Thank you for sharing

The pandemic has highlighted long-standing, deep-rooted challenges to the sharing of biological samples. Greater attention is needed to mechanisms for incentivizing materials transfer.

COVID-19 has laid bare the challenges of sharing clinical and other biological samples. Although the SARS-CoV-2 [genome sequence](#) was shared in early January, the exchange of human and other COVID-19 biological samples has been beset by challenges. Post-pandemic, the research community needs wider adoption of electronic legal agreements for sample transfer and increased harmonization, interoperability and searching capacity of sample collections. But stronger incentives from funders and publishers will be most important to encourage materials sharing.

The sharing of biological specimens and their associated data is critical to biomedical research. And yet, [81%](#) of researchers are constrained by the inadequate quantity and quality of biospecimens and [80%](#) of companies find accessing materials difficult.

In the early months of the SARS-CoV-2 outbreak, the shortage of clinical samples that hamstrung research was compounded by the difficulty of transporting pathogenic materials across national borders. Established collections like the [American Type Culture Collection \(ATCC\)](#) and its [Biodefense and Emerging Infections Research Resources Repository](#), offered one source of materials. Elsewhere, companies like Ginkgo Biosciences made available [COVID-19-related plasmids at Addgene](#) under an [open material transfer agreement \(MTA\)](#). But most clinical materials have remained marooned in the academic medical centers where they were originally collected. This contrasts sharply with genomic and structural data from virus and tissue samples, which have flowed relatively freely.

There are inherent differences between data sharing and materials sharing. Whereas biological data are initially created from specimens, specimens cannot be obtained from data (although this is one goal of synthetic biology). Similarly, data are perpetual unless corrupted or deleted, whereas specimens have a definite shelf life, even if preserved or frozen. Most important of all, most data can be easily replicated or duplicated, whereas specimens deplete with use and cannot be copied or regenerated in their original form. Consequently, repositories are more circumspect in releasing samples than in releasing data.

There are also legal differences. The World Health Organization encourages data sharing across borders but follows the Nagoya Protocol Access and Benefit Sharing (ABS) regime asserting the sovereignty of nations over biospecimens. In 2007, [Indonesia cited ABS](#) when restricting access to avian flu virus samples. Brazil and Saudi Arabia did the same to restrict transfer of pathogen samples during the Zika and Middle East Respiratory Syndrome outbreaks, and now ABS has been cited as a problem during [COVID-19](#). The issue is unlikely to go away unless more [support](#) on infrastructure is given to these countries so they too can benefit from materials transfer.

In the past, materials transfer occurred primarily on a peer-to-peer basis, with individual investigators coordinating sample collection, storage, maintenance and redistribution. As community demand for materials has risen, however, these commitments have become burdensome, costly and ever more complex legally and ethically. This has spurred the rise of institution-wide collections (for example, New York University's [Biorepository and Specimen Acquisition System](#), Medical University of Graz's [Biobank Graz](#), [Jackson Labs](#)), national biobanks offering a home for clinical samples (for example, [GTEx](#), [China Kadoorie Bank](#), [UK Biobank](#)), and broad community collections (for example, [Addgene](#), [Developmental Studies Hybridoma Bank](#)).

Clinical samples have their own peculiarities. They arise directly from the pact of care between physician and patient, which implicitly both restricts the distribution of samples and places the physician in the position of powerful curator. Unpicking that pact and [reformulating it](#) so that clinical samples broadly benefit the research community is a major challenge in human biology.

Navigating the patchwork of siloed collections is being made easier by one-stop interfaces, such as the European [BBMRI-ERIC](#) initiative, unified commercial marketplaces like [iSpecimen](#), and the recently announced UK Medicines Discovery Catapult's (MDC) [Biosamples supply network](#). These services help cut down the time needed to identify specimens that both are relevant and have

the appropriate consent, cutting out sample brokering intermediaries.

Other efforts are bringing MTA negotiations into the 21st century. Many transactions still involve faxing documents between the donating and receiving entity. And many tech transfer offices insist on drafting custom legal agreements, which can result in months of delays. Digitizing and standardizing legal agreements (as Vanderbilt did with [MTAShare](#)) is one way around this; for example, Addgene requires users to sign a [boilerplate electronic MTA](#). As of 18 August, 4,337 labs have signed up and the time for MTA approval has halved to a median of <36 h.

Underutilization of samples is another problem. Whether this is due to a reluctance to share valuable biological materials outside an institution or difficulty locating outside samples relevant to one's project is unclear. Again, new federating services like [iSpecimen](#) or [MDC](#) that collate and enhance the discoverability of samples may help.

Sample sharing is not only a public good, it is good science. And although it might seem like thankless work, it is a gift that keeps giving. According to one [source](#), deposition of a specimen in a biological resource center can boost citation rates of associated articles by 57–135%.

Publishers have a duty to ensure transparent statements concerning the availability of samples in papers, including adoption of the [Resource Identification Initiative](#) to enable citation and credit attribution for specimen sources. To encourage materials transfer, *Nature Biotechnology*, like other Nature research journals, [recommends](#) authors use an established public repository for samples where one exists.

But perhaps the most important check on sample hoarding should come from funders. There should be repercussions for serial offenders who fail to share materials. Thus far, funders have not only turned a blind eye to grantees refusing to share, but also shrunk funding for repositories. Funders need to change direction on both fronts. Biomedical research progress and reproducibility depend on it. □

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