

# maximizing automation & software in restarting your research

## introduction

Many of us are gearing up to return to the lab after months of working from home. For some, this will be a welcome change and, for others, perhaps another shock to the system in what has been a strange year for scientific research. The COVID-19 pandemic continues to complicate matters with strict social distancing guidelines in place and ongoing disruption to supply chains. Safety is the top priority for everyone. With this in mind, we consulted experts in automation, software, and cloud laboratories on how to restart your automation setup going back to the lab and maximize your research gains through streamlining your processes.

## contributor profiles



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### Dan Thomas, Arctoris Ltd

Dan is Head of Discovery Biology at Arctoris where he is responsible for the implementation of a comprehensive scientific strategy designed to deliver the best in data quality. Bringing together a world-class team of engineers and drug discovery experts, Arctoris has developed the world's first fully automated drug discovery platform, enabling researchers globally to configure experiments remotely and have them executed in Arctoris' robotic laboratory facility. Together with several of the world's leading AI drug discovery companies, Arctoris generates research data at unprecedented quality and speed, building a unique data resource for machine learning applications. Combining the latest in laboratory techniques with advanced robotics and AI, Arctoris brings drug discovery into the digital age.



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### Markus Gershater, Synthace

Markus is the Chief Scientific Officer and co-founder of Synthace, the company behind the Antha® software platform. Antha® enables users to trust and easily harness the power of automated experimentation and take a computer-aided approach to their biological R&D.



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### Joby Jenkins, SPT Labtech

Joby is Director of Product Strategy at SPT Labtech and heads up the product management, applications, and marketing teams. Joby has been instrumental in establishing SPT Labtech as an internationally recognised provider of leading-edge technologies for drug discovery and development.



### David Dambman, Biosero

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Biosero enables decision makers to make better decisions in less time using more data.

As Chief Technology Officer at Biosero, David Dambman leads the software and integrations teams and sets the vision and direction for Biosero's future software projects. David's leadership has contributed to the development of numerous software products including Green Button Go™. Green Button Go is a device-agnostic software platform that integrates equipment into a cohesive lab ecosystem to automate workflow processes and increase productivity.

# back to the lab checklist



## Getting your Bearings

Many labs have been left alone during the outbreak. Where possible, send an advanced team, ideally working in socially distant pairs, ahead to review supplies and check the status of equipment. There is nothing worse than turning up on Day One, ready to science, only to find there has been a leak, a power outage that reset everything, or that you have only three boxes of pipette tips left.



## Securing your Supply Chain

Supply chains have been thoroughly disrupted during COVID. Vendors and suppliers are doing their best, but it is essential to get your orders in as early as possible. Hopefully, your lab scouts have roughly tallied all the consumables and reagents that have survived lockdown so your team can order everything they need well in advance. *Consider using software* to track consumable usage and keep the lab informed. In the current climate, a robust tracking system will help you have orders in on time ensuring your supply never runs dry.



## Restarting your Robots

Have your advance team make a note of what equipment requires servicing, calibration or a preventative maintenance call out. Vendors are still sending expert technicians out to ensure their machines are operating properly. Reach out ASAP to get your robots serviced before the lab team returns or scheduled between shifts.

Note that *liquid handlers using disposable pipette tips* should be ready to go once reactivated, but more complicated devices using pumps or valve-based systems may require extensive cleaning and calibration before startup. If lab setup is looking like a long road ahead but you have the materials ready, consider outsourcing your processes to a cloud lab – more on this option on the next page!



## Simulate your Experiments

One of the great advantages of software is its mobility. Working from home has meant researchers' focus has shifted to data analysis. However, that shouldn't prevent *experimental design and planning*. Contact your vendor or software provider for a copy of the simulation software or, if applicable, use spreadsheet-based packages to design and simulate experiments outside of the lab. This means less time spent in the office where social distancing restrictions may apply. On your triumphant return to the lab, your code will be ready to go in the correct format!



## Expert automation off-site

Virtual companies – set up specifically with no wet labs – and some small biotechs currently make use of outsourcing to automated labs for performing research. Due to this approach, they have adapted well to the pandemic. Outsourcing is not always considered as a solution for reducing bottlenecks or alleviating in-house processes, despite its proven efficiency and flexibility with workflows. This approach is especially useful as labs adapt to working under newfound restrictions. Expert-led labs with cutting edge automation equipment can perform a wide variety of assays offering high-quality data (*and, importantly, metadata*) that can help inform decisions during this difficult period of limited lab access. With the current situation putting personnel, grant funding, and investment decisions at risk, outsourcing research offers a flexible solution for adapting your R&D strategy.

# streamlining with automation and integration



## Tracking and Tracing Protocols with Apps

“What gets measured, gets improved” as the saying goes, and the lab is no different. Tracking manual processes as well as automated steps using an app can help show bottlenecks in liquid handler usage as well as identify processes that could improve if automated. Additionally, using apps for manual processes may mean more rigorous adherence to the SOP or better notation of deviations from it. This information is important for investigating anomalous data points at the end of an experiment that uses both automated and manual steps. Additionally, the lessons learned can inform your automation strategy – whether to better integrate your systems, outsource key steps, or invest in new devices.



## Scaling Down to Save

When reagent shortages hit at the outset of the pandemic, many diagnostic labs were left with little choice but to devise a more efficient method of testing for coronavirus. Fortunately, qPCR and many other common laboratory processes are highly adaptable to scaling down. This helps save on costs and relieves pressure on the supply chain. Specialized low-volume liquid handling devices are both accurate and fast, achieving the replicability expected from automation with the capacity for high-throughput experiments. This has the added benefits of using less reagent, potentially using fewer plastic consumables like pipette tips, and reducing overall error, leading to major savings from the outset and helping research become more sustainable in the long term.



## Close the Loop: Digital & Physical Integration

As biology becomes a more engineering and data-driven field, linking the digital and physical aspects of research yields more robust and reliable results. Experimental design software coupled to robotic platforms allows for more complex approaches to experimental design like a multifactorial Design of Experiments, for example. Experiments are executed by robotic platforms, which feed both data and metadata of each step back to the software (more on metadata below). Data is collated by the software and easily interrogated by the researcher or fed into a machine learning (ML) or deep learning (DL) algorithm. This helps inform the next iterative design step, thus closing the loop.

In addition to high quality data, this level of digital and physical integration allows the researcher to have more walk away time from the lab as easy-to-use software removes burdens in programming, automated setup, and data collection. They are designed to be flexible, allowing researchers to change parameters rapidly and easily without specialist knowledge of coding. Startups with no wet-lab facilities make good use of cloud labs with an integrated approach. Their automated platforms allow rapid turnaround of samples while providing equivalent or even higher-quality data. Outsourcing key steps in your process to cloud lab partners is a neat solution to those rare but predictable bottlenecks requiring robust data.



## Mountains of Data

Context is king in the age of data-driven science. As automation and data acquisition increases, so does the ‘data bottleneck’ in bioprocess analysis. Cloud labs produce high-quality data and metadata – that is the data about the data point in question, such as the barcode of the plate used, or what the ambient temperature was at the time of sampling. These data are essential for use with artificial intelligence enabled approaches, such as machine learning, and may help explain anomalous findings in the often-fickle field of biological research.

Utilizing an integrative software platform in-house can achieve the same. Cloud-based systems collect data directly from devices, collating them into a standard format, and sharing with the team. This saves valuable time in gathering files manually and copying only the data deemed ‘relevant’ into a spreadsheet for analysis, as is often the case. An integrated software approach allows for a broader scope in data interrogation, saving hours on manual data processing, and helping to streamline your experiments from beginning to end.

A microscopic view of virus particles, likely coronaviruses, showing their characteristic spherical shape and surface spikes. The image is rendered in shades of blue and white, with a dark teal overlay at the bottom containing text.

## lab of the future: **lessons from COVID**

The thought of catching up on research now may seem daunting after months of furlough, lockdown, and inactivity. Leveraging your automation and software tools, and rethinking your approach in using them, will help cover lost ground in the uncertain months ahead. If we dare imagine the post-COVID lab, it will require at a minimum automation and software tools and partners to ensure production of high-quality, data-driven research supporting healthcare, drug development, and a growing bioeconomy.