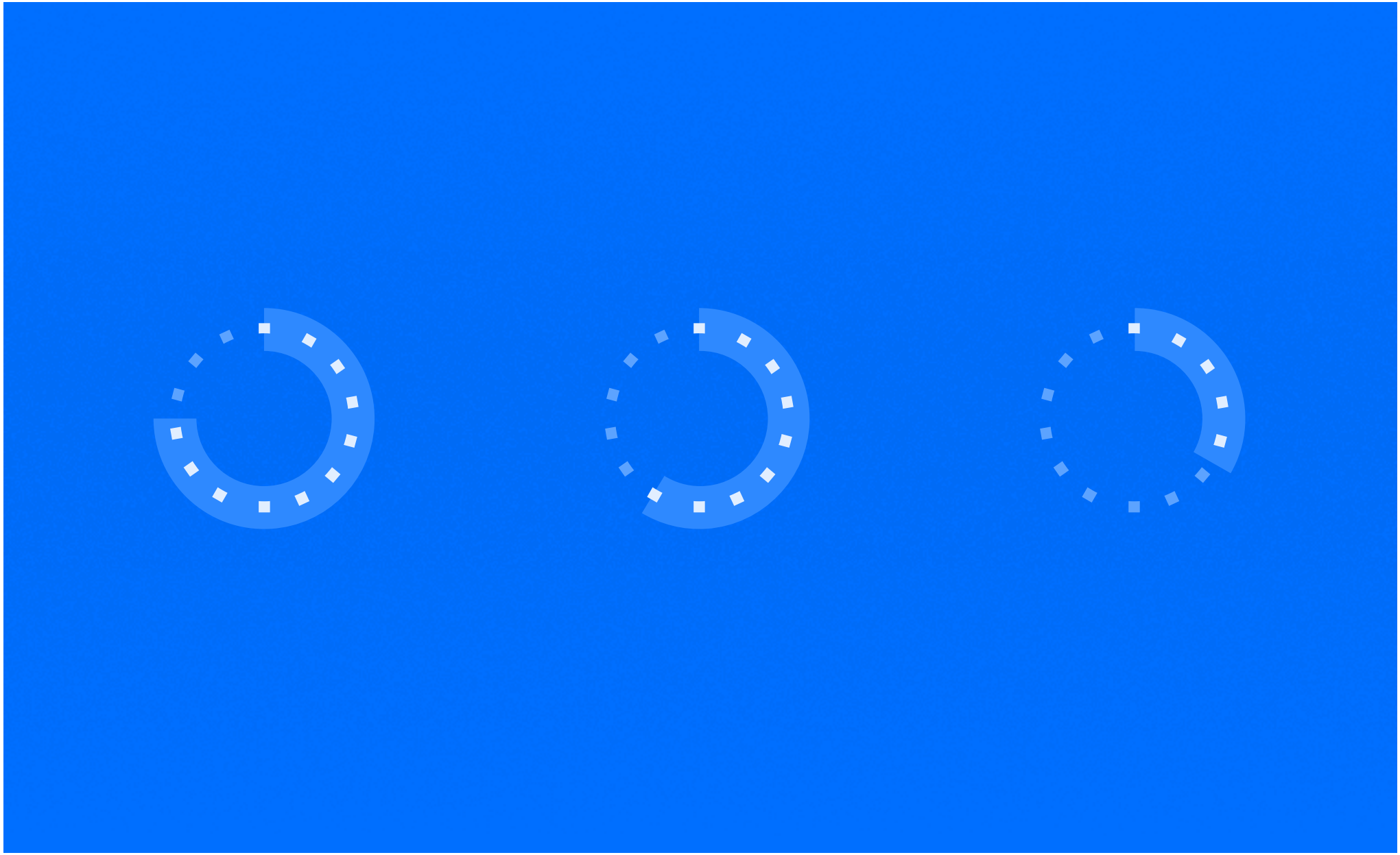
Kinnari Watson

CONTACT OPENTRONS

Opentrons Labworks Inc.

opentrons.com

info@opentrons.com



opentrons