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Remote working in research

An increasing usage of flexible work arrangements can improve productivity and creativity

Philip Hunter

Remote working—or flexible working arrangements—is becoming increasingly popular in scientific research, driven by both social trends and advances in technology. The major benefits—the ability to continue careers while starting families or avoiding the upheaval of moving for a temporary position—often outweigh disadvantages, such as the lack of face-to-face encounters around a laboratory or meetings. There are also unanticipated advantages, such as increased creativity resulting from an improved work–life balance, which has spurred not just scientific research, but also other professions to adopt flexible working. According to a survey by telecoms group Vodafone, 75% of companies worldwide have now introduced such policies, and of those 83% reported improved productivity (https://www.vodafone.com/content/index/media/vodafone-group-releases/2016/flexible-working-survey.html).

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The trend for flexible work arrangements is being driven not just by technical advances, but also cultural changes as workers themselves demand greater flexibility. A recent survey of nearly 10,000 people working in Australia, Canada, France, Germany, the Netherlands, Scandinavia, Spain, the UK and USA by Fuze, a provider of communications services in Boston, USA, found that 89% think that flexible working should become normal, and 54% would move jobs to obtain a better work/life balance (https://www.fuze.com/future-of-work). Research from the CIPD (Chartered Institute of Personnel and Development) spanning five leading European countries corroborated anecdotal reports of improved productivity through flexible working and also indicated longer-term health benefits through reduced stress.

Specific data for the life sciences are sparse, but it is hard to find a laboratory, biotech or pharma company nowadays without at least some remote working arrangements. Although bench work is harder to perform remotely, a growing amount of observation and analysis can be performed at a distance. Moreover, equipment such as electron microscopes, PCR machines and gas chromatography–mass spectrometers is increasingly being accessed remotely and shared between multiple sites through online booking systems. In addition, the life sciences are following in the footsteps of high-energy physics and astronomy towards large-scale multi-site collaborations.

Pioneers of remote work

Some institutions and universities, most notably at the Open University (OU) in the UK, which was set up for distance learning from the outset, embraced remote research early on. In 2008, the OU established a semi-autonomous astronomical telescope at the Observatori Astronomic de Mallorca (OAM) in Mallorca, Spain, where conditions for observation are on average far better than anywhere in the UK. As students could not be in regular attendance, in a project called Pirate the OU installed remote observation and control, which has hugely improved access for students, according to Nicholas Braithwaite, Associate Dean for Academic Excellence at the OU and one of Pirate's pioneers. Groups of any size can access the telescope at any time; when it is cloudy, it is possible to fall back on stored images taken from previous nights. The next stage is to collaborate with other universities that have similar equipment in different locations to provide resilience not just against equipment failure but also unsuitable weather conditions.

The OU has moved swiftly to extend similar remote operation and access to electron and optical microscopes, a PCR machine and mass spectrometry system, with similar benefits in extended access and quality of teaching. "We have two electron microscopes and can allocate them in slots between 5 minutes and 50 hours, with access to 400 pre-prepared samples", Braithwaite commented. "We also have video resources which is empowering because it allows people to get around the machine not just from any location but in numbers, say up to 45, that wasn't possible before".

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An additional benefit of remote working is that it gives students and researchers access to state-of-the-art equipment rather than making do with ageing laboratory facilities. Braithwaite noted that at the OU, students had been taught during practical classes in laboratories to fill old-fashioned burettes rarely used professionally today. "Titration is now done in machines that

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inject milliliters of fluid and measure a pH", he said. "So we have a titration machine in the lab with a web cam attached and real chemicals for remote demonstrations". As the ability to work and study from home was the founding principle of the OU, remote facilities are now rolled out across the whole STEM field. "The key is that it should not just be an add-on, but the way of working for all students", Braithwaite said.

Pro and cons

Another factor driving remote working not just at the OU but more generally in the life sciences is the increasing preponderance of analytics work using software tools that are often available through Internet or cloud-based services. This is also stimulating freelance opportunities for analytics and bioinformatics specialists for whom remote working is the modus operandi.

Padma Putta is one such freelancer working among others for the Seattle-based Omic group that is building an interconnected research network for medical genomics. "I see most jobs in life sciences being mostly about data-driven analysis now", Putta said. "Being a computational biologist, the nature of the work I do doesn't change much wherever I happen to be. It is almost the same as I do in regular employment. [...] Most of the facilities I need are accessible through the internet now, be it cloud technologies or publicly controlled access for data-driven analysis".

But remote access naturally has consequences for research projects and needs careful managing to ensure that it enhances rather than diminishes the quality of the work or the productivity of those who are still on site most of the time. There are also downsides that need to be mitigated: largely, a lack of interaction, project management and stimulation through face-to-face contact. Even Putta, an enthusiast for remote working, admitted that it can take longer to resolve unexpected issues: "When a situation demands a quick fix from the team, there might be delays in response followed by further delays in work progress".

Another concern is that not all people are equally suited to remote working as some perform better amid the buzz of a team. Such factors do need to be considered almost on a case-by-case basis, commented Jack Williams, Director of the Nelson Institute Center for Climatic Research at the University of Wisconsin, USA, and a great believer in flexible working. "I don't worry so much about productivity", he said. "My experience in academia is that most students and postdocs are highly motivated and able to maintain high productivity even working remotely. It's a highly self-selected population". But he concedes that some people he would be reluctant to pass for remote working. This caveat applies more generally to early graduate students because they require closer supervision and mentoring. "The distance-collaboration option works best for senior grad students, for example dissertators, postdocs, or research scientists", Williams said. He also acknowledged the communication challenges of flexible working and hinted that he had reined back slightly as a result. "I now think that the critical mass of the research group has to be on-site", Williams commented."It's OK to have 1–2 people off-site at any given moment, but if most people are off-site, then informal team communications start to break down".

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Even in high-energy physics where remote collaboration has long been established, it works best when all participants have at least met face-to-face, thinks Michael Spannowsky from the Institute for Particle Physics Phenomenology at the University of Durham, UK. "In my experience, collaborating remotely works extremely well after an initial contact is established", he explained. "To initiate a project I consider it essential to have met my collaborators, which usually takes place at workshops or conferences. At least for all the collaborations I have participated in, it is extremely rare to collaborate with somebody whom one does not know at all beforehand". This view is shared by Deepak Kar from the University of Witwatersrand in Johannesburg, South Africa, who performs analysis for ATLAS, one of the four major experiments at the Large Hadron Collider at CERN. "Remote collaboration comes with built-in advantages and limitations", he said. "Some of the latter can be addressed by better technology but, in the end, I believe humans work better when they feel it's a real person on the other side. Even in our 3,000 plus people ATLAS collaboration, I know a large number of people personally, and it is always more efficient and pleasant working with them remotely, compared to someone who I have never met".

The need for subsequent face-to-face interactions after people have met can be reduced by videoconferencing platforms, but Williams has found that these systems—at least, the affordable ones—are still insufficient. High-quality videoconferencing platforms do exist, but these are prohibitively expensive for most academic laboratories. They are also inconvenient to use on a regular basis, because participants have to be in specific rooms around dedicated screens. Yet, Spannowsky commented that video-centric systems, such as Vidyo, which is widely used at CERN, or Skype, work sufficiently well for large collaborations. "In my experience, Vidyo seems to be more reliable and useful for meetings with many people connecting from many different places", he said. "However, it comes with an overhead to setup such a meeting. Skype instead works very well for meetings with a small number of participants connecting from few places. Of course, a good internet connection is crucial".

Adapting to remote work

At present, many employers restrict the number of people working remotely, even if there are differences in opinion over the optimum proportion. The DateLife project to develop a web platform of species divergence for instance has settled on a 50/50 split between onsite and remote working, according to one of its participants Luna Sánchez-Reyes at the University of Tennessee in Knoxville, USA. Even though the project is more conducive to remote working, it was challenging at the beginning to atone for the reduced physical interaction. "In my former lab, I would usually have lunch with my coworkers, so it was easy just to learn about what they do and their thoughts on an almost daily basis, and there is a lot more opportunity for small talk", Sánchez-Reyes commented.

However, the benefits of remote working made it worth the efforts to overcome its

deficiencies. "You have to make a lot more effort in the meetings, to make sure you're asking relevant things, since our opportunity to chat face to face via video is limited to once or twice a week", Sánchez-Reyes explained. "You have to be more precise and efficient. However, it became easier, and I realized small talk can be done through messages and the lab chat. Now, whenever I want to comment on something, I just post something on the lab chat, without having to wait for lunch time or to meet with them". This form of asynchronous communication even has advantages. "You can comment on something at 4 am in the morning and someone might comment back on the other side of the world".

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Sánchez-Reyes also pointed out that remote working can get the best out of people who find social interaction within a team difficult. "Thanks to cell phones, we are all used to creating intimacy through text messaging, and sometimes it's even easier, especially for socially awkward personalities", she said. "It's just a different level of interaction".

Nonetheless, scientists working remotely will usually have to become familiar with tools more sophisticated than cell phones and chat channels, vital though those are. One is Git, an open-source version-control system, often used in conjunction with the web hosting service GitHub. Originally developed to manage development and version control of Linux, Git has become widely adopted within the scientific community to ensure reproducibility, store and share code, analysis scripts and data, as well as ensure the appropriate versions of files are used. Rather like the Excel spreadsheet, the tool has accumulated power at the expense of ease of use and has been criticized for its complexity, but for remote working it has become particularly valuable in coordinating projects.

Evolutionary biology is well suited to remote collaboration as it entails a lot of analysis and coding work. "The nature of the work we do is largely writing software, running analyses, and writing papers", explained Brian O'Meara, Associate Head in the Department of Ecology and Evolutionary Biology, University of Tennessee, USA. "With the advent of things like GitHub for code and analyses, Slack/Gitter/Google Hangouts for interaction, and Dropbox/Google Docs for collaboratively writing, it is easy to see how people are progressing. We also have a weekly joint meeting where everyone, including me, reports out on what we have been doing this week. I also have individual meetings every week with each lab member".

Eventually, every team leader has to find the optimal balance to ensure communication and keep tabs on projects. "We've evolved a kind of multilayered approach, with a combination of weekly or bi-weekly video or teleconferencing meetings, emails as needed, and the Slack system for team messaging", Williams said. "I'm a big believer in weekly meetings with all grad students and postdocs in the lab, lasting 30–45 minutes, sometimes as small groups, so that we all stay in touch and no one goes too far off track. Biweekly meetings and Slack are good for small teams of 4–8 people working on a common project".

Untapped potential

Remote working is of course not confined to individual teams or departments and is equally valuable for collaborations among multiple parties, which were common long before web-based tools and other aids to interaction became available. "Remote collaboration is now extremely common for research collaborations where projects and grants are split between researchers at different institutions", O'Meara said. "Two of my last four major grants have involved faculty working hundreds of miles apart, and that's been adopted because often the best person to work with to address a question is not at your own institution". In that respect, remote working is already improving the quality or productivity of many collaborative projects. "One unexpected benefit is ease of collaboration once people move on to other positions", O'Meara added. "We are already used to interacting remotely, and so can keep joint work going if it meets everyone's interests to do so". Related to that is the fact that many postdoc positions are temporary and so a requirement to relocate just for say 2 years can be a deterrent. "Allowing more remote work by postdocs would similarly broaden the pool to those who are the best fit, regardless of location", O'Meara commented.

Opportunities for remote working are even greater than is often appreciated because of the increasingly analytical nature of the work, according to David Bapst, a postdoc in O'Meara's group. "Given there are many post-doc positions in every scientific field that involve deep-dives into data analysis, rather than work requiring access to lab facilities, I think there is probably much greater capacity for remote post-docs than is currently realized", he said. "I can do my work anywhere that I can open my laptop". This is increasingly important for scientists whose partners cannot readily move because of their work. "I think it's not so much simply the economic cost of moving, but that young scientists are likely to have partners, children, parents, and other family obligations that make it difficult to easily accept a short-term research position that requires relocation", Bapst said.

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One concern though is that remote working can cut people off from the academic community with possible long-term effects on their career. But there are other opportunities for interacting with local institutions or taking up teaching roles. "I don't precisely work at home", Bapst explained. "In both remote post-docs I have had, I also had adjunct/lecturer/research faculty positions at other schools, where my spouse held a tenure-track position, which allowed me to have office space to work from, rather than work from home. This means I still benefited from being involved in an academic community, if not the one I am technically employed as a post-doc in".

This further blurs the lines between remote and onsite work and marks a trend towards adopting methods of communication and interaction that are suitable for the work in hand whatever and wherever it is.

The objective is to provide the flexibility for researchers to improve their work/life balance while eliminating negative impacts in terms of interaction and project management. When that balance is achieved, flexible working can yield real improvements in morale and productivity, according to O'Meara. "At least anecdotally, happy people are more creative, and a lot of the science we do requires creativity", he said. "Not forcing people to balance leaving family to move to a place can make them happier".

Further technical developments

One major impediment, at least for the life sciences, is the limited scope for automation and remote operation in wet laboratory work, but it has become increasingly possible in other scientific fields. One example is photovoltaics, where a remote laboratory has been developed at Loughborough University in the UK dating back to 2002 when a distance learning version of its MSc in Renewable Energy Systems Technology was made available as computer simulations (http://www.lboro.ac.uk/departments/meme/research/research-centres/crest/rpl/). When Internet-based capacity and services advanced, it became possible to go one step further and enable students to experiment with and control the physical apparatus itself from a distance. The remote laboratory is identical to a physical one designed to teach the energy conversion properties of photovoltaic (PV) panels, but with an experimenter–student interface that allows students to perform real experiments in real time from anywhere in the world.

"We had to integrate 10 different subsystems into the lab", commented Richard Blanchard, Head of Renewable Energy for Development Research Group at Loughborough University and one of the architects of the remote laboratory. "We had to integrate the lab into the university IT services for network protection and include an online booking system for users". He added that IoT (Internet of Things) developments would make it easier to further develop remote laboratories: "We have developed other remote monitoring systems for work we are doing on microgrids in Kenya and a biogas plant in Thailand, so we can see how well these systems are performing and react to any problems".

Such remote operations of facilities and equipment will without doubt usher in the next stage of remote working and collaboration, but what is less certain is just how radical the impact will be on working practices and team dynamics. Clearly, people are becoming more accustomed to interacting via online mechanisms but there will always be benefits from direct human contact. The balance will change but will still have to be struck.

