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Tackling poor research quality: From brain stimulation to the Journal of Physiology and beyond

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Progress in science requires the discovery of new facts. Ultimately, they should be corroborated by other researchers using various forms of replication and triangulation. Regrettably, the current scientific milieu is such that Ioannidis had to point out 'why most published research findings are false' (Ioannidis 2005). His illuminating paper has been read 3 million times.

My interest in this problem grew when we could not reproduce the results obtained by a leading laboratory with a particular form of transcranial magnetic stimulation (Martin et al., 2006). We were not alone. [Indeed, when the original researchers repeated their own work with 52 subjects rather than 9, the effect of the stimulation paradigm disappeared!] Subsequently we surveyed researchers using transcranial magnetic stimulation and were dismayed that only about half of respondents found similar results to those in the original publications. Others sometimes reproduced the original effects, or not at all (Héroux et al., 2015). Respondents lobbied us to analyse other forms of brain stimulation – again we found the same result (Héroux et al., 2017). In both studies, we also assessed the prevalence of shonky research practices. This was surprisingly high. As examples, more than a quarter of researchers knew other researchers who selectively reported study outcomes, adjusted statistical analyses to optimise results and removed outliers on a whim. Fewer respondents admitted to these practices themselves, but 25% reported changing statistical analyses to optimise the results (Héroux et al., 2017).

We went further and examined whether a 2011 campaign of targeted editorials published in the Journal of Physiology and British Journal of Pharmacology would enhance research reproducibility and transparency. We audited ~200 papers published just before and after the editorials had been published and included as part of the instruction to authors in these two pinnacle journals (Diong et al., 2018). In short, publication of the editorial advice led to no improvement in poor reporting practice. For example, in papers with exact p-values from 0.05 to 0.1, more than half were interpreted as 'trends' or statistically significant. Our findings mean that recommendations are not sufficient to improve reporting practices. Nonetheless, our findings prompted new submission and publication procedures for the Journal of Physiology (Forsythe et al., 2019).

Locally at NeuRA, we have established a research quality committee and developed a checklist so that we can monitor our publications. Our Quality Output Checklist and Content Assessment (QuOCCA) has now been used to assess all papers with an author linked to NeuRA for the years 2017, 2018 (Héroux et al., 2022) and 2019. The QuOCCA checklist is applicable across the biomedical sciences. It has 11 questions under three headings: transparency, design and analysis, and reporting practices. The results are salutary – they reveal limited engagement with several recommended practices. But they provide a benchmark against which to assess improvements that result from our educational initiatives.

No longer can we remain unperturbed about the issue of research quality and reproducibility: it affects all biomedical researchers. We urgently need critical educational and other interventions to lift our game.

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