



## The Evolving Landscape of Academic Research Integrity

According to Retraction Watch, over 250 papers regarding COVID-19 published since the start of the pandemic have since been retracted. While retractions are an acknowledged necessity for academic journals, the growing justifications demand attention. Much focus is concentrated on checking the text of manuscripts, but in the digital age images are often more important when conveying results to readers. Here, Dr. Dror Kolodkin-Gal, founder of automated image integrity checking software Proofiger Ltd., discusses the importance of image integrity and common sources of issues.

According to the STM Global Brief 2021 – Economics and Market Size report, the global science, technology and medical publishing market was worth 26.5 billion USD in 2020. Scientific research papers are seen as the gold standard for increasing our understanding of the world. Given the high regard in which academia is held, along with the growing size of the publishing market, the importance of maintaining the integrity of the industry is unquestionable. It is vital for the industry to ensure that findings and methodology are kept to rigorous standards to prevent reader misinterpretation and maintain credibility.

Retractions and amendments have always been a part of academic publishing, especially considering the recognised notion that science is self-correcting. However, according to the previously mentioned report, roughly 48,000 scholarly peer-reviewed journals are published yearly. Furthermore, the recent surge in misinformation, particularly involving COVID-19 and vaccines, reaching public opinion as well as steady retraction rates, it has highlighted an important issue – that the review process must be modernised.

### Common Sources of Image Integrity Issues

Scientific image integrity covers a broad scope, with different journals holding unique guidelines for ensuring integrity. Recent developments, such as the joint guidelines issued by representatives from eight publishers in late 2021, offered detailed information for specific scenarios. The three categories listed covered scenarios where some images have been altered or beautified whilst avoiding affecting the research's conclusions, to level three which involved "severe manipulation". Each category contains examples of issues, as well as actions for journal editors to take.

According to the International Journal of Cancer, a Wiley published journal, the most frequently found errors are duplicated panels deriving from copy and paste errors, magnification errors in microscopic images, and inappropriate splicing of gel sections together. The prevalence of duplication errors in life sciences manuscripts can be attributed to a variety of factors. Notably, many authors from different

locations can now contribute to the same study and work on the same manuscript, opening the door for duplication errors through human error and miscommunication.

Accidental image duplications can be missed by researchers, editors and peer reviewers because identifying overlapping sections of complex images is difficult for the untrained human eye. Taking many microscopy images – with or without using different levels of magnification – can lead to small overlaps within the same samples. Technically, it is difficult to completely avoid overlaps, and it's even harder to detect these issues.

The acknowledgement of purposeful manipulations as part of fraudulent research is also unavoidable. This is an increasingly worrying issue in the academic industry, with most publishers being the target of systemic academic fraud via paper mills. This is the illegal and unethical manufacture and sale of articles, some of which are completely fabricated, by companies to researchers who claim the articles are the fruit of their own research.

Paper mills increase the pressure on the scientific community. When such papers make it through the peer-review process, it undermines the credibility of real research. Publishers and researchers need the tools to help make sure credible researchers are recognised for their contribution to the field.

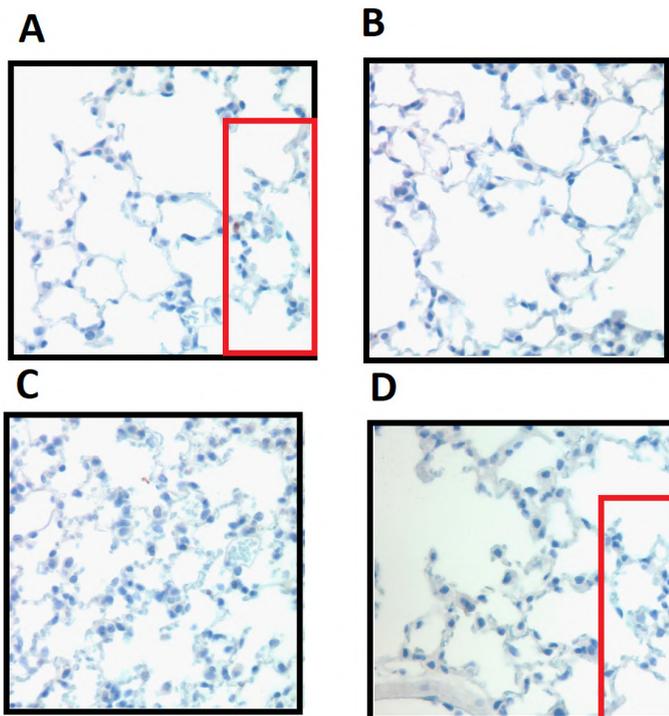
Paper mill articles are difficult to detect in isolation, but comparisons of multiple papers from different sources makes it much easier. The review process must adapt to cover unusual similarities or the use of stock images across several papers. As already mentioned, the joint efforts of publishers are a start, but a wider collaboration between publishers and investigators is necessary to ensure awareness and effective action across the whole academic sector.

### Considering Consequences

According to a recent report, one publisher found that 77 of its published journals were affected by fraudulent papers, with an average of 14 per cent of articles affected in each journal published or submitted between 2019–2021. Catching fraudulent papers before they reach publication will reduce the risk and associated costs of academics conducting future research built off low integrity papers.

Any published work with image integrity issues can have a lasting negative impact on all involved parties once retracted. For the publisher, retractions can tarnish the journal's impact factor, as readers may question the journal's credibility after a retraction. Institutions associated with the study may also experience reductions in trust and funding.

Researchers will also face consequences for image integrity issues, even if it was an honest mistake. If an image issue is



reported post publication, the publisher must take action, leading to a long and costly investigation for the researcher, during which they might struggle to gain funding for other projects or publish other work.

An often-overlooked consequence for researchers is the already prevalent mental health issues faced particularly by PhD students. One study found that more than 40 per cent of PhD students in the UK met the criteria for moderate to severe depression or anxiety. The high pressure and workload that researchers experience contributes to the increased likelihood of mistakes, and the greater mental impact that rejections or retractions can have. These consequences need to be understood by both researchers themselves and their institutions to ensure their safety and quality of work.

The consequences felt by the prevalence of poor scientific integrity encompass everyone involved in academia, and thus needs to be recognised and actioned by all parties as well. Collaboration between researchers, institutions and publishers can ensure innocent parties are corrected, guilty parties are punished and that only the research of most integrity is published.

### Digital Solutions for Digital Problems

The technological revolution has had prominent effects on almost every industry, and academia is no exception. Increased access to high quality imaging equipment gives researchers the tools they need to ensure they can convey results using high-quality images. A study found that as many as 72 per cent of cell biology<sup>1</sup> related papers included image-based figures to convey results, highlighting the prevalence and importance of images to manuscripts.

The increasing commonality of images in papers has made interpreting results more accessible, as digesting visual

stimuli can be easier than processing text. Despite this, it has not endured the same scrutiny as text during quality assurance checks, a problem exposed in research from image data integrity analyst Jana Christopher, who found when reviewing manuscripts checked at acceptance, the percentage of manuscripts flagged up for image-related problems ranges from 20 to 35 per cent.<sup>2</sup>

As the format of research papers evolve, we should also consider how the traditional peer-review process should evolve. This is particularly true for the image integrity review process, which is traditionally checked manually. It can be difficult, or even impossible to compare variations between sub-images by eye, supporting the need for tools to assist. Plagiarism software, such as iThenticate has long been established and widely used to detect plagiarism in education, so why has there been so little development for automated image checking software?

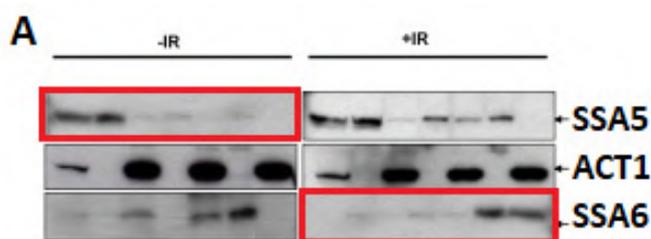
Recent exciting developments in AI and computer vision technology have allowed for more advanced methods of checking images. The trend has therefore been for publishers to adopt software, such as Proofigo, as part of their review process.

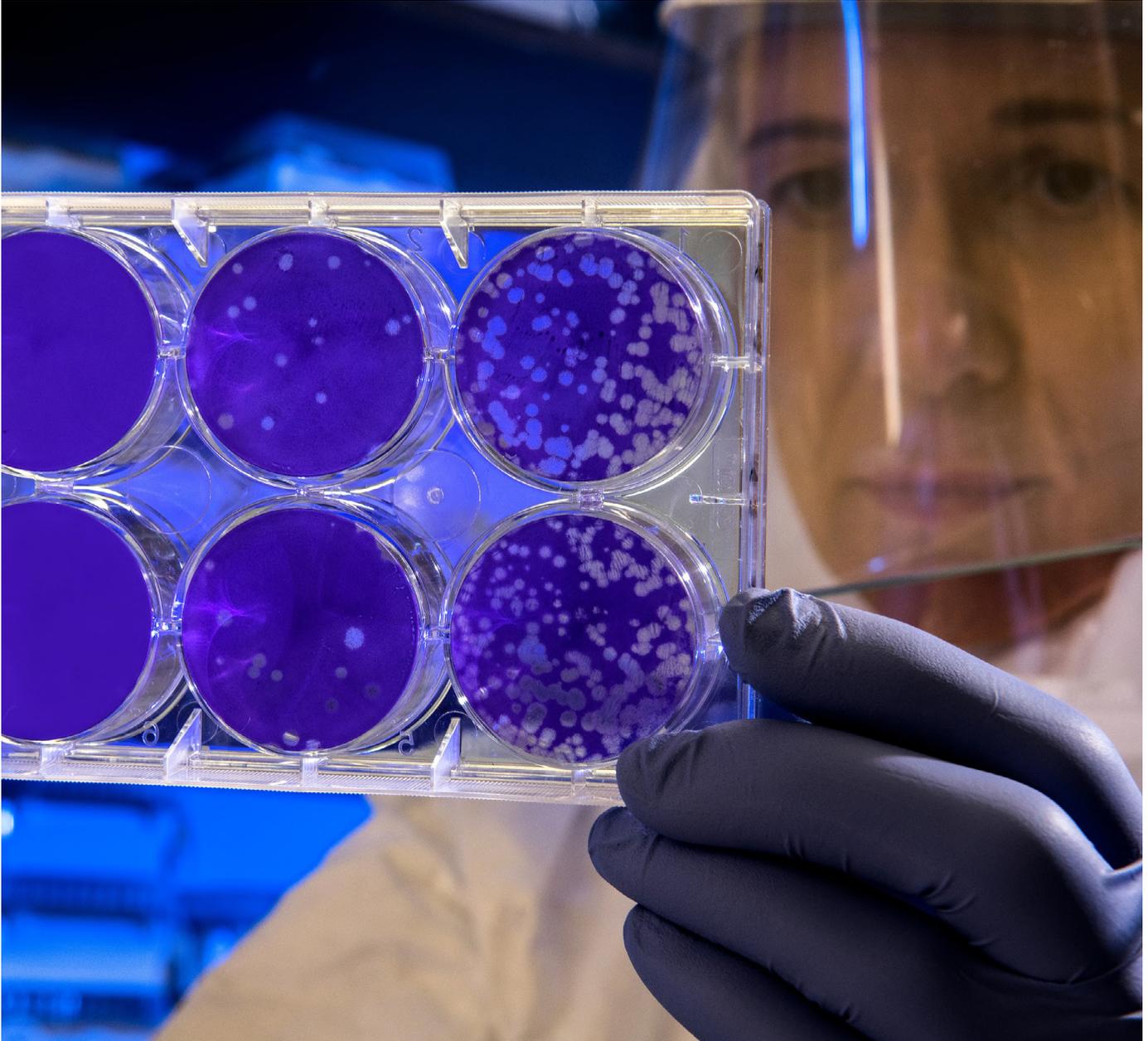
Anyone in academia can use AI software for quality assurance and to check images for possible duplications or manipulations in minutes, streamlining the review process. Computer vision also works more quickly and accurately than the human eye, reducing the risk of image integrity issues being missed before publication.

The use of such software can also provide an extra level of confidence for researchers, journal editors and grant committees. Researchers can proactively check their papers so that they can be confident that their work has the best chance of being published with no accidental image integrity issues tripping them up. For journal editors, they can be confident in the knowledge that published work is of the highest quality or thoroughly investigate any reports of issues and grant committees can make sure that they provide the grants to the best candidates.

No scientist wants their integrity called into question unjustly, so by using automatic image checking software before submission, researchers can check their data while keeping it confidential. This shifts the focus to the view that researchers are to be helped and encouraged toward high quality science rather than demonised.

The benefits of effective image integrity checking software are evident. By checking images proactively, journals can maintain or improve their impact factor and secure the quality





of future research. Institutions and funding bodies can better recognise valuable routes of research that will have the most significant positive impact for the community and researchers can be confident that they are sharing impactful research with accurate data.

Although retraction rates are high, and scientific integrity is facing challenges, there are actions that can be taken to improve integrity. Tools such as Profig are vital for the future of the scientific community in ensuring that only the most credible research is published, and the consequences of problematic papers and retractions are minimised.

## REFERENCES

1. <https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3001161>
2. Jana Christopher, M.A., Image Integrity Analyst <https://ukrio.org/research-integrity-resources/expert-interviews/jana-christopher-image-integrity-analyst/>



## Dr. Dror Kolodkin-Gal

Dr. Dror Kolodkin-Gal, Ph.D. is a life sciences researcher that specialises in new ex-vivo explant models to help understand disease progression and treatments. During his research, he became familiar with the issues surrounding image duplication and image errors in scientific publications. Dror co-founded image check software provider Profig to help colleagues avoid unnecessary reputational damage and the financial implications of an investigation into their careers, as well as academy institutions and publishing houses. Dror and his teams created Profig's artificial intelligence algorithms to help detect image duplication and manipulations in scientific papers. The software checks papers prior to submission and publication, preventing unexpected rejections and helping to improve article quality and credibility.