How Life Science Journals Can be Champions of Better Material Sharing and Reporting

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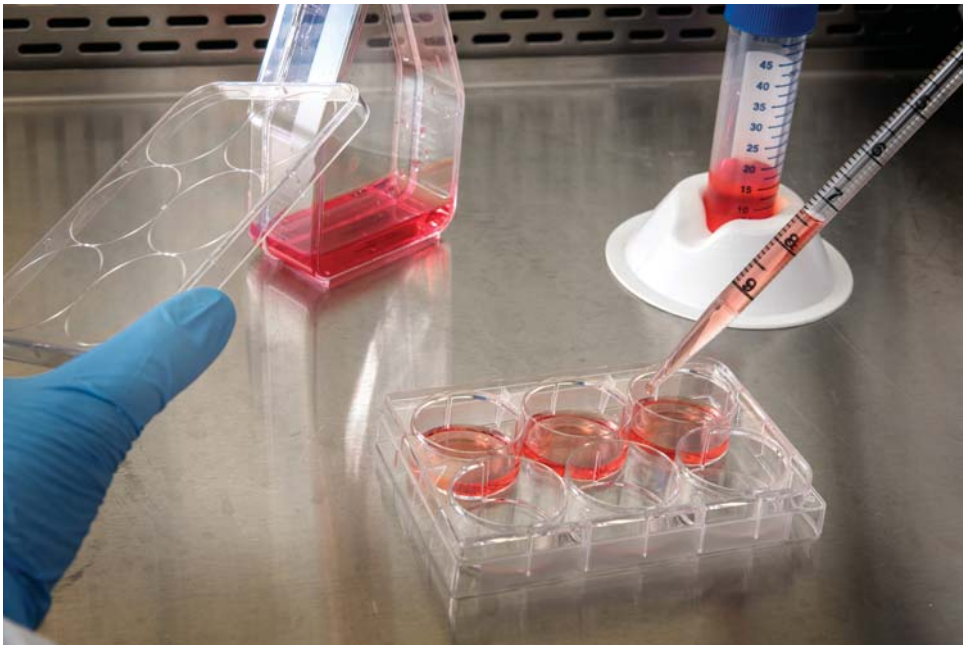
Deposition of biological materials is an important step toward improving scientific reproducibility. Life science journals are uniquely positioned to support better material sharing practices through specific journal requirements.



In September 2019, members of academic institutions, funding agencies, and journals participated in a workshop at the National Academy of Sciences to discuss ways to improve reproducibility in the life sciences—for a great summary, read Jonathan Schultz's article.[1] It was clear at the meeting that some journals were already taking action by establishing data deposition policies, but I was surprised by the lack of discussion on the sharing of biological materials such as cell lines and plasmids. Similar journal policies for depositing materials should exist to promote reproducible science.

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In the life sciences, data often come from the collection of information from biological experiments using materials such as cell lines, plasmids, and experimental organisms. Instead of having to make materials from scratch, researchers can save time and money by requesting what they need from a centralized biological repository. For example, it can take years and can cost up to $20,000 for researchers to make a mouse strain, whereas receiving a verified strain from a repository takes just a few weeks at a fraction of the cost.[2] Furthermore, if researchers use misidentified materials that they directly requested from an author, it can result in drastically different results and lead to irreproducibility that ultimately creeps into clinical research and drug development.[3]

The current system of "available upon request" often results in scientists having to wait months to receive samples from the corresponding author or never receiving

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Table. Best Practices for Adding Requirement for a Material Sharing Policy.

Requirements	Example Text	Rationale and Comments
Materials availability	Authors are expected to make an availability statement for biological materials described in their article. Unless restrictions in access or use are stated, authors are required to make these materials available to requesting researchers.	Providing an availability statement informs readers if there are any restrictions to access or use. For example, materials should not be shared if they compromise the privacy or confidentiality of human research subjects.
Deposition of materials	Authors are strongly encouraged to deposit biological materials to public repositories such as Addgene,[7] ATCC (American Type Culture Collection),[14] Arabidopsis Biological Resource Center,[9] Bloomington Drosophila Stock Center,[15] Caenorhabditis Genetics Center,[16] Coriell Institute,[10] DNASU,[17] the European Conditional Mouse Mutagenesis Program,[18] the European Mouse Mutant Archive,[19] the Knockout Mouse Project,[20] the Jackson Laboratory,[8] the Mutant Mouse Resource and Research Centers,[21] and RIKEN BioResource Research Center.[22]	Deposition enables the identification, authentication, and timely access to materials. The list provided in the "Example Text" column is not exhaustive, and only repositories relevant to the journal's scope of research need to be included.
Materials reporting	Authors are encouraged to use Research Resource Identifiers (RRIDs) to uniquely identify the biological materials used in their research. The RRID Portal[23] lists existing RRIDs as well as information for creating a new RRID if one does not already exist. If known, provide batch or lot number of antibodies.	RRIDs support the unique identification, tracking, and reuse of key research materials. If it is not possible to find or obtain an RRID, the catalog number from the supplier should be stated. Providing examples of how to report RRIDs can be helpful to authors. Requiring a material resource table encourages more complete reporting of all materials used.

a reply and having to remake the materials themselves. Lack of access slows down research and can lead to irreproducible results, hindering scientific progress. The Cancer Reproducibility project sought to replicate 50 publications but came to a premature stop[4] when reagents weren't available from the labs that had originally made them. To guarantee timely access to published materials, journals should make it mandatory to deposit such data before publication.

When authors don't sufficiently identify the materials used in their study, results can be impossible to reproduce effectively. The deposition of materials enables more transparent reagent reporting. Many repositories assign materials a persistent identifier, such as Research Resource Identifiers (RRIDs),[5] and create an information page that captures relevant details. For deposited samples, authors can simply provide the link to a material's curated repository page, making it easy for readers to find the information they need.

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For further improved reproducibility, it should be mandatory that all materials are authenticated.[6] A requirement that authors deposit materials before publication allows independent validation by repositories. Many repositories perform routine quality control: Addgene[7] sequence verifies all plasmids,

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Jackson Laboratory[8] genotypes their mice, Arabidopsis Biological Resource Center[9] performs quality control on seeds, and the Coriell Institute[10] authenticates cell lines.

You might be thinking, aren't these repository services expensive? First, it's typically free for scientists to donate materials. Additionally, many repositories are nonprofit organizations, and the requesting fees cover the cost of maintaining the service for the community as a whole. In the long run, it's actually more cost-effective for everyone to deposit. It saves authors the burden of having to ship out requested materials multiple times. Researchers who make the requests also save time and money by not having to recreate materials (e.g., an entire mouse line).

Deposition ensures timely access to materials and ultimately facilitates reproducibility. Journals can promote this best practice by updating their material sharing policies in their Author Instructions to require deposition and by reminding authors about the requirement during peer review. Journals such as *PLOS*,[11] *eLife*,[12] and *AHA/ASA Journals*[13] are already paving the way with comprehensive material sharing policies, and it's time for others to follow suit.

If you are a life sciences editor wanting to create or update a material sharing policy for your journal, the Table shows some best practices for adding this requirement.

References and Links

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18. https://www.mousephenotype.org/about-impc/about-ikmc/eucomm/.
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