

FENS-Kavli Network of Excellence: Mentorship during the COVID-19 pandemic: Perspectives, challenges and opportunities

1 | IMPACT OF THE COVID-19 PANDEMIC ON THE ACADEMIC LANDSCAPE

The COVID-19 pandemic has considerably changed the academic landscape in almost all aspects, ranging from impacts on research to mental health challenges (Börgeon et al., 2021; Else, 2020; Myers et al., 2020; Waaijer et al., 2017; Woolston, 2020a). In neuroscience, like in other scientific disciplines, the pandemic has most significantly impacted early-career researchers (ECRs): considerable delays in research progress have not always been accompanied by an extension of funding and contracts, a new mode-of-work and communication with peers have had to be rapidly learnt, increased care responsibilities have led to reduced working time and productivity, and travel restrictions have greatly limited research visits and scientific events. These challenges represent the visible aspects, but they are only the “tip of the iceberg”. Mental-health issues that have arisen or become magnified during the past 2 years are still mostly buried under the surface (Figure 1).

Neuroscience is among the most diverse and ambitious scientific disciplines (Laurent, 2020). Scientists studying brain structure and function investigate diverse topics from molecular processes to cognition, and range from theoreticians with strong backgrounds in mathematics, computer science or physics, to experimentalists working on humans or model organisms, and clinicians researching patients with brain disorders. This richness in research areas is directly translated into a wide range of challenges experienced by ECRs in these various fields. In this editorial, we focus on how the COVID-19 pandemic has affected mentors and mentees in academia more generally, and ECRs more specifically. We are a diverse group of scientists, representing different career stages and fields, encompassing theoreticians, experimentalists and

clinicians, principal investigators, postdoctoral fellows and graduate students united under the neuroscience umbrella.

Although the pandemic has entered a new phase, it is not over yet and its lingering effects will be with us for the foreseeable future. We propose practices to manage the continued challenges, considering the diversity of needs. We conclude by reflecting on positive outcomes of the pandemic on our everyday academic lives and highlighting measures which should be cherished and maintained as we go forward.

2 | HOW TO MENTOR AND MOTIVATE WHEN YOU ARE BURNED OUT YOURSELF? THE PIs PERSPECTIVE

“What’s the difference between a principal investigator (PI) and a lamp? A PI is expected to shine even after it burns out ...”; meant as a joke to describe the hurdles of the principal investigator in a cynical way, the expectations have not decreased during the COVID-19 pandemic: writing grant applications to secure funding, re-thinking teaching, maintaining productivity and an impeccable publishing record, all while juggling familial and mentoring responsibilities. We consider two main aspects of the challenges PIs have faced during the pandemic: the “external” technical challenges, which are visible to the entire community, and the “internal” ones, which reflect the emotional toll the external factors exert (Figure 1).

The COVID-19 pandemic has made existing biases even more pronounced. Women and other underrepresented minorities, especially those at the early career level, continue to represent a small fraction of invited speakers at conferences, workshops and seminar series, win fewer prizes, and have more difficulty publishing papers as last authors (Schrouff et al., 2019). If getting a highly cited scientist to speak at a conference before the pandemic was

Abbreviations: ECR, early-career researcher; PI, principal investigator.

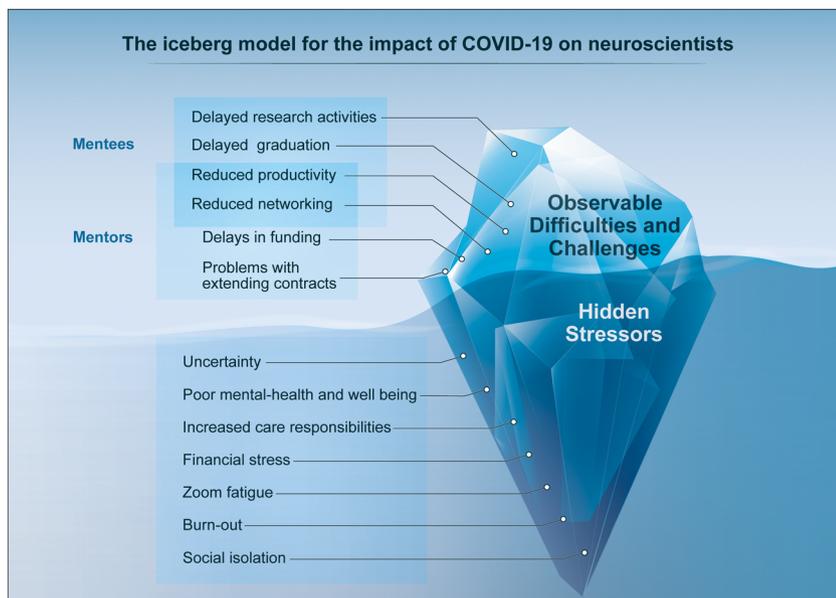


FIGURE 1 The iceberg model for the impact of COVID-19 on mentors and mentees in neuroscience

difficult because they could only fly so many times in a month, the move of many such events to the World Wide Web with the onset of the pandemic enabled these scientists to speak even more frequently than before. In addition, frequent and prolonged school and daycare closures have greatly increased familial responsibilities for scientists with young children and thereby led to reduced working time and productivity. Research not only shows that women take the bigger bulk of this responsibility (Kasymova et al., 2021; Malisch et al., 2020; Oleschuk, 2020; Staniscuaski et al., 2020) but also shows they submit proportionally fewer papers (Squazzoni et al., 2021; Staniscuaski et al., 2021) and get fewer grants (Woitowich et al., 2021) than men. The COVID-19 pandemic has further widened the already wide deep gap between scientists with and without care duties.

Besides these overt effects of the COVID-19 pandemic, perhaps the biggest toll the pandemic has taken is on the PI's mental health, whilst juggling multiple duties. Increased research and teaching responsibilities, in addition to the emotional support of group members (often without having a basic training in mental health) and familial duties, have left many PIs in a state of constant stress. The obvious slowing in research pace has resulted in a struggle to successfully compete in new funding cycles. And yet, new or renewed funding suddenly has become essential to support graduate students and postdoctoral fellows whose projects hit a standstill as labs closed, operated with reduced hours, equipment deliveries became delayed and overall motivation decreased. At the same time, as scientists became less mobile because of less frequent pandemic travel, it became more difficult to recruit new staff for open projects. Despite frequent requests from scientists, until

recently many funding agencies were not flexible in meeting the demands of extended PhD theses and delays in recruiting trainees, and even now, not all funding agencies allow for no-cost extensions.

Other than the "technical" challenges, not being able to effectively discuss project progress among colleagues and get feedback from, or network with, peers and more senior colleagues in what-used-to-be normal venues (such as face-to-face group meetings, institute seminars, faculty meetings, workshops and conferences) has led to social isolation. Although many of these events moved to an online format with new benefits (see below), the extensive use of close-up eye contact, view of self-video, reduced mobility and increased cognitive load quickly generated "zoom" fatigue and greatly increased the feeling of burnout (Ratan et al., 2021; Wiederhold, 2020). Furthermore, mentoring through a screen meant that important social cues and also impact on the well-being of mentees were more difficult to detect.

3 | THE OTHER SIDE OF THE SAME COIN: THE YOUNG SCIENTISTS' PERSPECTIVE

The COVID-19 pandemic has not only had a major impact on PIs in academia but also on young scientists (we focus here on PhD students and postdoctoral fellows, which we will refer to as mentees, although they often play the role as mentors to other students). Mentees' well-being and job satisfaction were already bleak before the pandemic because of to the proliferation of temporary contracts and the low probability of obtaining a permanent position. Pre-pandemic research showed that

temporary contracts negatively impact job satisfaction and researcher's personal lives (Waaiker et al., 2017). The stress induced by temporary contracts has now been aggravated by the pandemic, as many labs have temporarily stopped hiring new PhD students and postdoctoral fellows (Gibson et al., 2020; Woolston, 2020a). Indeed, a survey carried out by *Nature* of more than 7000 postdoctoral fellows revealed that 61% of respondents believe that the pandemic has negatively affected their career prospects (Woolston, 2020a). Moreover, during this career phase, job prospects often depend on successfully acquiring a PhD or postdoctoral grant of fellowship. Chances of acquiring grants depend on publications, conference presentations, research stays abroad and international networks, all of which were negatively affected by the pandemic. The job uncertainty in an unpredictable pandemic environment may be a tipping point for many mentees (Woolston, 2020b). It is thus important to reflect on the impact of the pandemic on mentees.

Surveys conducted during the pandemic have revealed an alarming increase in anxiety and depression among PhD students (Grineski et al., 2021; Woolston, 2020b; Zeng et al., 2021). There are many factors that have negatively affected PhD student's well-being during this pandemic. As discussed in the previous section, the first aspect has been *social isolation*. Noteworthy, the reduced possibilities for social interaction in the work environment may have an even more detrimental effect to early career researchers, as many of them live and work in a foreign country, far from family and friends. The uncertainty about the duration of the pandemic and the associated travel restrictions may have exacerbated feelings of loneliness and psychological distress (Behisi et al., 2021; Bradham & Umaña, 2021; Uvais et al., 2021).

Another aspect hampered by the necessary social isolation has been the lack of celebrations of small and big achievements, for example, when publishing a paper, presenting a poster, giving a talk at a conference, or defending a PhD. Honoring these milestones in a mentee's career is important for the mentees well-being (Flaskerud, 2021). Third, it has been extremely challenging to continue research activities during lockdowns, quarantines and ever-changing state regulations. This disruption of the continuity of the mentee's work has made it hard to plan and execute research projects, negatively affecting motivation and increasing stress (Peters et al., 2017). Besides the impact on conducting experiments, the pandemic has also changed the practice of peer review. More specifically, it has become very difficult to find suitable reviewers, increasing the duration of the peer review process (Shan et al., 2020). The cumulation of delays in research activities and publishing can be detrimental to mentee's careers given the limited

duration of funding and associated deadlines for defending one's PhD.

Although many of the challenges related to research delays pertain to neuroscience areas requiring "bench work", scientists doing computational work have also experienced many of the same challenges related to social isolation. Indeed, working from home can increase the sense of loneliness and boredom because of the monotonous work with little or no social interactions and no routine-breaking events.

Moreover, during the pandemic, the need for supervision has increased as project timelines, goals and priorities have needed to be redefined and reorganised. However, at the same time, the pandemic has also negatively affected the supervisors' time for research because of increases in (online) teaching loads and family care responsibilities (Myers et al., 2020). Indeed, approximately 30% of graduate students (Börgeson et al., 2021) and postdoctoral fellows (Woolston, 2020a, 2020b) experienced a lack of supervision during the pandemic. Consequently, the long-term impact of the COVID-19 pandemic on this generation of mentees has been extensive and should not be underestimated as it may be incremental over time.

In addition to a reduced motivation, the lack of scientific events has made it harder to learn scientific soft skills that are needed in the mentee's future scientific career. Because many conferences and seminars were cancelled or moved online, there have been fewer opportunities to present in front of a live audience. Without these face-to-face conferences, it has been difficult to establish new scientific connections or collaborations. Meeting other mentees with similar interests and sharing experiences at conferences and seminars is an important part in the mentee's scientific career. Learning from one another, from observation and by interacting with other mentees has also become harder, specifically during times of lockdown and working from home. The boundary to ask for advice or feedback is higher if one needs to schedule a virtual call rather than passing by at the desk in the office.

Similar to PIs, the COVID-19 pandemic has deepened several gaps that existed before the pandemic. That is, the toll of the pandemic on women mentees has been greater than on their male counterparts (Fulweiler et al., 2021). The imbalance exists not only for parent mentees with young children but also for ones who have caring responsibilities towards other family members such as sick parents, spouses and siblings (Myers et al., 2020). Although it has indeed been a great challenge for mentees with care responsibilities to achieve progress during the pandemic, this has not meant that other groups, such as mentees without caring

responsibilities, have not experienced negative consequences from the pandemic. Mentees from underprivileged countries have already struggled to participate in the scientific community before the pandemic. They often have limited funds to attend international conferences. However, these struggles have been greatly enhanced because of the pandemic. Going to a conference or travelling for work now comes with a substantial risk of cancellations or getting infected by COVID-19. Although the risk is present for all researchers, it is especially detrimental for those from underprivileged countries who might only have one chance in their PhD or postdoc or who use personal funds to go to a conference.

The pandemic has been difficult for many mentees: mentees from all groups reported a decline in mental health and decreased motivation during the COVID-19 pandemic (Eleftheriades et al., 2020; Forrester, 2021; Loissel, 2019). Foreign students, for example, suffered from “closed skies” more than most. Being away from family and friends can be difficult, and even more so during a pandemic, with the obvious challenges to travel to other countries to visit family or to support sick family members. Other than loneliness, many international students have faced concerns for their health in a care system they do not know, as well as for financial support (Cage & McManemy, 2022), raising even more challenges and enhancing the experienced mental stress.

4 | MANAGING THE CHALLENGES: WHAT HAVE WE LEARNED FROM THE PAST 2 YEARS?

The negative effects of the pandemic on individuals are diverse, depending on research environments, disciplines, career stages, financial resources, etc. This means there is no one magic solution that fits all. Hence, PIs should aim to tailor solutions to the varying needs of the ECRs. We offer a few ideas to diversify the toolbox at our disposal to manage the ever-growing challenges. At the same time, we acknowledge that the pandemic has entered a new phase such that some of the ideas may only need to be applied in case of new restrictions:

1. Acknowledge the difficulty of the current times, and that the pandemic has had and may still have a strong impact on the mental health of young scientists and PIs. Offer help regularly and be open to accepting help.
2. Promote collegiality among PIs: sharing mentoring responsibilities with or offering help to peers or more junior colleagues.

3. Celebrate achievements as much as possible! Thesis defenses might be easier to conduct over zoom, but the sense of accomplishment for the ECR is not the same.
4. Schedule regular update meetings. Pay special attention to more reserved/shy individuals, as some people internalise personal issues and feel uncomfortable sharing.
5. Organise a virtual meeting series where the trainees will be the presenters; invite senior PIs in different neuroscience disciplines as audience. This could help overcome the lack of networking opportunities for ECRs.
6. Organise a “talk buddy” system, where pairs of group members chat for a short period of time (~30 min), once a week. Topics can range from specific scientific questions to small talk. This can be done at the lab/neighbouring labs level or at the institute level and even multiple institutes, and it is a great opportunity for new ECRs to get to know their peers.
7. Invite first authors of papers to give a short virtual presentation to your journal club. This way, first authors (usually PhDs or postdoctoral fellows) get credit for their work, get the chance to present it and gain experience, and can get more direct feedback.
8. Be generous and give recognition: allow ECRs to put cancelled conference talks, posters and summer schools on CV (Weissgerber et al., 2020).
9. Be open and flexible with remote work. This could help some ECRs in delicate situations (caring responsibilities, long distance relationships etc.) to better manage their time.
10. Keep virtual meetings short and interactive, turn off the self-view, and try to avoid back-to-back virtual meetings if possible.
11. Create a “virtual office”, in which ECRs can “sit” at their virtual desks and can “walk” to another person’s desk to ask a question or have a discussion. This can reduce the boundary of interacting with your lab mates. A virtual office with the possibility to have a video chat can be designed in Gather town (<https://www.gather.town>).

5 | THE GLASS HALF-FULL VIEW OF THE PANDEMIC: WHERE DO WE GO FROM HERE?

Looking ahead, how can science and academia evolve and grow from the COVID-19 pandemic crisis? Many aspects of science have changed during the pandemic, but can we adapt and continue practising changes that allow us to grow as a community?

“The virtual revolution”: there is no scientist who envisioned what our scientific daily routines would look like in 2022 before the COVID-19 pandemic: endless virtual meetings, conferences from the comfort of our home sofas and limited physical interaction. Although the downside is evident, the virtual setting has allowed science to go “global” with minimal effort. Although we should not underestimate the added value of in-person international interactions, the switch to online meetings and conferences has provided access to those who were previously out of reach: ECRs from underrepresented countries, remote locations, or from labs with less funding for travel can now present their work, listen to talks and visit poster sessions. Indeed, a positive impact on diversity and equity was observed in neuroscience conferences (Federation of European Neuroscience Societies [FENS] Forum, Bernstein Conference and COSYNE) (Figure 2). The representation of participants from different countries has greatly increased during the pandemic (Figure 2). In addition, there has been a sharp increase in the number of participants in several conferences. For example, the number of participants in the Bernstein Conference for Computational Neuroscience has quadrupled from 2019 (590 participants) to 2020 (2402 participants). Similarly, the number of COSYNE participants has greatly increased after the move to a virtual format (960 and 924 participants in the 2019 Europe meeting and the 2020 USA meeting, respectively, compared to 2390 for the 2021 online meeting).

The computational neuroscience online summer school, “Neuromatch Academy” (NMA et al., 2021), has brought thousands of attendees together, from around the world, as a response to the pandemic *“which has shut down nearly every summer program in the world at which students, postdoctoral fellows and faculty would normally gather to acquire crucial skills and build networks that are the lifeblood of academic science. This crisis left an enormous hole in the career prospects of our most valuable and vulnerable scientists”* (<https://neuromatch.io/>). In addition, hundreds of ECRs gained teaching experience by serving as teaching assistants in this online school.

Another positive example of virtual platforms promoting open science is the “World Wide Neuro” platform (Bozelos & Vogels, 2020), an open science platform that hosts and disseminates information on virtual seminars in the domain of Neuroscience (<https://www.world-wide.org/Neuro/>). “World Wide Neuro” hosts seminar series from numerous academic institutions around the world. The advantages of such opportunities for ECRs are many: easy-to-listen to cutting-edge scientific talks independent of the geographical location and easier to get invited to talk about one’s project (no travel costs, low or no registration costs). A very important benefit is the reduction in carbon emission because of restricted air travel and reduction in waste (time, funds, resources and energy) (Leochico et al., 2021; Welch et al., 2010). Studies have shown that online education can greatly reduce carbon emission, substantiating the importance of digitising

Change in representation of countries at neuroscience conferences: FENS Forum, COSYNE, Bernstein

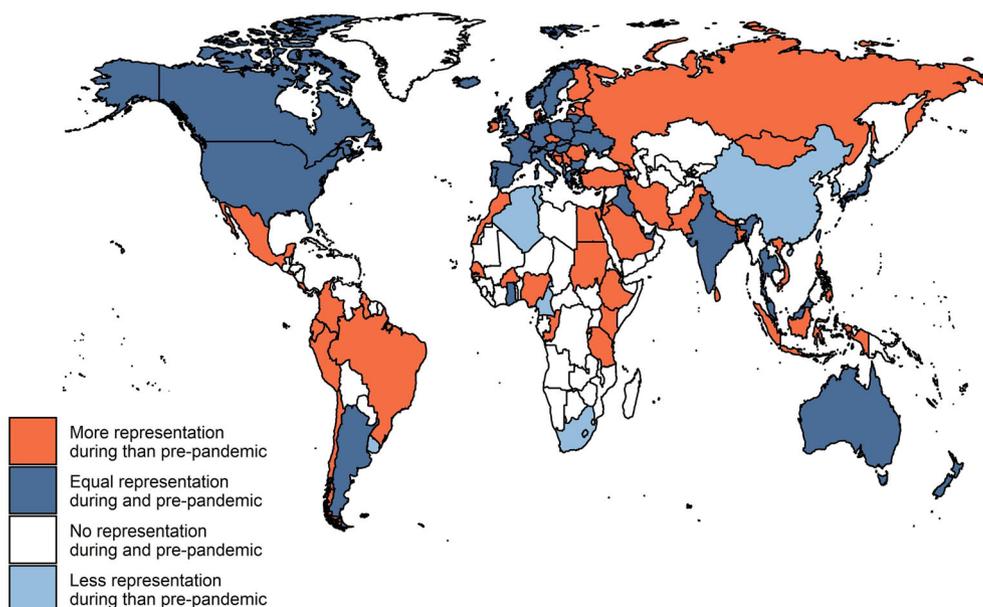


FIGURE 2 Change in representation of countries at neuroscience conferences (FENS Forum, COSYNE, Bernstein Conference) during the pandemic. The presence of at least one attendant from a country to each of the three conferences for the last editions pre-pandemic versus the first editions during the pandemic was compared. FENS, Federation of European Neuroscience Societies

conferences through synchronous or asynchronous Internet-dependent activities (Versteijlen et al., 2017).

The switch to virtual platforms has also had some positive impact on our wellness, as increased flexibility can reduce anxiety and stress that might stem from care load, work load and extended travel times. From the PI's perspective, the shift to a remote working environment has increased the faith and trust in their mentees, greatly strengthening the work relationship.

Taken together, going forward as a community, we need to make sure the goal of inclusivity and universal accessibility is behind every online event organised. This would be a positive step towards minimising the gaps, increasing diversity and maintaining equity in science. Because there is a clear value in personal face-to-face interactions, we suggest that the use of hybrid formats for international conferences and meetings is an optimal compromise that still can dramatically reduce the need for travel whilst maintaining the values we discussed above.

6 | CONCLUDING REMARKS

COVID-19 has had and may continue to have a significant impact on the research activities and mental health of many neuroscientists, affecting mentors, mentees and their relationship. Although some of the challenges may never be overcome as long as social distancing and telework are the norm, the pandemic has also had a positive impact on different levels. If we make sure the digital revolution does not leave anyone behind and we take an active approach in closing gaps and maintaining diversity, we, as a community, can come out of this crisis with an upper hand.

Information about the authors

The authors are scholars of the FENS-Kavli Network of Excellence (FKNE) (MOS, JG, CRG) and their mentees. FKNE is a network of 30 outstanding early to mid-career European neuroscientists that join efforts to shape the future of neuroscience by putting young researchers in the driver's seat. The Network was established in 2014 through a collaboration by the Federation of European Neuroscience Societies (FENS) and The Kavli Foundation.

Sapir Sela-Vasiliu is a PhD student under the supervision of Meital Oren-Suissa. Sapir combines research in *Caenorhabditis elegans*, human cell culture and mouse models of neurodegeneration to elucidate the emerging role of DCC/UNC-40 in the maintenance and

malfunction of the adult nervous system. She is married and has a 2-year old toddler. The pandemic started just as Sapir returned to the lab after her maternity leave, making it extremely difficult to kick start her project after her absence. She likes the flexibility of remote work and learned to do that efficiently.

Christoph Miehl is a PhD student supervised by Julijana Gjorgjieva at the Max Planck Institute for Brain Research Frankfurt and the Technical University of Munich, Germany. He uses computational models of neuronal circuits to investigate the underlying mechanisms of learning and memory formation in the brain. In his role as a PhD representative at the MPI for Brain Research, he faced the challenge of finding new ways of social interaction during the pandemic. Although, as a theoretician, his research was not directly affected by lockdowns, social isolation and lack of routine-breaking events had a negative impact on his mood and motivation. He hopes that positive side effects like hybrid conferences, summer schools and talk series are here to stay.

Hanne Huygelier is a postdoctoral fellow at Brain and Cognition KU Leuven, Belgium and University of Utrecht, The Netherlands. Her research focusses on innovating clinical neuropsychological practice. The pandemic started in her last PhD year. Mandatory telework allowed her to focus on writing her PhD, postpone a clinical study and publish a pre-registered report of this study instead. Now she collaborates with two research groups in a mostly online fashion.

Meital Oren-Suissa is a senior scientist on a tenure track at the Weizmann Institute in Israel and a FENS-Kavli scholar. Her research focusses on gaining a better understanding of neuronal circuit development in general, and of how sexual identity is represented in neuronal circuits to control a dimorphic behavioural output, in particular. She is married and has two daughters. The pandemic impacted her ability to successfully balance motherhood and research. She dislikes the lack of personal communication in online settings but appreciates the flexibility it generated for her and her lab members.

Julijana Gjorgjieva is an associate W3 professor at the Technical University of Munich, Germany and a FENS-Kavli scholar. She uses theoretical and computational approaches to study how brain circuits develop, learn and remain stable in adulthood during normal behaviour and changes in internal state as well as during external perturbations. The pandemic made maintaining a balance between family life and professional expectations very difficult especially with lack of reliable and consistent childcare. On the positive side, the flexibility introduced by working from home made it possible to stay connected to her group and continue supervising projects.

Céline Gillebert is associate professor of neuropsychology at the KU Leuven, member of the Young Academy in Belgium and a FENS-Kavli scholar. Céline's main research interests lie in the cognitive consequences of acquired brain injury such as stroke. Her research is aimed at understanding the behavioural and neural mechanisms underlying these consequences, and at using this knowledge to develop rehabilitation protocols that can improve the quality of life of patients and their relatives. Although the pandemic has directly affected her research, teaching and service, the primary challenge has been juggling work with the increased caring responsibilities for her two daughters. She appreciates the flexibility of hybrid working and the increased possibilities to collaborate with international colleagues.

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CONFLICTS OF INTERESTS

We have no conflicts of interest to disclose.

PEER REVIEW

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DATA AVAILABILITY STATEMENT

The data used to create Figure 2 are openly available at https://github.com/comp-neural-circuits/mentoring_during_pandemic.

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