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EDITORIAL

The continuing challenge of paper-mills to publishing in the biological sciences

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In October 2020, Biology Open (BiO) published an editorial entitled "Publishing ethics in the era of paper-mills" (Hackett and Kelly, 2020), outlining the challenges experienced by BiO concerning fabricated and/or fraudulent research papers. We highlighted the ways in which BiO and its publisher, The Company of Biologists, were taking action to tackle this issue and prevent such papers from being sent for review or published.

Since then, BiO has continued to refine the ways in which we detect such papers. Currently, we identify and discard several suspect, or outright obviously fraudulent, submissions per week.

In the autumn of 2021, the Company hosted a seminar with Elisabeth Bik, the science integrity consultant. She spoke to journal editors (our research-active editors who handle submissions to all five of the Company journals), in-house staff and Company directors about fraudulent papers and paper-mills, and shared her tips and tricks for identifying scientific misconduct, in particular the hallmarks of paper-mill papers. This valuable seminar was instructive and has helped editors to identify and flag papers of concern.

BiO wants not only to look out for poor and fraudulent practice, but also to encourage good practice. In this vein, BiO is watching with interest the experiences of one of our sister journals, Journal of Cell Science, in their efforts to improve the transparency and availability of data in published articles. They recommend that authors "use graphs that allow the reader to see the true data spread (such as box and whisker plots or superplots);….use appropriate statistics with the sample size representing biological replicates rather than technical replicates; and …provide an additional supplementary figure that contains either full, uncropped western blots or substantial portions of the blots that highlight the origins of the bands shown in the figures." (Way and Ahmad, 2022; Fig. 1). We will hear from JCS in the future about the uptake and feedback from authors. Might such requirements deter those intent on publishing fabricated data? BiO currently asks for raw data should there be concerns about a paper at any stage. However, in some cases, insubstantial portions of blots are then received (rather than full blots), which does little to alleviate concerns.

As mentioned in our previous editorial, the Company was looking into purchasing manipulation detection software, for use in addition to the manual checks that will also continue to be performed. Proofig has since been chosen to help with our image manipulation checks. This software will help our team to analyse a wide variety of images, including western blot bands, all types of microscopy (confocal, light or electron), plates, and *in vitro* and *in vivo* images.

Armed with these additional tools and knowledge, BiO has committed to undertaking a review of its historical content. It is likely that BiO will have been targeted with submissions from paper-mills before anyone really realised that there was a market for such papers. All papers will be reviewed against a checklist of paper-mill hallmarks. Once any candidates have been identified, we will use the new manipulation detection software and repeat the manual checks on the figures carried by members of our in-house team. Should concerns remain, we will contact authors to ask for raw data (noting that papers might be several years old now) and an explanation for any identified areas of concern. If a decision is made to retract a paper or publish an Expression of Concern, this will be approved by the Editor-in-Chief, who has ultimate responsibility for the content of the journal. Retraction notices will be drafted to include as much information as possible. All steps will be undertaken following the guidance produced by COPE – The Committee for Publication Ethics.

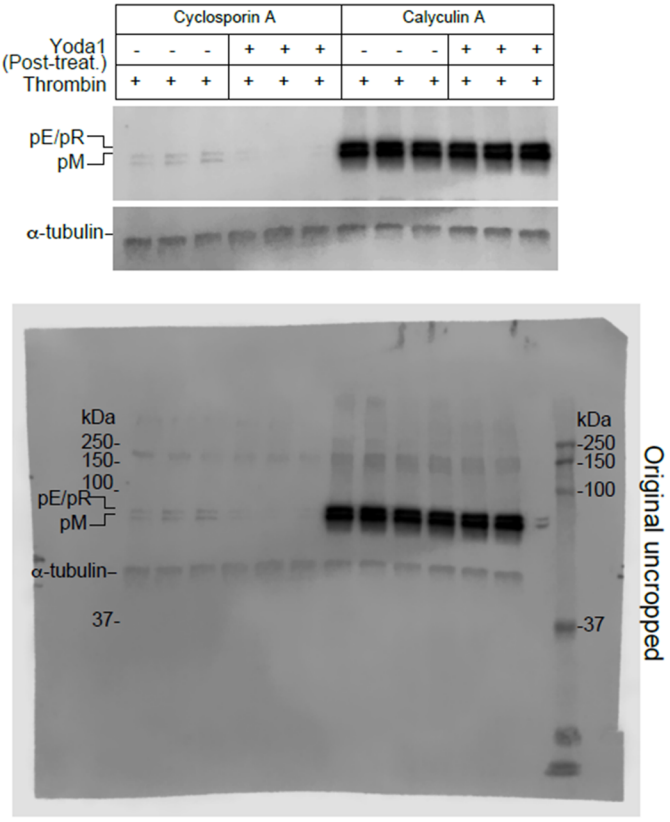

Fig. 1. Example of original uncropped western blot and subsequent presented figure. Reproduced with permission from O'Callaghan et al. (2022).

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Experience has shown that it can be very difficult to absolutely prove that a paper is fraudulent, despite showing many of the hallmarks of such papers and employing available tools. Making the decision to retract a paper is never undertaken lightly. However, although our undertaking to review historical content will be challenging and time consuming, we believe it is important to take these steps, to ensure the long-term integrity of the scientific record and to deter any others from submitting fraudulent papers.

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