


Into the Brave New World of Academic Publications: New Perspectives and Good-Bye to Business as Usual

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As we explore new frontiers of academic publishing, let's start with a simple foundational question: 'What is Spine Research?'

Hopefully these principles are commonly acceptable to all:

"Spine research refers to the scientific study of the spine, which is the column of bones that supports the body and protects the spinal cord. There are several principles that are important in spine research, including:

1. Anatomy and structure of the spine: Understanding the structure and function of the various components of the spine, such as the vertebrae, intervertebral discs, ligaments, and muscles, is critical for developing treatments and therapies for conditions affecting the spine.

2. Biomechanics of the spine: The spine is subjected to various forces and loads, and understanding how these forces affect the spine is important for developing strategies to prevent injury and promote healthy functioning.

3. Pathophysiology of spine disorders: Spine disorders, such as herniated discs, scoliosis, and osteoporosis, are caused by a range of factors, including genetics, aging, and mechanical stress. Understanding the underlying mechanisms of these disorders is essential for developing effective treatments.

4. Diagnosis and assessment of spine disorders: Accurate diagnosis and assessment of spine disorders is critical for developing appropriate treatment plans. This may involve imaging techniques such as X-rays, MRI, and CT scans, as well as physical examination and other diagnostic tests.

5. Treatment and management of spine disorders: There are a range of treatment options available for spine disorders, including medication, physical therapy, exercise, and surgery. Research is ongoing to identify the most effective treatments for different types of spine disorders.

6. Rehabilitation and prevention: After treatment, rehabilitation and ongoing management of spine disorders is important to maintain mobility and prevent further injury or deterioration. Research is also focused on developing strategies to prevent spine disorders from occurring in the first place."

Based on this hopefully generally acceptable foundation let's look at a couple of recent or emerging turbulences that affect our field of academic (Spine) publications:

- In academic publishing, digitization has in short order quite definitively replaced print to the tune of now representing over 90% of all output in the fields of Medicine, Science and Technology.^{1,2} The initial excitement over open access (OA) publishing has, however, given way to evolving profit models that utilize subscriptions, paywalls, submission fees and increasingly robust 'article processing fees' (APC's), all adding to the already well-filled coffers of the privately owned publishers around the world. Indeed, in this evolving OA era, APC's have become a most profitable venture as they are free of the burdensome overhead associated with actual print production and shipping of physical materials around the world.²
- The Covid19 pandemic is increasingly recognized a true epochal global disruptor of far fetching direct and indirect consequences, many of which yet to become manifest. During the fulminant emergence of this virus the need for publicly available rapid and objective medical information exchange using trustworthy platforms in an OA space emerged as an eminently desirable resource for the greater good of mankind. Data sharing took on a dynamic of its own, for instance in form of live data repositories opening the possibility for macro-metanalyses and preprint/pre peer review study releases disseminated on social media, both becoming overnight pandemic scientific publishing phenomena.³ Not surprisingly, pay firewalls and other pecuniary obstacles imposed by medical publishers that restricted immediate public access of potentially relevant scientific information were bound to draw the scorn of regulatory entities and sponsors.
- As digital publishing has evolved rapidly, 5 revenue generating mechanisms surrounding academic publications burdening taxpayers and publicly funded research institutions have been exposed in their intricately orchestrated arrangements: 1) agencies funding research;



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2) researchers paying to publish; 3) libraries paying for journal subscriptions; 4) Researchers providing unpaid time for peer review; 5) public paying access fees for paywalls. This ‘Quintuple-dipping profit model’ has now come under the scrutiny of federal institutions in the USA and agencies in other countries.⁴

- The perception of concerns regarding restricting publicly relevant information to the detriment of the greater good of the public recently has led to a legal directive in the USA that will likely significantly impact the current cash cow publishing industry. On August 25, 2022 Dr Alondra Nelson of the Office of Science of Technology Policy (OSTP) issued a transformative memorandum that is poised to change the current very lucrative business model of the largely privately held scientific publishing industry.⁵ The specific language of this new ruling is worthy of direct reprint as it will bear widespread implications, some of which are yet to evolve in their practical impact:

1. Update their public access policies as soon as possible, and no later than December 31st, 2025, to make publications and their supporting data resulting from federally funded research publicly accessible without an embargo on their free and public release;
2. Establish transparent procedures that ensure scientific and research integrity is maintained in public access policies; and,
3. Coordinate with OSTP to ensure equitable delivery of federally funded research results and data.⁵

As explanation Director Nelson stated: *“The American people fund tens of billions of dollars of cutting-edge research annually. There should be no delay or barrier between the American public and the returns on their investments in research.”* Included in accompanying text, this memorandum provides an important new distinction of OA and PA (public access). The latter is defined as “free availability of federally funded scholarly materials to the public (including publications, data, and other research outputs) and is a policy term”.⁵ This seems to go beyond the notion that federally funded projects need to be published without delay in freely available online media formats, but beyond that implies that in the future authors also provide open data sets to go along with their articles. In contrast OA remains defined in more general terms as initially provided by UNESCO: *“Open Access (OA) is the provision of free access to peer-reviewed, scholarly and research information to all. It requires that the rights holder grants worldwide irrevocable right of access to copy, use, distribute, transmit, and make derivative works in any format for any lawful activities with proper attribution to the original author.”*⁶

- Spreading beyond the US Federal government’s recent action, the inception of this groundbreaking legal

mandate probably dates as far back as 2018 when an international group of research foundations formulated a ‘Plan S’ which demanded that research funded by their philanthropic entities be published unimpeded by any restrictive paywalls. Independent of the US legal directive this ‘Plan S’ apparently has now been enacted by 25 funding agencies starting in 2021.² So far little has changed for medical authors, except that major publishers have added more detailed disclosures to the already endless author declarations to make sure there are no conflicts of such funding agencies. The potential impact on the medical publishing industry is difficult to predict as interpretations of what constitutes research funding and ethical references are bound to evolve over time.

- Remarkably, plagiarism might no longer the biggest threat to organized scientific publication standards. The emergence of predatory publication piracy, ‘authorship for hire’ schemes and the beginnings of a goldrush into a potential future “Spine Metaverse” realm within a gargantuan metaverse that currently mushrooms in a largely unregulated boundaryless cyber environment have caught the traditional academic community unprepared.^{7,8} Verifying authentic and unique high quality academic work will go well beyond using word check programs to identify illicit authorship appropriations and will require digital sleuthing to counter these new dynamics.
- Into this arena of evolving complex challenges to detect academic misconduct and fraud arrives a new evolutionary step in Artificial Intelligence applied to sophisticated content creation in form of free public writing platforms. An example for this is an open resource platform called ChatGPT launched by the ‘Open AI’ project which has refined an algorithm called ‘Reinforcement Learning from Human Feedback (RLHF)’.^{9,10} This algorithm presents as an ever-evolving human reinforced feedback cycle that provides a logically structured word product from its access to vast data resources by applying intrinsic associative protocols. The quality of this iteration of freeware may come as a surprise to many, who were familiar with common logical and semantic flaws of similar word creation efforts in the past. Remember the entry paragraph with which this editorial started? You were probably wondering what it was about. Hopefully you approved of it. Would you think of it differently if you knew it was entirely and without editing created by this open access platform ChatGPT drawing from its AI on first pass? It was created by AI. Literally on moment’s notice. To illustrate the power of this new platform here are some more examples. This is the first ChatGPT response created literally within seconds to this simple general Spine question:

“How Can One Measure Success in Complex Surgery?”

“Measuring the success of complex spine surgery can be challenging, as it depends on a number of factors, including the specific condition being treated, the patient’s overall health and functional status, and the surgical technique used. Some common measures of success for complex spine surgery include:

1. Pain relief: One of the primary goals of spine surgery is to reduce pain and improve the patient’s quality of life. This can be assessed through subjective reports from the patient and objective measures such as changes in pain medication use or physical therapy progress.
2. Functional improvement: Another key measure of success for complex spine surgery is improvement in the patient’s overall functional status, such as their ability to walk, stand, and perform daily activities.
3. Reduction in symptoms: Complex spine surgery may be aimed at addressing specific symptoms, such as weakness, numbness, or tingling. Assessing the extent to which these symptoms are reduced or eliminated after surgery can be an important measure of success.
4. Complication rates: Complex spine surgery carries a risk of complications, such as infection, bleeding, or nerve damage. Measuring the incidence and severity of complications can be an important indicator of the success of the surgery.
5. Patient satisfaction: Ultimately, the success of complex spine surgery is often judged by the patient’s perception of the outcome. Patient satisfaction surveys can be used to assess how well the surgery met the patient’s expectations and how satisfied they are with the results.”

In reviewing the quality of this AI generated text response the clarity of correct word choice and the meaningful hierarchical structure of addressing the major 5 factors related to outcomes determination honestly exceeds the writings of many human authors. This response, however, presents just the first iteration to a question. This free open source allows for limitless refinements to an initial search with increasingly sophisticated responses. To demonstrate this, here is the unedited example of a sequence of 2 queries. The first query asked to ‘Describe craniocervical instability’ and the second refinement asked the program to describe ‘Sagittal alignment measurements’:

Q1 “Describe Craniocervical Instability”

Craniocervical instability is a condition in which the bones of the neck and head (cranium and cervix) are not properly aligned, resulting in abnormal movement between these bones. This can cause a range of symptoms including neck pain, headaches,

dizziness, difficulty swallowing, and changes in hearing or vision. Craniocervical instability can be caused by a variety of factors, including congenital abnormalities, trauma, and degenerative changes in the neck and head bones. It is typically diagnosed through a combination of physical examination, imaging tests (such as CT or MRI scans), and other diagnostic tests. Treatment options may include medications, physical therapy, and surgery.”

Q2 “Sagittal Alignment Measurements”

Sagittal alignment refers to the position of the head and neck in relation to the spine. In healthy individuals, the head and neck should be aligned with the spine in a position that is straight and upright. However, in some individuals, the head and neck may be misaligned, resulting in a condition called sagittal imbalance.

There are several different measurements that can be used to assess sagittal alignment, including:

1. Cervical lordosis: This is the natural curvature of the neck in the sagittal plane. A healthy cervical lordosis should have a curve that is concave posteriorly.
2. Craniocervical angle: This is the angle formed between the line of the skull and the line of the neck. A healthy craniocervical angle should be between 30-40°.
3. C2-C7 sagittal vertical axis (SVA): This is the distance between the C2 vertebra and the C7 vertebra in the sagittal plane. A healthy SVA should be between 5-10 cm.
4. T1 slope: This is the angle formed between the line of the T1 vertebra and the horizontal plane. A healthy T1 slope should be between 5-10°.

These measurements can be used to assess the degree of sagittal imbalance and to guide treatment recommendations.

Note that to our Editors’ eyes the only discernible flaw was found in the program’s choice of the word ‘cervix’ (underlined to add emphasis) in the first sentence of the response to Q1. The overall comprehensiveness of this computer-generated answer and the depth and up-to-date nature of the details provided to the second query could easily pass muster for review for a submission for a book chapter or an overview article. It is hard to fathom at this point how this will impact academic publications when quality academic writings in passable English can seemingly be created on moment’s notice by using an AI writing program. Does this creation actually pass for knowledge and whose work product is this? How do we attribute authorship or check for illicit appropriations in presence of such online resources? In the future will we have to add another disclosure (“We the authors promise to not have used an AI resource in any of our writings”) to our growing declaration list?

As these various exploration points have hopefully shown we are indeed set for an exciting and tumultuous future.

The future is bright, we just need to be brave and smart to thrive in it and not get burned. (Anonymous)

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