OPINION ARTICLE

The end of ‘mini-brains’! Responsible communication of cerebral organoid research [version 1; peer review: 1 approved with reservations]

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Abstract
Recent developments in cerebral organoid research have sparked widespread interest among the public and scientific communities alike. However, sensationalism and oversimplification of scientific findings in media coverage can lead to false hope, misinformation, and public distrust in science. This opinion article argues that responsible reporting on cerebral organoid research is not only an ethical imperative, but also critical for advancing the field and maintaining public engagement and trust in science. By examining the negative impacts of oversimplification and sensationalism, the article calls for a more responsible and nuanced approach to science communication. The article also highlights the role and responsibility of various stakeholders, including science communicators, journalists, media outlets, scientists, and ethicists, in promoting ethical communication and ensuring that the public is adequately informed about the scientific and ethical implications of cerebral organoid research.

Keywords
Cerebral organoids, science communication, ethics communication, responsible research, journalism

This article is included in the The Ethics of Brain Organoids collection.
Introduction

“Researchers are growing mini-brains in the lab, and they may be conscious”. Imagine coming across such a title in the news. What is the first thing that you would think of? To a non-expert, this title could trigger several thoughts. Surely, for many non-experts, being curious about the nature of these “mini-brains” and the reasons they are being grown in the lab is a given. Cerebral organoids – often referred to as “mini-brains”, “brain organoids”, “brain-in-a-dish” by various science and media outlets – are miniature three-dimensional structures that are generated from human stem cells in the laboratory (Lancaster & Knoblich, 2014). These structures mimic some of the characteristics of a developing human brain, including the ability to generate different types of brain cells and form basic neural connections (Bershtein & Kriegstein, 2013). Although they are not miniature versions of a human brain, as they lack advanced brain functions and some of the more complex features of a mature human brain, cerebral organoids are an important tool for studying human brain development and disease such as neurodevelopmental disorders (Di Lullo & Kriegstein, 2017), due to their improved modeling capabilities as compared to other two-dimensional and/or non-human in vitro brain models. Additionally, cerebral organoids are the subject of much debate regarding the ethical implications of generating human brain-like structures in the laboratory (Lavazza & Massimini, 2018). The main ethical discussions regarding the use of cerebral organoids in research include implications for research oversight, the collection of human biomaterials and donor consent, translational clinical potential, the generation of animal chimeras, and potential emergence of consciousness in cerebral organoids (Lavazza & Massimini, 2018) and hence the need for considerations of moral status (Hyun et al., 2020).

Cerebral organoid research is a new and exciting field and has received increased media attention in the last years, with almost every new cerebral organoid research making headlines. A recent study investigating media literature into cerebral organoids, demonstrated increased polarization and misleading claims regarding cerebral organoid research (Presley et al., 2022). Highlighting scientific breakthroughs and discoveries in the news is crucial for fostering public engagement and trust in science. However, making use of hype and “dumb-it-down” science communication tactics is harming science (Caulfield, 2016; Caulfield, 2018). The need for communication training, particularly responsible communication, is increasingly becoming evident, with cerebral organoid research being a great case study to illustrate this point.

The harms and pitfalls

Hype and false hope

There has been a lot of hype surrounding cerebral organoid research in recent years (Huch et al., 2017), with some media outlets (including reputable platforms) portraying it as a breakthrough that will revolutionize our understanding of the human brain. However, this hype can lead to unrealistic expectations (Caulfield & Condit, 2012) and can obscure the ethical concerns associated with this research. For example, a news article that overemphasizes the potential of cerebral organoids to cure diseases without discussing the ethical implications or scientific challenges can give the public a false sense of hope and may distract them from the ethical issues and technical challenges involved. Moreover, this does not rule out the role and influence of scientists in hyping early scientific results. While scientists may rely on similar methods to gain funding for the continuation of their research (Caulfield, 2004), they may also be responsible in propagating false hope by exaggerating their findings and as such should be cautious. Hope is considered an important coping mechanism for many patients and their caregivers, so let’s avoid contributing to the deceptive of those that rely on hope, which is in and of itself unethical (Ruddick, 1999).

Hype and misinformation

Misinformation can easily spread in the absence of responsible communication. The latest COVID-19 pandemic showcased the dangers of misinformation in the context of public health (Nelson et al., 2020). There is a risk that sensational and exaggerated claims, misleading information, unsupported claims, or even outright falsehoods could be disseminated in the media regarding cerebral organoid research, which can have serious implications (Kataoka et al., 2023). For example, an (n) (news) article that inaccurately describes how cerebral organoids work, e.g., stating that they are sentient or capable of solving problems (as seen on Tiktok), could lead to public misconceptions about the research, which could lead to harmful practices or misunderstandings. For instance, a recently published scientific article titled “in vitro neurons learn and exhibit sentence when embodied in a simulated game-world” (Kagan et al., 2022), makes an exaggerated claim of emergent intelligence and sentience and as such is not only misleading but also may prove to be harmful to the whole field (Balci et al., 2023). Calling organoids intelligent, as recently seen in a scientific publication (Smirnova et al., 2023) similarly contributes to that hype (Balci et al., 2023). I truly believe that semantics are important when it comes to accurate and responsible communication. More popular articles with titles such as “Scientists are growing mini brains in the lab. Are they… conscious?” (Dimitropoulos, 2023) similarly makes use of sensationalism and click bait headlines. Some may argue that the content of the article does justice to the actual science by elaborating on many of the research and ethical aspects. However, the majority of individuals only read and share news based on headlines alone (Gabielkov et al., 2016)? And more and more people (particularly GenZers) consume their news online through social media (West & Bergstrom, 2021). It is important to note that adding a single statement about existing ethical implications associated with the use of cerebral organoids in a (news) article, is not sufficient to convey the ethical considerations raised, which must be transparently communicated with the public. There are plenty of science communicators explaining the science, what we need is ethics
communicators to explain and break down the ethics (often dealing with concepts that may be even more complex and challenging).

In today’s media environment, click bait headlines and sensationalized news stories are common. However, when it comes to cerebral organoids research, it is important to avoid click bait and sensationalism, as it can lead to a lack of understanding and even distrust of the research.

Unscientific oversimplification
Simplification of technical and scientific terms is common practice in science communication. However, oversimplification is a common problem that can even be viewed as unscientific (Jensen, 2022) particularly when it concerns complex topics such as cerebral organoid research. For instance, terms such as “mini-brains” or “brain-in-a-dish” are attempts to avoid using jargon such as “organoid”, with the aim to convey scientific findings and concepts in a way that is accessible to a general audience. Some titles even score high on being sensationalized, unscientific, and misleading, for the sake of grabbing attention. For example, headlines such as “Mini-me brains-in-a-dish mimic disease, raise hope for eventual therapies” (Begley, 2017) make claims that could be misleading by giving false impressions of what cerebral organoids are and false expectations among the public. A group of scientists have proposed the use of standardized nomenclature of organoids and assembloids in order to improve dialogue with the scientific community and the public (Caullfield, 2004; Pașca et al., 2022). Similarly, the scientific community could guide journalists and science communicators to follow in these footsteps, by coming to agreements on accurate and effective simplification of cerebral organoid research in ways that are both scientific and accessible.

The “yuck!” factor
Transplantation of cerebral organoids into rodents can raise a “yuck factor” among some members of the public (Jensen, 2022). This negative reaction is due to ethical and moral considerations surrounding the transplantation of human cells into animals. This reaction can also be influenced by cultural experiences (Kelly, 2011), with some cultures showing increased disgust about certain scientific developments than others. The media can perpetuate this “yuck factor” (Chuong et al., 2015) by sensationalizing the use of human cerebral organoids in animals and exaggerating the potential consequences of cerebral organoid chimeras on for instance animal behavior, i.e., becoming human-like and super-intelligent. This can lead to negative public perceptions and a decrease in public support for the research (Chuong et al., 2015). It is important for journalists and science communicators to report on the ethical implications of using human cells in a responsible and nuanced way, taking cultural perspectives into consideration.

Public distrust
Ethical communication is vital to build and maintain public trust in science and research (Master & Resnik, 2013), also in the form of participation in cerebral organoid research (Weingart & Guenther, 2016). If the public perceives that cerebral organoid research might be erroneous or unethical, they may become hesitant to support or participate in such research. As previously argued, poor communication about using cerebral organoids in stress-related research could give potential donors a false impression about inducing stress in the laboratory, especially if the media has alluded to potential sentence and intelligence (Bassil & Horstkötter, 2023). This lack of support could also extend to the legislative level, where laws and regulations related to cerebral organoid research might be influenced by public opinion. This was seen in the case of human embryonic stem cell research, where ethical concerns raised by some members of the public and political groups led to restrictions on funding and research (Acosta & Golub, 2016). Similarly, if the public perceived cerebral organoid research as unethical or harmful, it may lead to a lack of support and potentially hinder the progress of the research, and generally a loss of public trust in science (Master & Resnik, 2013). It is therefore important to engage in responsible and ethical communication when reporting on cerebral organoid research, to ensure that the public is properly informed and understands the scientific and ethical implications of the research.

Are you responsible?
Each concerned stakeholder carries a role and responsibility in the responsible and ethical communication of cerebral organoid research. Scientists have a responsibility to also avoid any hype and clearly communicate the scientific (Cutat et al., 2014) and ethical implications of their work (Rinaldi, 2012). They should also be willing to engage with the public and media to discuss their findings and address any concerns or questions that may arise. Science communicators have a duty to convey information accurately and effectively about cerebral organoid research to the public without oversimplifying or sensationalizing scientific findings (Jensen, 2022). Journalists and media outlets also play a critical role and should abstain from employing clickbait tactics, promoting false hope, or making unsupported claims about the research (Rinaldi, 2012). Finally, ethicists also play a key role in providing guidance and insight into the ethical implications of the research, but also to communicate the ethical implications associated with cerebral organoid research, in order to prevent any hype and misinformation.

Conclusion
Cerebral organoid research has the potential to be a game-changer in neuroscience, but it is important to remember that it is still in the early stages of development. While researchers have made significant progress in growing cerebral organoids, there is still much that we do not know about how they relate to the human brain. Scientists could benefit from science communication training in order for science to become more approachable and understandable to society. It is important for journalists and science communicators to report accurate and balanced information about the research in a responsible and ethical manner. Although many of the ethical issues raised in the communication of cerebral
organoids are being discussed in an academic setting among professionals, including the potential of cerebral organoids to be sentient, sensationalism and unscientific oversimplification must be avoided at all costs. By avoiding click bait headlines and reporting on cerebral organoids research responsibly, we can promote ethical discourse and ensure that the potential benefits of this research are fully realized. Let us learn from past habits and handle the communication of upcoming cerebral organoid research (or other novel biotechnologies) in ways that employ responsible and ethical methods of science communication.

Data availability
No data are associated with this article

References


Rinaldi A: To hype, or not to (o) hype: communication of science is often tarnished by sensationalization, for which both scientists and the media are responsible. EMBO Rep. 2012;13(4):303–7. PubMed Abstract | Publisher Full Text | Free Full Text


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This paper promises to be an excellent addition to the debate on public (ethical) discussions of brain organoid research. That being said, it needs improvement in order to reach the level of quality needed for indexing.

The introduction leaves much to be desired, as it does not provide the structure of the paper or provide adequate background.

Organization could be better. As things stand, it reads as if there is one major heading with subheadings, while everything else is (kind of) subordinated to the “harms and pitfalls” section. Also, some of the subheadings are repetitive (e.g., hype is listed in two subheadings).

The conclusion leaves much to be desired. In my view, the paper needs to have a clear section summarizing major points and take-home messages.

Formatting needs improvement. There are some instances where the grammar is off or sentences are weird (e.g., at p.3, the sentence ending with Gabielkov et al. has a question mark). Also the tone should be more academic (as opposed to journalistic or conversational).

Is the topic of the opinion article discussed accurately in the context of the current literature?
Yes

Are all factual statements correct and adequately supported by citations?
Yes

Are arguments sufficiently supported by evidence from the published literature?
Yes

**Are the conclusions drawn balanced and justified on the basis of the presented arguments?**
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Neuroethics, Public policy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.