



EDITORIAL

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# How large language models will be regulated in academia

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The automobile was commercialized in the late nineteenth century, beginning with Karl Benz's Benz Patent-Motorwagen in 1886. As cars started appearing on public roads, governments introduced regulations to ensure safety with the first driving license issued in 1888 in Germany, granted to Benz himself, and standardized licensing systems later spread across Europe.

Similarly, powered flight began in 1903 with the Wright brothers' first successful airplane flight. As aviation expanded, regulation became necessary. In 1909, the Fédération Aéronautique Internationale (FAI) created the first official pilot licenses, establishing standards for pilot competence and marking the start of modern aviation regulation.

Many other examples could be cited, but the lesson is consistent: whenever humanity makes a major technological leap, regulation soon becomes necessary—not to block innovation, but to ensure that its benefits are preserved and its risks contained. Without appropriate regulations, the extraordinary advantages of new technologies risk being undermined, or worse, their misuse may cause harm to society.

Large language models (LLMs) are the product of decades of research in natural language processing and machine learning. Early efforts in the mid-twentieth century relied on rule-based and symbolic systems, which were gradually supplanted by statistical approaches in the 1990s [1]. A major breakthrough occurred in the 2010s with the advent of deep learning and neural networks, particularly following the introduction of transformer architectures in 2017 [1]. These innovations enabled training on vast textual datasets, giving rise to powerful LLMs capable of generating coherent text, translating languages, and answering complex questions. Today, LLMs underpin a growing number of AI applications and continue to evolve rapidly in both scale and capability [2]. However, research indicates that many academics remain uncertain about artificial intelligence in general and LLMs in particular [3].

As history teaches us, in a time where innovation makes a giant leap and the community has to adapt to it, regulations become necessary in order to make it sustainable. Automobiles and aircraft did not lose their transformative potential once rules and licensing were introduced; on the contrary, regulation enabled their safe expansion, increased public trust, and facilitated global adoption.

And today it is the time to discuss them as LLMs are not a threat to be resisted, but powerful tools whose integration into scientific practice must be guided by clear principles, shared responsibilities, and transparent governance. In fact, as editors and custodians of the scientific record, we bear both the responsibility and the opportunity to shape how this technology is used, before its risks overshadow its promise.

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Recently, more than fifty Editors-in-Chief of anaesthesiology and pain medicine journals, or their delegates, participated in a Delphi consensus process to define the limits, possibilities, and opportunities that large language models pose to the academic ecosystem in a project called RULE-AP and published in the *British Journal of Anaesthesia* [4]—to which we proudly contributed as the *Journal of Anesthesia, Analgesia and Critical Care*.

The core message of this consensus is acknowledging both the undeniable benefits of LLMs, including improved efficiency, linguistic support, and reduced cognitive burden for editors, reviewers, authors, and publishers, but it also highlights the substantial risks they pose when used indiscriminately or without disclosure. Hallucinated content, fabricated references, erosion of critical thinking, and threats to confidentiality are not hypothetical concerns; they are real challenges already encountered in daily editorial practice.

The RULE-AP consensus does not aim to impose rigid prohibitions, but rather to define a responsible path forward. Its central message is unequivocal: LLMs may assist, but they must never replace human judgment, accountability, or intellectual responsibility. Transparency in disclosure, rigorous human verification of outputs, and clear journal policies are essential to preserving trust in scientific publishing. Just as no vehicle is permitted on the road without a licensed driver, no scientific work should enter the literature without a clearly accountable human author.

We therefore find ourselves at a familiar crossroads. Technology is advancing faster than our norms, but the answer is neither delay nor denial. It is deliberate, collective action. For this reason, we are proudly presenting to our readers RULE-AP, representing a crucial first step toward ensuring that LLMs enhance—rather than undermine—scientific integrity.

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