Running a lab amidst the COVID-19 crisis: how to stay productive during lockdowns and get ready for the New Normal

Sittinan Chanarat[a,b,*], **Varodom Charoensawan**[a,c,d,†], **Danaya Pakotiprapha**[a,b,†]

[a] Department of Biochemistry, Faculty of Science, Mahidol University, Bangkok 10400 Thailand
[b] Center for Excellence in Protein and Enzyme Technology, Faculty of Science, Mahidol University, Bangkok 10400 Thailand
[c] Integrative Computational BioScience (ICBS) Center, Mahidol University, Nakhon Pathom 73170 Thailand
[d] Systems Biology of Diseases Research Unit, Faculty of Science, Mahidol University, Bangkok 10400 Thailand

*Corresponding author, e-mail: sittinan.cha@mahidol.edu
† These authors contributed equally to this work.

The ongoing coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become one of the largest and worst pandemics in history since the H1N1 swine flu in 2009. The virus is highly contagious in humans, with the rapid infection rate, leading to the death toll that increases in an unpredictable scale. The infection was thought to originate from mainland China and first spread through the East Asian countries. However, the number of infected cases and deaths in Europe, North and South America have overtaken those in Asia. The disease not only causes extreme social anxiety, but also affects virtually every single occupation and profession – including research scientists – in many unimaginable ways.

Besides the self-quarantine required for those infected with SARS-CoV-2 or at risk of infection, it has been suggested that the general public should also practice social and physical distancing when possible [1, 2]. Because the disease can be transmitted by an infected person who has yet to show symptoms [3], public health officials of several countries undergoing the "peaks of infection", have recommended strict physical distancing to prevent the spread of COVID-19, and thereby banned all public gatherings and suspended all in-person educational instruction, including those in universities and research laboratories. As a result, many researchers are affected during the "lock-downs".

Nobody knows for sure when the coronavirus pandemic will end, or at least be sufficiently controlled by effective vaccinations, and whether life will ever return to "normal". In order to keep up the work momentum, scientists need to adapt fast. In this Editorial, we highlight some key aspects that may help biologists and researchers in related fields, especially "experimentalists" who have been heavily affected by the pandemic, to prepare for the challenges of keeping healthy and productive research laboratories during possible recurring lockdowns, as well as adapt their working routines to the "New" or "Next" Normals.

HELP PREVENT THE SPREAD OF THE CORONAVIRUS

Because the virus is new to humans, virtually none of us have developed the immunity against it yet. Without an effective vaccine or treatment standards, hospitals and healthcare systems can become overwhelmed by the sheer number of infected patients. Since the number of intensive care unit (ICU) beds is limited, the mortality rate increases rapidly when this capacity is exceeded [4, 5]. An attempt to "flatten the curve" in order to reduce the overall load of infections and delay the rate thereof would ensure that the healthcare demand does not exceed the supply.

Standard protocols for preventing COVID-19 spreading include coughing or sneezing into your elbows, washing hands regularly, avoiding touching faces or staying home if you feel sick, to name a few. This goes without saying but the most effective and simplest ways to stop SARS-CoV-2 infection is to avoid exposure to the virus. According to the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO), the mode of transmission of the coronavirus is person-to-

person via respiratory droplets and aerosols [5, 6], which has been confirmed in all the affected countries [4, 5]. Therefore, it is recommended that during the lockdowns, everyone, including scientists, stays home as much as possible, avoids mass gatherings, and maintains distance of approximately two meters from others insofar as possible, together generally known as social distancing.

As researchers, especially experimentalists working at the bench, we want to enjoy new discoveries in our laboratories every single day. However, as responsible members of the societies, we need to protect ourselves and help prevent the spread of the virus by staying away from our beloved labs temporarily and strictly practice social distancing. If the scientists, who are expected to understand the scientific rationales of the lockdowns, do not comply with these recommendations ourselves, how can we expect anyone else to?

EMERGENCE OF A SECOND WAVE OF SARS-COV-2 INFECTION AND RECURRING LOCKDOWNS

While vaccine development is still ongoing (as of August 2020) [7], lockdowns begin to be relaxed in some countries due to the social and economic reasons, and there has already been evidence of the second-wave outbreaks in several cities of Japan, China, and Korea to name a few. Lessons learned from the previous and ongoing lockdowns may help us prepare for the next, during which scientists could still continue working and contributing to the research community.

Chance to go over paperwork, finish off manuscripts and proposals

If you have ever dreamed of having time to get through all the paperwork, then the COVID-19 outbreak might have created such an opportunity. Because, in theory, you should have more time for yourself: You do not have to commute for a start; nobody will come to interrupt you during the day at home (except your family members!), and so on. If you are a PI, you may encourage your students and postdocs to improve their writing skills – and of course, at the same time helping you get your work done – by preparing presentations, writing and reviewing manuscripts, creating beautiful figures and graphical abstracts, and helping you draft grant reports and develop new grant proposals.

Update your bioinformatics computer skills

Self-isolation and social distancing may sound like a disaster for most experimentalists, but perhaps unsurprisingly, less so for those bioinformaticians. Since bioinformatics and systems biology now have ever-increasing influences on day-to-day biological experiments and new discoveries [8, 9], it is probably not a bad time to pick up some computational skills that could expedite your ongoing experiments, or even turn you into one of those bioinformaticians who can publish multiple papers each year without doing a single "experiment" (although this "accusation" is not always true). At the end of the day, what you need to get going is a computer, and the will to dive into it.

If you are new to bioinformatics, there are already a large number of online learning platforms and tools that would help you get going very quickly, notably the Coursera class offered by US San Diego [10], and the bioinformatic collections offered by the Rosalin platform [11]. Bioinformatics is not confined to counting bases or modeling three-dimensional structures. In the midst of the COVID-19 pandemic, there are also several epidemiology [12] and genomic data science [13] programs organized by Johns Hopkins University, that would readily equip you with the tools to understand and hopefully stop the virus and its spreading.

For those who are already proficient in bioinformatics, you may consider taking this opportunity to disseminate your technical skills to others by putting together online learning materials. For instance, Lior Patcher and Sina Booeshaghi, one of the world's leading researchers in single-cell omic data analysis, have posted a YouTube video explaining how bench scientists can learn to analyze single-cell RNA-seq data [14]. If you are a keen data/text miner, there is a COVID-19 Open Research Dataset (CORD-19) that one could dive into [15] and contribute novel insights into how we could control the pandemic more effectively.

Keep on conducting your fascinating research (and contribute to stopping COVID-19 if you can!)

All scientists are passionate about science that contributes to a better world. So, never let the pandemic stop us from doing the science that we love. We may be unable to fully access our laboratories, but there are so many ways to productively do science outside the labs: pieces of random data that your students previously showed might be worth

another review; your new fuzzy ideas or hypotheses could finally be crystalized; even some long forgotten unanalyzed results from your former students hidden away at the bottom of an old drawer might be waiting for you to re-examine; comprehensive literature review that you wish to do a long time ago can be an actionable option. Now as you have more uninterrupted time, the choice is absolutely yours.

Moreover, if you can, why not contribute to the research that could help stopping COVID-19 as well? There are various aspects of research that may – directly or indirectly – need your expertise. Amid the outbreak, we are fascinated to see a number of preprints as well as peer-reviewed manuscripts published by researchers around the world over a short space of a few months. Epidemiology, mathematical models, molecular diagnostics, vaccines, therapies, systems biology, and so on, are just some examples of the effort the scientific community has chipped in to help solve the situation.

Like many other countries, Thailand's research community is also striving to combat the coronavirus. Many strategic collaborations between academics and industry have been established since the beginning of the outbreak. In such an active research atmosphere, several promising solutions have already been rapidly developed; and the work of several key figure scientists have already been widely recognized. To give you a glimpse, L'Oréal Thailand has just awarded the Science Special Fellowships for COVID-19, to three outstanding Thai female researchers who energetically worked to fight the disease [16]. Besides, several leading research institutes and hospitals, including Chulalongkorn University, Mahidol University, Vidyasirimedhi Institute of Science and Technology (VISTEC), National Center for Genetic Engineering and Biotechnology (BIOTEC), and Ministry of Public Health, have been working closely together with the private sector on several aspects of research to mitigate the pandemic and better manage the disease in a longer term. Presently, several serology-based and nucleic-acid-based point-of-care diagnostic tests have been successfully developed; potential antiviral proteins and RNA vaccines are already in the clinical testing pipeline. We believe that many more are also currently doing their best to ease the situation. One may wonder how our skills and knowledge could be applied in such a crisis. But we must all step out of our comfort zones and give it a try, in as many different ways as we can. Every little help is needed, so do not underestimate yourself. In fact, we ourselves are trying our best

to make use of our expertise to help develop affordable test kits for SARS-COV-2 in Thailand (S.C. and D.P.) [17], and applying our expertise to investigate the immune responses in the COVID-19 patients (V.C.). As several national and international funding agencies have recognized the importance of COVID-19 related research, a number of grant programs and fellowships are now available for application. In summary, it is a good opportunity for us to rethink and find a way to contribute with your expertise now more than ever.

Use your science communication skills to help educate (and comfort) others

Since the beginning of the outbreak, there has been an overwhelming amount of new information, some of it useful and some less so, reaching us day by day. This can make the general public worry and ask lots of questions with fear. Unfortunately, the answers to many of these questions are full of technical terms and may be difficult for the general public to readily digest, not to mention panic-inducing fake news and conspiracy theories. Therefore, people with relatively little medical or scientific literacy can easily be overcome by a sudden dread.

Our scientific knowledge and skills in science communication can directly help the community in this case. You may start by calming down your non-science friends or members of your family by distinguishing facts from journalists' opinions and speculations. In addition, if you can, you may even contribute to short, easy-to-digest online contents for a layperson and share them on social media among your community. Who knows, maybe your voice might be louder than you could ever think. Do not underestimate your potential!

PREPARE FOR THE NEW AND NEXT NORMALS

In many ways, the COVID-19 outbreak has already changed lifestyles of people around the globe. The way we live, work and study, socialize and connect, has already been affected. Some guidelines and regulations on how to live our lives can be tedious and restrictive, so that we want to get away from them as soon as possible. Some changes, however, can actually benefit us physically or mentally, and make our lives easier than before the crisis, and should be continued even after the end of the outbreak. These changes will become the New Normal, the lasting changes of human behavior or lifestyle during and after the pandemic.

Being able to work remotely and access the institutional network via Virtual Private Network (VPN)

has become a new norm in many workplaces. Like it or not, we are now living in the fast-paced world of technological paradigm shifting. Free and commercial interactive web-based tools are useful when social distancing is necessary. They are suitable not only for teaching online classes, but also for virtual lab meetings (Table S1). Features such as audio and video conferencing, screen sharing, slideshow presentation to a large group, live chat rooms are particularly helpful. Speakers and audiences from different places are able to attend the same meeting with ease as effectively as in-person. As some would say, online meetings also mean one could fit more meetings into their calendar, as compared to onsite meetings that require commuting from place to place. Interestingly though, while many tools have been available long before the start of the pandemic, they were, for many reasons, not so popular in academia as compared to in business sectors. But because of the widespread institutional shutdowns, researchers are forced to adapt to working from home (WfH) or working from anywhere (WfA) policy, so the use of those technologies therefore has increased greatly during the past months.

Online training and Webinars have become more and more commonplace, as they give students much more freedom to decide when and where they are ready to be trained. Because travel restrictions are still strictly imposed in many countries, several academic conferences in Thailand and elsewhere in Asia have moved partly or wholly online. It is likely that some of the online conferences and congresses imposed during the COVID-19 lockdowns will be continued beyond the pandemic, due to the logistic conveniences and lower resource requirement.

Though useful, some of these "hi-tech" tools can have a steep learning curve, especially for individuals who are less technologically inclined. In these cases, easy-to-follow, step-by-step instructions would be extremely helpful. To make a transition from offline to online, emphatic relationships among coworkers are vital. The IT service department of your institutes could play a driving role in facilitating the process by preparing a technical manual or providing a training workshop for all staff and students. On the other hand, non-digitally native persons should be seriously aware of the situation in which they have to adapt by upgrading basic computer skills and by learning how to use relevant programs as quickly as possible. If you are one of them, you are not alone. Do not hesitate to ask for what you need.

FINAL NOTE: PREPARE FOR THE UNKNOWN

Being scientists and understanding the science behind the pandemic do not guarantee you a life without a panic attack from the current situation. So, there is no need to be ashamed if you feel so. But at the end of the day, it is important that we scientists apply our knowledge, soft and hard skills to help ourselves and the societies as much as possible, particularly amid the outbreak. If you think about it, the current situation could be a lifetime opportunity where the full spectrum of our abilities can help solve the crisis in real life. At the time like this, the importance of basic and applied sciences, and the roles they have played in saving people's lives must be highlighted now more than ever. We should also be proud and confident in our research for humanity. The power to push the frontier of science forward is within us.

Finally, as mentioned above, no one ever knows for certain when the pandemic will end; but eventually what is certain is that, this too shall pass. Rather than worrying about the unknown, we should focus on what is known and what we can control. We hope that we – and all scientists around the world – will be able to fully resume our exciting experiments and research activities in our beloved laboratories soon. The most obvious but hard-to-answer question is, when.

Appendix A. Supplementary data

Supplementary data associated with this article can be found at http://dx.doi.org/10.2306/scienceasia1513-1874.2020.068.

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Appendix A. Supplementary data: Online tools for Working-from-Home researchers

Table S1 The following is the selected, but far from complete, list of web tools and applications that may empower research scientists who are working from home.

Tasks	Web tools/ applications	Main features and functions	Computer skills required	Education plan/discount	Authors' note[†]	Web address (URL)
Video conferencing, recording or simultaneous watching, instant messaging	Zoom	Video conferencing, screen/application sharing, video recording, instant messaging	Beginner	Education plan available*	Zoom, for us, is probably the most user-friendly and contains all the basic tools required for online meetings, including annotation tools where you can draw on your students' slide	https://zoom.us
	Microsoft Teams/ Skype	Video conferencing, screen/application sharing, video recording, instant messaging	Beginner	Education plan available*	Being a pioneer in peer-to-peer communication, Skype is one of the first choice we could think of. Empowered by the application, Microsoft Teams provides video conferencing with screen sharing feature and document sharing, and become a full collaborative working environment for serious work.	https://teams.microsoft.com
	Google Hangouts Meet	Video conferencing, screen/application sharing, video recording, instant messaging	Beginner	Education plan available*	Google Hangouts Meet provides an easy-to-use web-based conferencing tool. It offers a high-quality video call with no time limit. Its full integration with Google applications makes it an outstanding platform for team collaboration.	https://meet.google.com
	WebEx Meetings	Video conferencing, screen/application sharing, video recording, instant messaging	Intermediate	Education plan available	As one of the most widely-used platform, WebEx is feature-packed and highly customizable. Although its user interface is simple, it may not be intuitive for everyone.	https://www.webex.com
	Slack	Video conferencing, screen sharing, instant messaging	Intermediate	Education plan available*	One of the most popular text instant message and information sharing platforms for many research groups and communities. Also used in large consortia to exchange information and opinion, such as the Human Cell Atlas (HCA)	https://slack.com
	WhatsApp	Video call, instant messaging	Beginner	Available for free	With more than 1.5 billion users around the globe, WhatsApp obviously become the most-popular instant messaging application. It is easy to use for chatting and voice calling. Group video call up to 4 people is also available for free.	https://www.whatsapp.com
	LINE	Video call, instant messaging	Beginner	Available for free	Line is popular in some countries in Asia, especially in Japan, Taiwan and Thailand. It is easy to use. Free group call is available for up to 200 people . The application, however, has lots of limitation that might not be suitable for serious work.	https://line.me
Recording and streaming	Loom	Video recording	Beginner	Free for education	Easy and intuitive web-based video recording application. With user-friendly interface, Loom is one of the best tools for beginner who wants to record video.	https://www.loom.com
	OBS: Open Broadcaster Software	Video recording/ streaming	Advanced	Available for free	OBS - one of the most popular open-source streaming and recording software. Because its versatility and availability free of charge, it is also being used by many online gamers. However, due to its versatility and multiple features, it may take longer for non-tech-savvy person to get going at first.	https://obsproject.com

[†] This is by no mean an exhaustive list. The comments shown are based on our own experiences, which may differ from those of other users.

* Special offer available during COVID-19 university shutdown.

Table S1 Continue ...

Tasks	Web tools/ applications	Main features and functions	Computer skills required	Education plan/discount	Authors' note[†]	Web address (URL)
Project management	Basecamp	To-do lists, file sharing, forum-like messaging, time tracking	Intermediate	Free for education	Nice and simple platform for project collaboration and management. Can also be used as an online classroom in a similar way to Google classroom.	https://basecamp.com
	Trello	Kanban-style list-making	Beginner	Premium plan available	Very user-friendly project management platform. Users can create "to-do lists" or "cards" that can be assigned to other team members, with deadlines, and also checklists.	https://trello.com
Document and result sharing	Dropbox	File storage and sharing	Beginner	Education plan available*	The big three of cloud storage services. Coming with free and premium options, they offer document syncing and easy-to-use user-interfaces which are ideal for collaborating while working from home.	https://www.dropbox.com
	Google Drive	File storage and sharing	Beginner	Education plan available*		https://www.google.com/drive
	Microsoft OneDrive	File storage and sharing	Beginner	Education plan available*		https://onedrive.live.com
Online learning resources	EdX	Free online education platform	Beginner	Available for free*	EdX, Coursera and KhanAcademy offer a large variety of free online courses, many of which are created by top-ranked universities around the world. They provide valuable platforms to help upskill, reskill, and deepskill expertise.	https://www.edx.org
	Coursera	Free online education platform	Beginner	Available for free*		https://www.coursera.org
	KhanAcademy	Free online education platform	Beginner	Available for free*		https://www.khanacademy.org
Calendar and scheduling	Doodle	Appointment scheduling	Beginner	Available for free	A user-friendly and straight forward scheduling platform. Its simplicity is hard to beat.	https://doodle.com
	Google Calendar	Event scheduling, calendar viewing and sharing	Beginner	Available for free	Google Calendar is a time-management and sharable scheduling calendar service	https://calendar.google.com
Online classroom	Google classroom	Assignment creating, distributing and grading	Beginner	Available for free	Together with Basecamp, it is probably one of the most comprehensive platforms for running an online classroom presently available. In Google classroom, "Teachers" can share teaching materials, slides, links to video with "Students". Assignments can be posted, submitted, and graded within the platform.	https://classroom.google.com/

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