Research ethics courses as a vaccination against a toxic research environment or culture

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Abstract
Hofmann and Holm's (2019) recent survey on issues of research misconduct with PhD graduates culminated with a notable conclusion by the authors: ‘Scientific misconduct seems to be an environmental issue as much as a matter of personal integrity’. Here, we re-emphasise the usefulness of an education-based countermeasure against toxic research environments or cultures that promote unethical practices amongst the younger researchers. We posit that an adequately conducted course in research ethics and integrity, with a good dose of case studies and analyses, can function in a manner that is metaphorically akin to vaccination. The training would cultivate the ability to analyse and build confidence in young researchers in making decisions with sound moral reasoning as well as in speaking up or arguing against pressure
and coercions into unacceptable behaviour. A sufficiently large number of young researchers exposed to research ethics trainings would essentially provide a research community some degree of lasting herd immunity at its broadest base. Beyond passive immunity, a crop of research ethics-savvy young researchers could also play active and influential roles as role models for others at their level and perhaps even help correct the wayward attitudes of some senior researchers and initiate prompt action from institutional policy makers in a bottom-up manner.

Keywords
Authorship, research environment, research ethics, research misconduct, responsible conduct of research courses

Introduction – young scientists and research integrity

As with all human-related activities, research is susceptible to malpractice. It is not uncommon for individuals in the research field to engage in research misconduct – performing research which does not conform to the institutional, legislative and international guidelines or is deceptive in nature, irrespective of the intention. The three major types of research misconduct, falsification, fabrication and plagiarism (FFP), may appear relatively straightforward, but other acts which compromise research integrity may be harder to define and spot. These questionable research practices (QRPs) lie in a grey area where the definition of wrongdoing is ambiguous (Steneck, 2006). The extent and nature of QRPs are discipline dependent but would include acts such as p-hacking, HARK-ing (hypothesising after results known) or the omission of certain results (Macleod, 2018).

Conducting research in a manner that is devoid of misconduct or questionable practices has been termed the ‘responsible conduct of research’ (RCR). Research ethics, research integrity and RCR are at times used interchangeably. However, it is necessary for a distinction to be made. Steneck defined research ethics as ‘research behaviour viewed from the perspective of moral principles’, while research integrity is defined as ‘research behaviour viewed from the perspective of professional standards’ (Steneck, 2006). It is, however, impossible to consider one element without the other; research integrity rests squarely on the principles of research ethics, which materialises into the practice of RCR.

The awareness of RCR has been on the rise over the past two decades, which could be credited to the growing number of RCR courses (Phillips et al., 2018; Todd et al., 2017; Watts et al., 2017). The knowledge of RCR, QRPs and research misconduct is a requisite to identifying the prevalence of such acts in one’s community. Measuring the prevalence of FFP and QRPs is challenging, especially due to the sensitive nature of the topic. It is recognised that if respondents are required to self-report their involvement in misconduct, presented results are often very
conservative (Gardner et al., 2005; Martinson et al., 2005). This has been circumvented in part by the provision of incentives for truth telling (John et al., 2012). A meta-analysis performed on 18 surveys calculated a pooled weighted estimate of a mere 1.97% researchers admitting to having engaged in FFP, while a much higher 33.7% admitted to QRPs (Fanelli, 2009). Not depicted in the mean is the large variation between surveys, and this could be attributed to several factors, including a lack of standardised definitions that would qualify QRPs as acts of research misconduct. A more realistic measure of research misconduct is possibly the proportion of researchers who have observed acts of misconduct by their colleagues. The proportion is notably higher, with the same meta-analysis reporting 14% researchers having observed misconduct and 72% having witnessed their colleagues engaging in QRPs (Fanelli, 2009).

Despite the general awareness of what constitutes research misconduct as demonstrated by the high incidence of knowledge about these acts, individuals do succumb to moral transgressions from time to time. Multiple factors could promote research misconduct, some of which can be controlled, while others are more difficult to mitigate (Davis, 2003; DuBois et al., 2013; Gunsalus and Robinson, 2018). Two prominent factors in this regard are pressure to publish (Fanelli, 2010, Tijdink et al., 2014) and authority pressure to deviate from accepted ethical norms (Gunsalus and Robinson, 2018, Jensen et al., 2018).

A recent survey by Hofmann and Holm (2019) presented some interesting yet disturbing data for PhD students and graduated PhDs in this regard. The authors queried participant PhD awardees at the Faculty of Medicine, University of Oslo, in 2016 and compared the responses with those from first-year doctoral students over the period 2010–2017 (Hofmann and Holm, 2019). The questions asked pertained to the witnessing of research misconduct, experiences in pressure to commit misconduct as well as self-admission of having committed misconduct. The study indicated a significant proportion of the students had some encounters with acts of research misconduct. In particular, ‘nearly a third of respondents had experienced unethical pressure with respect to authorship. . .’ Furthermore, ‘. . .13% of respondents reported experiencing unethical pressure in relation to other forms of dishonesty and 11% had experienced the consequences of some form of scientific dishonesty’. Alarmingly, ‘. . .18% of the respondents believed that one or more actions, which in the literature were perceived as scientific misconduct, were not wrong’. This is supported by other studies where graduate students consider misconduct events acceptable or are unsure if they have falsified or plagiarised data themselves (Hofmann et al., 2015; Nilstun et al., 2010). Apparently, despite having gotten a PhD and an obvious enhancement in their scientific knowhow (such as the use of statistical analysis methods), ‘. . .many still have attitudes that are not in line with general moral norms in science’.
A notable conclusion of Hofmann and Holm (2019) is that ‘scientific misconduct seems to be an environmental issue as much as a matter of personal integrity’. As the authors noted, this notion is in agreement with a previously expounded ‘environmental hypothesis’ (Mumford et al., 2007). The authors’ finding that nearly one-third of the students experienced unethical pressure in authorship matters echoed those of other studies (Jensen et al., 2018). Other environmental factors, such as increased stress, lead to compromised ethical decision-making capabilities and research misconduct (Davis et al., 2007; Mumford et al., 2001). In other words, personal integrity or virtues aside, one, especially a young researcher, could either be forced to abandon or fail to uphold one’s values under duress, coercion or intimidation. The latter would build a research culture laden with malpractices, forming an unhealthy research environment, which would be especially detrimental for an early career researcher (Muchinsky, 2004).

**Ethical perils of a young researcher**

A general way to curb undesirable or unethical practices would be to erect guidelines, rules and regulations that outlaw acts of research misconduct and make the latter punishable in definitive ways that would impact a perpetrator specifically and negatively in financial terms or in relation to his or her career development. The more blatant forms of research misconduct defined as fabrication, falsification and plagiarism (FFP) (Gross, 2016) or unlawful acts of harassment of the individual would be issues of misconduct that would be intuitively clear. These guidelines and rules, however, must still be readily available and conveyed in an effective manner to every young researcher. Guidelines can take the form of endorsement of basic principles on which research ethics are based (the Belmont Report, the Declaration of Helsinki), national legislation and/or institutional guidelines. Although most of the research misconduct is not usually considered criminal, some might be in contravention of the law (such as human biomedical research acts), and those can be acted upon legally. Although there has been discussion on the topic of criminalisation (Bülow and Helgesson, 2019), enforcement of national and institutional guidelines and sanctions is generally left to the institute and funders.

Very often, despite having basic knowledge of the rules, effectively reacting or dealing with a case of misconduct still poses a considerable challenge to a young researcher. To be armed with the knowledge of ethical guidelines and institutional rules would definitely be beneficial, but applying the knowledge in a context-relevant situation takes a different set of skills, for which training would also be required (Mumford et al., 2008). Without prior relevant initiation and training, it would be difficult for an inexperienced young researcher with lesser intuitive clarity to adequately handle and address situations, such as deciding between the correct methods of analysis and those bordering on result falsification (e.g. bias and
subjective sampling or cherry picking of data), as evidenced in Hofmann’s earlier study where a small proportion of PhD students had deemed research misconduct acts acceptable (Hofmann et al., 2015). In such instances, following the example of one’s contemporary appears to be a common and convenient approach. In a research environment in which proper research approaches and ethical conducts are unclear or not well-fostered, it is possible that researchers could simply follow their deviant peers and ‘infect’ each other with the tendency to engage in deviant behaviour, malpractices and irresponsible conduct in research (Cohen, 1965). Indeed, since deviant peers contribute to a less than desirable research environment, the perception of a healthy research environment has been linked with more desirable research practices (Crain et al., 2013).

From another perspective, there often exists some degree of value pluralism in several issues in research ethics and integrity (Peels et al., 2019). One such issue concerns credit sharing in research, mostly pertaining to authorship (Moffatt, 2018; Penders, 2016; Tang, 2018). Assignment or attainment of authorship for a manuscript is very much dependent on research context and manuscript content. Therefore, although international best practices and authorship criteria guidelines exist (ICMJE, 2016, Moffatt, 2018), and these are subscribed to by majority of the credible journals, explicit or strictly worded rules on authorship and credit sharing are almost never provided and subsequently enforced by institutions. Instead, individuals who encounter issues with authorship need to turn to external parties such as the Committee on Publication Ethics (COPE) for guidance. To a young researcher, grievances in authorship could arise in the form of coerced authorship, in which requests for authorship are made by others either in exchange for a reagent, facility or technique (Bülow and Helgesson, 2018) or as contributions that are on their own normally considered as undeserving of authorship (ICMJE, 2016). For junior researchers, honorary authorship included by decree from supervisors or senior authors in various guises of political power plays (Al-Herz et al., 2014) often occurs. On unfortunate occasions, the expected (or previously ‘promised’) author position might change against one’s will. Alternatively, and again particularly applicable to junior researchers, one’s departure from a lab prior to publishing one’s work could mean inadvertent condemnation to becoming a ghost author, with one’s contribution to a paper not duly recognised as that of a co-author. The problems already mentioned would be exacerbated if the student does not have access to a student advisory that could address any grievances in a timely manner.

In addition to being simply infused with a defective mindset or approach in research, and the incidental feeling of disappointment and frustration associated with a brush with ‘environmental reality’, perhaps a worse consequence is that all these could be passed down from one generation of researchers to the next. Toxic environments may thus prevail and an undesirable research culture would persist
in a manner analogous to the spread and persistence of an infectious disease in a community.

**Vaccinating against a toxic environment and culture – the need for formal instruction and training in research ethics and integrity**

Since a toxic environment or culture is unhealthy and could have a lasting negative impact on generations of young researchers, intervention would be necessary (Marusic et al., 2016). An effective intervention should be one that is both mandatory and readily administered. Within the educational setting of academic institutions, this would most conveniently take the form of a class for credit. We posit that an adequately conducted course in RCR, research ethics and integrity can work in a manner that is metaphorically akin to vaccination.

In the wake of the increased recognition of prevailing research misconduct, the research field has seen a concordant increase in RCR education courses worldwide (Phillips et al., 2018; Todd et al., 2017). Accordingly, there have been recent studies measuring the effectiveness of RCR ethics training courses. Since there is no consensus on what the ‘gold standard’ of research ethics training is, there is still much variability in the methods employed (DuBois et al., 2010; Mulhearn et al., 2017; Resnik and Dinse, 2012; Watts et al., 2017). Of these, some elements which have proven effective include relevance to day-to-day practices, arming the student with strategies to tackle ethical problems (Kligyte et al., 2008) and for the RCR training to contain case-based analyses (Watts et al., 2017). There has been a shift from passively imparting research ethics knowledge to the active fostering of an RCR culture (Kalichman, 2014) and this can be achieved by incorporating RCR training into a long-term career development process, which has been identified as another feature of effective RCR courses (Kligyte et al., 2008). In studies which evaluate the effectiveness of different approaches taught to mentees to deal with research ethics issues, the strategy-based approach, especially the sensemaking model, has come up strongly. The sensemaking model allows an individual to evaluate the situation at hand, recognise the presence of an ethical dilemma to solve and apply professional and personal experience to come to a properly weighted decision (Mumford et al., 2008).

Another variable factor in RCR courses is the mode in which the content is delivered. Multiple evaluations of research ethics training courses have demonstrated the effectiveness of active learning strategies requiring student interaction (Antes et al., 2009; Brummel et al., 2010). In particular, training involving case study-based instruction is effective not only in developing ethical decision-making skills but also in presenting academic benefits (Antes et al., 2009; Watts et al., 2017). However, the effectiveness of a single mode of instruction has
limited benefits and a combination of instruction modes has proven to be most effective (Mulhearn et al., 2017), supporting what was shown in earlier literature (Watts et al., 2017). The strategic time in which the course is administered has also proven to be an important element, with early education proving to be critical in instilling a sense of integrity in one’s self (Satalkar and Shaw, 2019).

In vaccination, the body is typically challenged with a close mimic of a pathogenic agent such that the immune response incurred would elicit persistent immunological memory. Likewise, an effective way to truly grasp the intricacies of ethical dilemmas in research would be to first prepare young researchers with the basic ethical principles and then to engage them in role-plays of characters in well-scripted cases, with thorough follow-up analysis of norms, reactions, options and consequences. For example, in a research ethics course we have conducted (Tang and Lee, 2020), students are placed in realistic simulations in which they are required to convince senior authors of what they perceive is a worthy authorship, as well as fending off attempts to add honorary authors. The value of incorporating role-plays in our research ethics training is supported by other studies in which students have returned positive feedback on its utility (Brummel et al., 2010). Indulging students with a sufficiently realistic case study would better equip them with lasting immunological memory than the administration of a passive symptomatic treatment in the form of a didactic lecture would, where there is an abundance of one-way knowledge transfer but limited discussion.

An effective research ethics course would cultivate the ability to reason and strategise, especially under duress, and the ability to base one’s decision on sound moral reasoning. In doing so, the exercises build one’s confidence in speaking up and effectively arguing against pressure and coercions into unacceptable behaviour. Furthermore, strategic approaches in obtaining peer or counselling advice, as well as mechanisms and proper channels of whistle-blowing, are also taught and discussed. In other words, students would be fully prepared to face, discuss or tackle a situation of misconduct that has befallen them or their colleagues and friends. At least in principle, a sufficiently large number of young researchers trained in ethical research would likely constitute some form of potentially lasting herd immunity against a toxic research environment and culture.

**Beyond passive herd immunity**

Beyond passive immunity, research ethics-savvy young researchers could play more active and influential roles. The research environment, healthy or otherwise, could largely be determined by more senior members of the community who have research practices ingrained in them. Some of these practices, although readily accepted in the past, might be classified as QRPs in contemporary practice, for example, allowing the laboratory head or the principal investigator to dictate
authorship arrangements. If these senior individuals are indeed ‘diseased’ and are engaging in misconduct or QRPs, it is unlikely that the ‘immunised’ young scientists will effectively transfer their immunity to these individuals to eradicate the pathogenic behaviour without endangering their career or well-being. Instead, immunised young scientists would know how to engage institutional research integrity officers who have the authority to address the misconduct officially and symptomatically treat the ‘disease’. Furthermore, these young, vaccinated scientists would be better equipped tactically and emotionally to stand against unruly coercion or pressures applied by ‘infected’ senior scientists. Compared to a single student disturbed and confused by a grievance, a bunch of clear-minded, logically sound and ethically knowledgeable students with a collective dissenting opinion on malpractices in research would be much harder to dismiss offhand. Secondly, those vaccinated could serve as role models for other young researchers at their level. Forming the base of the research pyramid, uninitiated students are the most susceptible to research misconduct infection in the community, being unable to distinguish questionable practices from responsible ones. The pressure and likelihood to engage in misconduct can be neutralised by their vaccinated and trained peers, who would pave the way to responsible practices. Thirdly, where there is absence or inadequacy in terms of clear guidelines and rules in research misconduct, these students could prompt or hasten their formulation by institutional policy makers in a bottom-up manner. As Tregoning has aptly remarked, ‘No researcher is too junior to fix science’ (Tregoning, 2017). In fact, it would be more important for junior researchers to fix a faulty research environment because the future is theirs. Analogous to young climate activists’ ability to capture the world’s attention (Marris, 2019), research ethics-trained young researchers could probably do better in navigating and changing toxic research environmental and cultural landscapes than senior researchers could, with the latter more likely burdened with social and personal reservations and inhibitions cultivated over the years.

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