

ON THE INTEGRATION OF RESEARCH INTEGRITY ISSUES WITHIN SCIENCE TRAINING – THOUGHTS ON RESORTING TO VISUAL REPRESENTATIONS IN THE MOLECULAR BIOSCIENCES

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Abstract

Resorting to images as decisive proof regarding some claim is a widely followed practice in the preparation of scientific articles (for a comprehensive analysis see for instance Cambrosio, Jacobi, & Keating 2008) and the fact ascribes to this kind of element a key role in peer communication. At the same time, problems with image manipulation underlie a significant number of article retractions happening in the broad field of the life sciences and biomedicine (Bik, Casadevall, & Fang 2016; Bik, Fang et al. 2018). This led to a so-called crisis of trust in scientific images and the introduction by journal editors of guidelines addressing integrity issues in image manipulation (Frow 2012), as well as the practice of forensic analysis of the images submitted (Frow 2012; Noorden 2015).

Fostering the awareness of the responsible conduct of research has been a growing concern in academia. The *European Code of Conduct for Research Integrity* (ALLEA – All European Academies 2017) focuses on four fundamental principles of research integrity – reliability, honesty, respect and accountability – and is intended as serving as framework for self-regulation within the research community. Looking, for instance, at both research procedures and publication and dissemination, two of the contexts explored in this code of conduct, it is clear that special care should be taken with visual representations. This also

refers to science education at the university level, where training should clearly emphasize good research practices.

Present thoughts emerge from the acknowledgement that undergraduate students undertaking laboratory course units should be confronted with integrity aspects in image use and manipulation, especially if the experimental procedures explored lead to visual representations usually included in research articles. Or, more closely, if the students should use these kinds of experimental results which they obtain in-class in their final reports. This acknowledgment, and also worry, led us to include these kinds of topics in a practical course unit of a first cycle of studies study plan in the molecular biosciences for the last few years. So far, the approach has been focused on visual representations; the idea, in the near future, is to further develop the approach to encompass other kinds of data produced. Although the implemented pedagogical activity has not been formally assessed, in our understanding it added value to the training offered in this particular course unit. Moreover, we could observe that the students performed the proposed activity – a basic group exercise – with interest. After an introduction to the problem and its contextualization within the research integrity framework, each group of students is attributed a specific (and *leading*) scientific journal in the

field to explore the guidelines regarding image manipulation. The task is to gather information, specially what is closer to the experimental approaches followed (*e.g.*, electrophoresis gels or blots), to prepare a brief presentation summarizing the findings and finally share them with the remaining groups. Of course, common rules are found in the different journal guidelines, but this result is, somehow, illustrative of what really matters as good practice in image use and manipulation. These thoughts draw on an experience of integrating the theme of visual representations

and research integrity in undergraduate training in the molecular biosciences. Here, we present the implemented pedagogical activity and discuss different ways of integrating these kinds of themes in the study plan. The exploration of research integrity issues may be done in curricular units specially focused on these topics. Another way is to explore a specific problem from this point of view whenever it can be invoked. In our experience, this latter approach is feasible. We will argue it is of foremost importance.

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