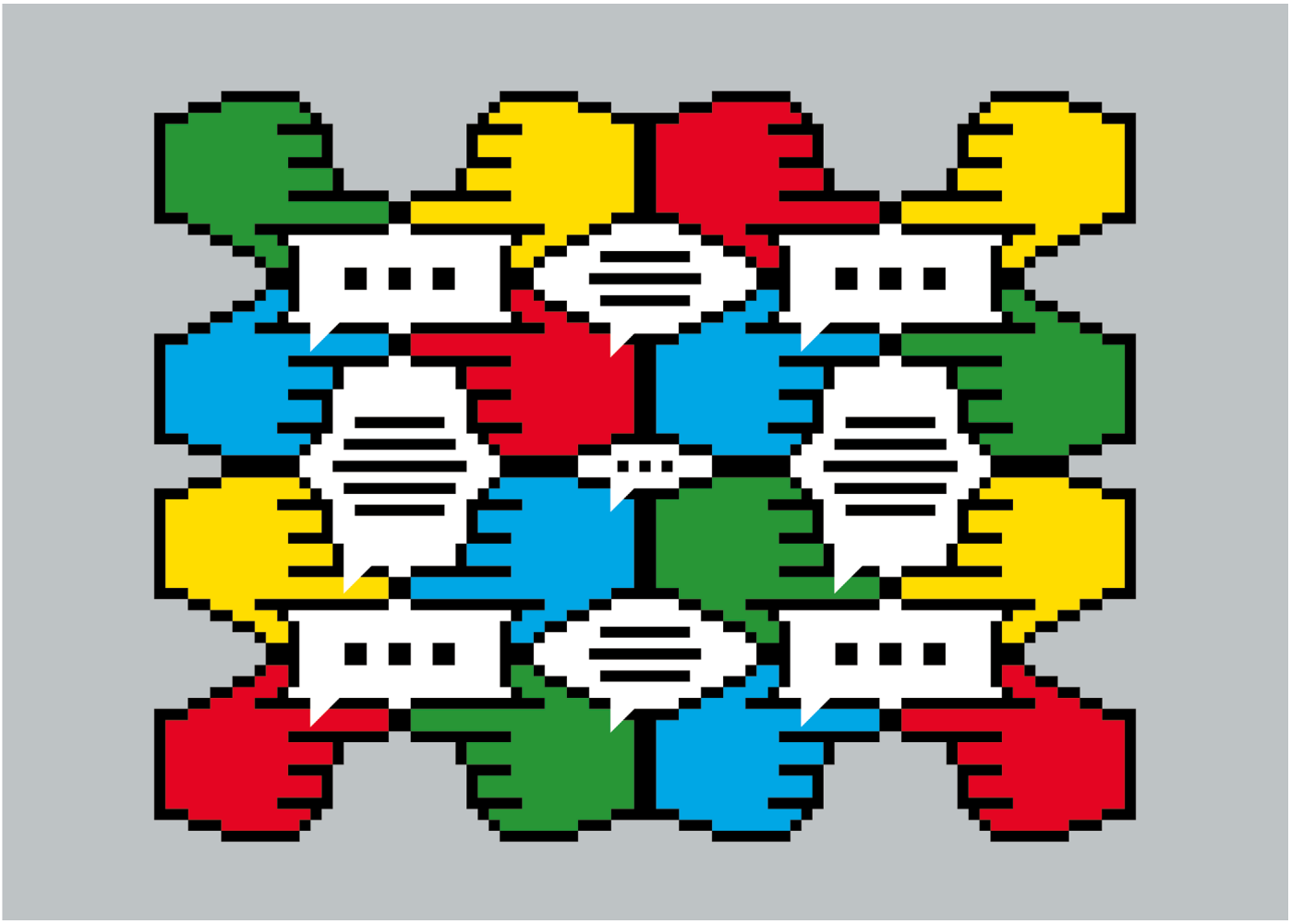

ILLUSTRATION BY THE PROJECT TWINS

TECH TOOLS TO MAKE RESEARCH MORE OPEN AND INCLUSIVE

Laboratory heads are deploying apps and software in innovative ways to build broad and diverse research groups. **By Kendall Powell**

Doris Taylor knows the sting of being set apart as different. As a young, lesbian woman starting her career in regenerative-medicine research in the late 1980s, she was often excluded from faculty functions and private meetings on the golf course. "You want to be differentiated when doing great science, but not because of who you are," she says.

Galvanized by her experiences, Taylor has built a laboratory group at the Texas Heart Institute in Houston that strives to be diverse and culturally sensitive. She knew she had come close when she overheard an undergraduate researcher telling his mother about a lab birthday celebration: "I was the only white guy there – it was great!"

Taylor thought carefully about how best to build a diverse, inclusive and equitable team, representing a range of perspectives and backgrounds, and like many other investigators who value such things, she has increasingly relied on technology to advance those goals.

Group leaders say that these tools can help to flatten power differentials between lab members and keep people connected and communicating on common, and importantly, even ground. The tools are familiar, and even ubiquitous – Slack, Skype and WhatsApp (Taylor's tool of choice), for example. But when deployed strategically, these apps can promote a more level playing field to benefit colleagues from disadvantaged and under-represented backgrounds, those with disabilities, or those who might work and think differently.

That's not to say technology is a silver bullet – building an inclusive environment requires a sustained commitment from lab leaders and members, on multiple levels and using many techniques. And no amount of technology can erase bullying, discrimination and other bad behaviours from the workplace. But these tools are helping many inclusive-minded group leaders to transform research from an isolated pursuit into a more open, collective exercise.

"Any technology that increases communication in a way that is non-threatening, is beneficial," says Taylor.

Messaging equality

The University of Helsinki's Computational Field Theory Group, which studies what happened in the 10 picoseconds after the Big Bang,

for instance, uses an open-source messaging platform similar to Slack to share data and discuss results with collaborators. But the group takes the tool, called Mattermost, even further: it uses it as a forum for nearly all group communications, from discussing research projects to organizing spontaneous outings and lunches. This keeps discussions open and transparent to all of the group's 20 or so members and their colleagues. Members frequently add notes from face-to-face conversations as a transcript record and to keep everyone in the know.

David Weir, a physicist in the group, explains that workplace surveys had revealed internal communication problems in the Helsinki physics department, and showed that members, particularly women who didn't speak Finnish fluently, often felt isolated. "I do think [Mattermost] helps lower the threshold to people participating," he says.

Saga Säppi, a PhD student in a neighbouring theoretical-physics group, says the open-to-all messaging has made a "night and day" positive difference to social interactions. And it lowered the barrier to getting help, she adds, by making it easier to send research questions informally to the entire group rather than having a time-consuming e-mail exchange with a supervisor.

Terms of engagement

Other tools can also ease communication and lower barriers. Juan Gilbert's computer and information-science group at the University of Florida in Gainesville, for instance, uses the videoconferencing program Zoom to support lab members during pregnancy and parental leave. Zoom allows them to join lab meetings or have consultations when at home — but only if they choose to. "They want to stay engaged, and using Zoom keeps them connected on their own terms," says Gilbert.

Brenna Hassett, a physical anthropologist at University College London, says such open, transparent group communications can provide a healthy counterbalance to the power dynamics that naturally exist in group meetings led by a principal investigator or a closed-door meeting between a supervisor and their student.

When everyone can weigh in on a conversation, she says, it helps to guard against misunderstandings or misread cues and adds broader context. "You might leave a closed-door meeting thinking your PhD supervisor hates you, when in fact, they just had a reasonable criticism about your bibliography," says Hassett.

Another advantage to all-group communications apps is that they make it harder to say "anything even remotely inappropriate", adds Hassett, who was co-organizer of a session on tech tools for gender inclusion at the 2019 Science Foo Camp conference, held last July in Mountain View, California, and supported by Nature Research, part of Springer Nature (the publisher of *Nature*).

But there are downsides, warns computer scientist Kate Devlin at King's College London, who co-organized the session with Hassett. "I wonder how many brakes are put on conversations because of the transparency?"

Research co-op

Another way of flattening group hierarchies is to make research both open and collective.

Marine-data scientist Julia Stewart Lowndes is an advocate of the open-science movement, which espouses open-source software, data sharing and transparency in data analysis and publishing. "But you need a team culture and welcoming environment for people to feel safe" about sharing and discussing data freely, says Stewart Lowndes, who works at the National Center for Ecological Analysis and Synthesis in Santa Barbara, California.

One way to build this trust, she says, is to make codes of conduct or lab values public so that everyone has shared expectations. For instance, one such document from an event that Devlin helped to run states: "We believe that everyone has the right to be in a safe and welcoming environment." The information might also help to recruit scientists from more diverse backgrounds, if they see that a group welcomes different perspectives and has values that align with their own. (See 'Low-tech tips for inclusivity' online at go.nature.com/2gdubnt.)

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In Stefania Milan's team, doing science collectively isn't just an attitude, it's an operating principle. Her group at the University of Amsterdam studies the evolution of political activism in the age of big data, and each of the dozen members has an equal say in both group and research decisions.

After receiving a five-year grant to start her group, she and the team spent about 18 months crowdsourcing and developing a set of lab values by which they operate, along with a research questionnaire and the technology infrastructure needed to conduct their research securely. Milan could have completed that work more quickly on her own, she says, but her international and cross-disciplinary team helped to forge a stronger toolkit.

The lab members pool their data and do team analyses using open-source software, including a custom code-sharing system similar to GitHub, which is paired with the ownCloud cloud-storage service. This infrastructure allows them to write and code collaboratively and to share calendars and documents while storing the data on a private, protected server. The whole system is accessible by team members who live abroad or work from home, so everyone can join in the team's weekly coding session.

Supporting learning differences

For regenerative pharmacologist Sara Rankin, inclusivity means accommodating a neurodiverse population. Rankin found out late in life that she has dyslexia and dyspraxia: learning differences in the way her brain processes written words and organization. "People work and think in different ways and you've got to allow them to do that," she says.

Rankin's university, Imperial College London, invests in a suite of 16 inclusive software programs to help students and staff who have learning differences or for whom English is a second language. It includes programs such as Grammarly, to check spelling and grammar, as well as tools to help researchers to craft writing or talks in non-conventional ways. Audio Notetaker, for instance, records audio during lectures and syncs it with typed notes, while the speech-to-text software package Dictation.io helps those for whom dictating papers or presentation slides comes more easily.

Rankin uses the idea-mapping program MindView to see her notes on methods together with data charts, images and literature associated with a project — all on one screen. "At a single click, that can be converted into a Word document" as a rough draft of your paper, she says. "That's amazing if you are a visual learner."

Gilbert suggests that leaders take their cues from their team when adopting tech tools such as Slack and WhatsApp. He says that many younger researchers view e-mail as formal and cumbersome. "They are already using these apps in their daily lives, so I wanted to incorporate my lab into that," he says. "And I get a better, more productive workforce that way."

That said, no matter how inclusive an environment might be, there is always room for improvement. Simple technologies can provide anonymous mechanisms for making complaints, reporting inappropriate behaviours or asking questions without the fear of bias or retaliation. For neurobiologist Leslie Vosshall at the Rockefeller University in New York City, an anonymous lab survey proved transformative, she says. The responses prompted Vosshall to make lab meetings more focused and journal club meetings more interactive, and revealed that there was uneven access to lab resources — a problem that was easily solved with a shared online folder for lab protocols.

Embracing that spirit of sharing solutions, resources and power can go a long way towards transforming laboratories into welcoming, fair workplaces. "Science is a social process. We do it in teams and we do it best when we are a diverse, respectful team who care about each other," says Weir. "It's also more fun that way."

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