Remote collaborations deliver fewer scientific breakthroughs, co-led research finds

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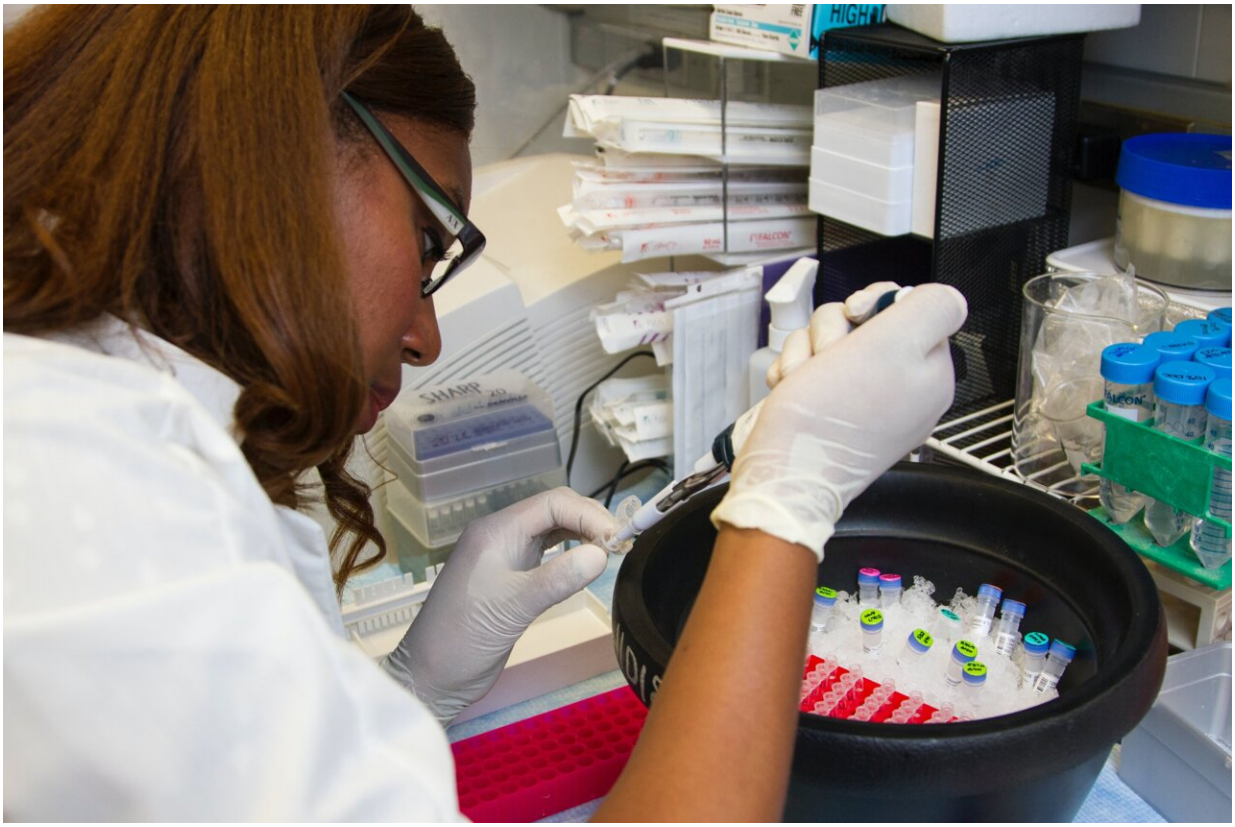

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Remote teams are less likely to make breakthrough discoveries compared to those who work onsite, according to research led by the universities of Oxford and Pittsburgh into the rise of remote

collaborations among scientists and inventors across the world.

In their study published in *Nature*, the researchers' key finding was that, while remote collaboration has the potential to deliver new and creative scientific ideas through easier access to a global knowledge pool, it is harder for such teams to integrate effectively to deliver breakthroughs.

Lead co-author Professor Carl Frey, Dieter Schwarz Associate Professor of AI & Work at the Oxford Internet Institute and Director of the Oxford Martin Program on the Future of Work, said, "The computer revolution and the rise of the Internet has connected talent from all around the world yet, rather than accelerating as many predicted, studies have shown that breakthrough innovation is in decline.

"Our paper provides an explanation for why this happens: while remote collaboration via the internet can bring together diverse pools of talent, it also makes it harder to fuse their ideas.

"Today, there is much talk about Artificial Intelligence supercharging innovation. Yet many predicted the same with the advent of the PC and the Internet. This should serve as a reminder there is unlikely to be a pure technological solution to our innovation problems."

The team analyzed more than 20 million research papers published between 1960 and 2020, from 22.5 million scientists in 3,562 cities. They also examined four million patents filed between 1976 and 2020, by 2.7 million inventors across 87,937 cities.

Over this time period, the researchers found:

- The average distance between team members for papers increased from 100 kilometers to nearly 1,000 kilometers and, for patents, from 250 kilometers to 750 kilometers;

- The fraction of extremely long-distance collaborations (of more than 2,500 kilometers—the distance from Brazil to Liberia) increased substantially from 2% to 15% for papers, and from 3% to 9% for patents;

- But researchers in these remote teams relative to their onsite counterparts were consistently less likely to make breakthrough discoveries; and

- Researchers in remote teams were also less likely to engage in conceptual tasks (needed to produce breakthrough research), such as conceiving research or writing papers. But they were more likely to contribute to technical tasks, such as performing experiments and analyzing data.

The team says its findings have important policy implications: the shift to remote work after the pandemic could facilitate smaller and more gradual improvements in scientific research, but might make it harder for breakthroughs to happen. Therefore, the focus on digital infrastructure should not take precedence over investment in physical infrastructure that helps reduce travel costs and makes housing more affordable.

Lead co-author Professor Lingfei Wu, Assistant Professor of Information Science at the School of Computing and Information at the University of Pittsburgh, said, "True innovation often has a hometown. This is because geographical proximity breaks hierarchy, enabling flat team structures and intensive communication essential for conceiving groundbreaking ideas.

"It is easier, for example, for a graduate student to discuss informally ideas with a senior professor in a hallway than through email. Even with digital advancements, online meetings cannot fully replace the unique

value of face-to-face interactions in fueling innovation."

More information: Lingfei Wu, Remote collaboration fuses fewer breakthrough ideas, *Nature* (2023). DOI: 10.1038/s41586-023-06767-1. www.nature.com/articles/s41586-023-06767-1

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