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Commentary

Travel Less. Make It Worthwhile.

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Academic travel has a substantial carbon footprint. The ongoing pandemic has propelled the development and adoption of technologies for online delivery of seminars and remote attendance at scientific conferences. This should not lead to the complete elimination of in-person events, but the scientific community must seize the opportunity to permanently change its *modus operandi* and reduce the impact of its activities on the environment.

I was supposed to be across the ocean mid-June for a society-run conference on plant reproduction. However, just like many other conferences this year, the event was canceled because of COVID-19. I currently serve as the society's president, and I had been looking forward to hearing about research happening in the field and discussing new initiatives with the executive board. Though the cancellation was disappointing, not going on this and several other trips has allowed me to substantially reduce my carbon footprint this year. Despite being aware that my academic travel contributes substantially to my overall carbon footprint, it has taken the ongoing international pandemic to trigger me to critically review my habits. It has prompted me to reflect on the assumed benefits of academic travel and the creative alternatives that can replace it.

Just like many of my colleagues, my annual travel schedule usually comprises multiple trips abroad. It is not unusual for a mid-career principal investigator (PI) to attend 5, 10, or even more out-of-town events per year to attend workshops, conferences, PhD defenses, or invited seminars. All of this adds up to academics traveling at a rate that is substantially higher than the average population (Buchs, 2019; Nathans and Sterling, 2016; Quinton, 2020). Given that many of these trips involve plane travel, an activity that causes a particularly high amount of greenhouse gas release, conference attendance alone has been calculated to represent 35% of a researcher's overall carbon footprint (Achten et al., 2013). As a result, the sector has a staggering carbon footprint (Sarabipour et al., 2020).

Travel is, therefore, a worthwhile target for the reduction of the impact of academic activities on the environment. Yet, reducing academic travel is one of the last and most vehemently opposed bastions encountered by academic administrators aiming to make their institutions' operations more sustainable. Although many universities worldwide have successfully increased the energetic efficiencies of buildings and operations, or eliminated single use carbon-neutral plastic items, curbing academic travel has been met with pronounced resistance as this measure is perceived to interfere with academic freedom and mandate.

The opportunity to travel in the name of science, be it on field trips, to conferences, or to visit other research institutions, is considered by most academic researchers to be an integral part of their work. For many, it is even considered a perk that goes a long way toward compensating for modest salaries, performance pressure, and extreme work schedules associated with a successful tenure-track career. When scientists defend the necessity of travel, one of the main arguments is the perceived correlation between the value of an academic CV and the frequency of travel. The number of international speaking opportunities is, after all, among the quantifiable academic performance indicators. It is prestigious to be invited, it seems important to be visible in the community, and, more than anything, it appears crucial to disseminate research in person and to build the academic network. As a result, merit algorithms at many institutions reward international visibility and by consequence, the incentive system is de-

signed to be in direct opposition to sustainability goals. However, whether the true value of these travel-related elements in the CV is actually as high as perceived has been put into question since research output and citations were found to not correlate with travel frequency in a study conducted at the University of British Columbia (Wynes et al., 2019). We must therefore carefully examine our motivations for travel.

Significant improvements in the ecological impact of science will take structural changes in how the scientific community values professional travel as a currency of success. It calls for innovative ideas on how to replace or disrupt that value with sustainable alternatives, and it will necessitate individual willpower to adopt and persist in changes to our habits. At the institutional level, incentive structures must be reviewed to critically examine how performance parameters can be reconciled with sustainability goals. At the individual level, critical self-assessment is warranted. Some colleagues have started developing ideas for making academic travel and events more sustainable (Hamant et al., 2019; Nathans and Sterling, 2016; Quinton, 2020; Sarabipour et al., 2020), but few have taken drastic steps, and the disciplinary background doesn't seem to make a difference (Wynes et al., 2019). Despite the slow progress, we are amid a massive shift in the culture and practice of scientific travel. All it took to expedite change was a pandemic.

All travel worldwide came to a screeching halt because of a curveball with effects that are unprecedented in our lifetimes. The sudden emergence of the

pandemic threat to human health was able to accomplish what the potentially much bigger threat of climate change hadn't been able to do: it forced entire societies to engage in altruism and accept that the greater good requires individual sacrifice and change of behavior. Will our ability to respond to a perceived acute threat translate into the collective change of behavior that is necessary to face the much bigger yet apparently slower approaching threat of climate change? It is likely that once the current pandemic crisis is over, we will be tempted to return to the *modus operandi* of pre-2020. Once international travel restrictions are lifted and airlines resume their schedules, most of us will be eager to catch up. There might even be an overcompensation given that many of the conferences originally scheduled for 2020 are now rescheduled to 2021, and hotels and conference centers will be eager to fill their capacity.

We have an opportune time, between now and the end of the COVID-19 pandemic, to pause for a moment and reflect on the future of academic travel. The sudden necessity to shelter in place and stop seeing people in person brought about the rapid emergence of alternative ways to meet and interact. Remote collaboration-enabling software, which had been available but only sporadically employed, is now ubiquitously installed on everyone's computers. Although many had used Skype for simple video-conferencing before, we have now discovered a whole new technological world: from conversing with dozens of people simultaneously while screen sharing a presentation, to virtual waiting rooms, breakout sessions, and creative virtual backgrounds that successfully mask the pile of unfolded laundry in our home office. We should now seriously consider which of the face-to-face interactions we used to travel for before the pandemic could be permanently replaced through these technological means.

Some types of academic interactions are easier to transfer to an online venue than others. Lab meetings, for example, became quite productive for my own team. We seized the opportunity to invite external speakers to journal clubs, something we hadn't even thought of previously. The same format is easily adopted

for the participation of external examiners at thesis defenses, and there is no reason to discontinue this practice after the pandemic. Online delivery of courses and lectures, on the other hand, remains a challenge—talking to a green light on top of a computer screen is so much harder than standing in front of a room with an audience whose members smile and nod in 3D, whose body language tells you whether to speed up or go slower, whether to rephrase a statement or skip a slide. With practice, delivering seminars remotely will become second nature, however.

One of the most complex types of events to bring online is a scientific conference because it comprises so much more than oral presentations and poster sessions. The program of a typical larger conference might feature plenary and concurrent symposia, breakout sessions, panel discussions, networking events, workshops, poster competitions, industry exposition, award ceremonies, interview training sessions, banquets, and social mixers. Each of these formats has a purpose ranging from the dissemination and discussion of scientific data to career development training for junior scientists. Most importantly, conferences offer opportunities for both targeted and serendipitous encounters. Students can seek out potential future supervisors at the poster session, and scientific collaborations are born from spontaneous conversations at the welcome mixer. Online conferences had to invent ways to simulate these different communication channels and types of socialization and some did so quite successfully. Even chance encounters have been emulated by creating algorithms that bring individuals together on a virtual meeting platform (Achakulvisut et al., 2020). So, is this the brave new world of the scientific conference? Is this the solution to the travel conundrum of the academic, at least until petrol-free and sustainable alternatives are widely implemented for travel and mobility? The answer is “yes, but not exclusively.”

The resounding “yes” is motivated by the fact that, in addition to reducing the overall carbon footprint, online meetings have other advantages. For instance, participation is more affordable, accessible, and less time intensive. Online con-

ferences offer the possibility to include those who are unable to travel for a variety of reasons, be they financial, related to family care obligations, reduced mobility or health reasons, or caused by travel bans or visa problems (Sarabipour et al., 2020). Online conferences are also easier to organize logistically, and the format offers structural opportunities. For example, more oral presentations than a conventional on-site conference can be accommodated, and posing questions doesn't require the courage to grab the microphone but can be done through a chat function. The chat can also be used during synchronously delivered presentations for real-time exchange between audience members thus enriching the experience, especially for junior scientists (Achakulvisut et al., 2020).

The momentum created through the current pandemic needs to be seized to further develop the sophistication and versatility of online platforms to address their inherent challenges and promote their adoption. Challenges arise, for instance, when participants are in different time zones, and interacting with people on a screen for hours at a time is simply exhausting. Many of these challenges will certainly be solved through improved technology. Soon enough, the conference experience might be enriched using virtual reality headsets that allow participants to partake in a group chat around a virtual water cooler. Alternatively, hybrid models can be envisaged that combine online with smaller and local in-person events (Abbott, 2020).

Here is the caveat: as brilliantly imaginative as future technological solutions will be, participating in an event from the office chair or kitchen table will never allow the experience of a full immersion. That pile of laundry, successfully masked from view by the virtual background on screen, will not fold itself—as your partner or child will certainly remind you. Traveling to an on-site conference means being away from home, being away from the daily grind—a state that frees the mind from domestic chores and day-to-day professional responsibilities. Letting the mind detach from daily routines for a while is beneficial for creativity. The proverbial collaboration that starts with an equation scribbled on the back of a cocktail napkin



Figure 1. Acapella Singing Competition Has Conference Participants Bond Outside of the Lecture Hall

In 2018, I organized the 9th International Plant Biomechanics Conference in Montreal, Canada. In line with a long-standing tradition, the conference banquet offered the opportunity for *ad hoc* teams to present favorite national tunes. Practicing the harmonies of the German classic “Mein kleiner grüner Kaktus” led to the co-authoring of an editorial between colleagues Thomas Speck (center, University of Freiburg), Karl Niklas (not pictured, Cornell University), and myself (not pictured) (Geitmann et al., 2019).

requires that the mind be allowed to wander and that we feel a connection to others that may start with a joint walk to a restaurant, a morning jog with like-minded colleagues along the river, or a friendly swim competition in the ocean behind the conference hotel.

Aside from mental availability when away from home, an in-person event also involves the use of more senses than just seeing and hearing. The gustatory, olfactory, and tactile experience of a shared meal generates a feeling of community. I will never forget the lunch table discussion between two competing research groups who met in person for the first time at a conference that I had organized a few years ago. Arguments flew, hands waved, forks carved equations into the wooden table. Agreement on anything at all seemed far off. But by the time dessert was served, the two groups had not only agreed to amicably disagree but also to co-author a review paper. How much better can the outcome of a single shared lunch be? Would this be

achievable on an online platform? Hard to say, but I don’t think so.

It’s those seemingly collateral experiences happening outside of the official conference program that make the on-site conference experience worthwhile. The people I spent late nights on the dance floor with are the ones I still co-author papers with, who accept my graduate students for internships, or who respond to my invitations for review assignments. Our regulatory cell growth model began at a beachside conference venue as a collaborative drawing in the sand made using a stick and seashells to illustrate cellular features.

Can scientific connections be maintained through online communication? Certainly. Can true relationships built on trust be created through online channels? I doubt it. Shared evenings spent exploring the local cuisine in a hole-in-the-wall restaurant or practicing for the conference’s traditional acapella singing competition are more conducive for that purpose (Figure 1). There are intangible el-

ements of a connection that don’t develop unless you “break bread” together or walk up the same mountain after the last symposium of the day. Although we should carefully choose which events are truly worth the carbon footprint, we still need in-person academic events. However, before booking a trip, we should reflect on whether the event offers opportunities that cannot be reproduced online. Is the PI’s presence at a recurring conference required each year? Could the grad student attend the event on their own to ensure “visibility” of the lab? Will there be true benefit to our research program or career? Will the venue inspire us? Would participating in a small local workshop be more productive than presenting a talk at a huge international conference? A critical (carbon) cost-benefit analysis should precede all conference travel.

The conference that I was meant to attend this June has been rescheduled to next year. In the role as the society’s president, I will ensure that the event is

organized with sustainability goals in mind and provides enriching opportunities, particularly for early career researchers. I do hope that it will be worthwhile for those participating. My own participation in earlier iterations of this conference series had played a crucial role in my eventual involvement on the society's executive board. The feeling of belonging that began the first time I participated as a graduate student, decades ago, directly influenced the amount of time and effort I have put into helping the society function. It is not the talks or posters—elements that can be easily delivered via digital platforms—I remember from that first conference. The lasting impressions stem from shared dinners, midnight swims, and late nights at the pub with those who would eventually become co-authors or provide constructive criticism of my work.

It is imperative that academics reduce their carbon footprint. There are many ways to do so, both in private and pro-

fessional life—all involve changing habits. Changing travel routines requires a departure from an element of academia that many of us have considered an integral part ever since our graduate studies. If all of us travel less often, but more deliberately, we can make a difference without entirely giving up what has made academia special for hundreds of years.

DECLARATION OF INTERESTS

A.G.'s husband is employed in the aerospace industry sector.

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