EDITORIAL

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Integrity in science and scientific writing

"Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world." Louis Pasteur (1822 - 1895)

The generation of new knowledge, the application of existing knowledge in new ways, and the dissemination of knowledge enjoys a special place in all societies. The public (who, through granting agencies, fund research; who, through their trust, provide material for research; and in whose interest research is largely undertaken) expect a substantial benefit from the novelty, innovation and impact of science. Increasingly, science is intricately intertwined with and is responsive to the major health, social, philosophical, economic, legal, and political issues of our time. As science provides a lens to examine and to glean insights about who we are and our environment, scientists, by necessity, are increasingly accountable to the larger society of which they are a part. Consequently, it is more important than ever that individual scientists and their institutions constantly evaluate the values and professional practices that guide research and conduct of science as well as efforts to perform scientific work with integrity.[1]

"The level of trust that has characterised science and its relationship with society has contributed to a period of unparalleled scientific productivity. But this trust will endure only if the scientific community devotes itself to exemplifying and transmitting the values associated with ethical scientific conduct".[2] Hence, it is incumbent on all scientists and scientific institutions to create and nurture a research environment that promotes high ethical standards, contributes to ongoing professional development, and preserves public confidence in the scientific enterprise.[3]

Integrity characterises both individual researchers and the institutions in which they work. For individuals, it is an aspect of moral character and experience. For the individual scientist, integrity embodies a commitment to intellectual honesty and personal responsibility for one's actions and to a range of practices that illustrate responsible research conduct (Table I).[1] For institutions, it is a matter of creating an environment that promotes responsible conduct by embracing standards of excellence, trustworthiness, lawfulness that inform institutional practices and hold individual scientists and authors accountable (Table II).[1] "Leadership by individuals of high personal integrity helps to foster an environment in which scientists can openly discuss responsible research practices in the face of conflicting pressures. All those involved in the research enterprise should acknowledge that integrity is a key dimension of the essence of being a scientist and not a set of externally imposed regulatory constraints".[1]

TABLE I: Individual practices that illustrate scientific integrity.
Intellectual honesty in proposing, performing, and reporting research.
Accuracy in representing contributions to research proposals and reports.
Fairness in peer review.
Collegiality in scientific interactions, including communications and sharing of resources.
Transparency in conflicts of interest or potential conflicts of interest.
Protection of human subjects in the conduct of research.
Humane care of animals in the conduct of research.
Adherence to the mutual responsibilities between investigators and their research teams.

TABLE II: Institutional practices that illustrate scientific integrity.
Provide leadership in support of responsible conduct of research.
Encourage respect for everyone involved in the research enterprise.
Promote productive interactions between trainees and mentors.
Advocate adherence to the rules regarding all aspects of the conduct of research, especially research involving human subjects and animals.
Anticipate, reveal, and manage individual and institutional conflicts of interest.
Arrange timely and thorough inquiries and investigations of allegations of scientific misconduct and apply appropriate administrative sanctions.
Offer educational opportunities pertaining to integrity in the conduct of research.
Monitor and evaluate the institutional environment supporting integrity in the conduct of research and use this knowledge for continuous quality improvement.

The 4 most notorious frauds of contemporaneous science, by the stem-cell biologist, Woo Suk Hwang,[4] the physicist, Jan Hendrik Schön,[5] the physicist, Victor Ninov,[6] and the clinician-scientist, Andrew Wakefield,[7] all brought into question the responsibilities of co-authors in the

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oversight of their colleagues' work. Despite the concerns raised after these episodes, there remains a need for a clearer understanding, both within a collaboration and by readers of the eventual papers, of the various contributions made by the authors not only to the research but also to safeguarding its integrity. A welcome development in transparency was pioneered by medical journals: "authorship on a paper is justified when a researcher has contributed significantly to the work being described and to the writing or approval of the manuscript".[8] The traditional publication style is entirely opaque as to which co-author contributed what. While many journals now explicitly ask for the contribution of each author, such statements delineate contributions to the work but do not underwrite its integrity. While we celebrate the increased accountability of individual authors, much more still needs to be done to improve scientific integrity.

In this issue of the Journal, the Editors' Network of the European Society of Cardiology (ESC) which provides a dynamic forum for editorial discussions and endorses the recommendations of the International Committee of Medical Journal Editors (ICMJE) to improve the scientific quality of biomedical journals, provides timely commentary on accountability of authors.[9] They indicate that authorship confers credit and important academic rewards, but also argue that authorship requires responsibility and accountability; these issues are now covered by the new (4th) criterion for authorship. Authors should agree to be accountable and ensure that questions regarding the accuracy and integrity of the entire work will be appropriately addressed. The ESC Editors' Network argues that understanding the implications of this paradigm shift on authorship requirements while increasing awareness on good scientific and editorial practices.

Capistrant and colleagues investigated whether there was a difference in the determinants of hypertension prevalence, diagnosis and control in individuals aged 50 years and above between South Africa and Ghana, and found that South Africans had higher age-standardised prevalence rates for hypertension, and key determinants of the prevalence of elevated blood pressure included rural residence, educational attainment, income, and body weight.[10]

In a single-centre study from Durban, South Africa, Russel, et al studied the utility of admission blood glucose for predicting major adverse events in hospital and 6 months post-discharge in acute myocardial infarction patients, and found that major adverse cardiovascular events correlated with admission blood glucose levels, and that the optimal admission blood glucose threshold for predicting in-hospital and 6-month mortality was 8.5mmol/L.[11]

Dellar and co-authors explored the levels of knowledge on cardiovascular disease (CVD) in HIV-infected South African surgical patients, attending a public hospital.[12] In this small study, including only 39 patients with a homogeneous demography, the authors found that the level of knowledge on CVD in public sector surgical patients infected with HIV was poor and recommend health promotion targeting CVD in HIV-infected South African patients.

Weich, et al describe the first case of transcatheter aortic valve prosthesis implanted into a calcified native mitral annulus (TAV-in-MAC) in South Africa, which is now a viable treatment option for mitral valve replacement in patients with severe annular calcification who cannot undergo mitral valve replacement surgery.[13] The authors describe the surgical technique and review the procedural success and associated complications of TAV-in-MAC.

Fan and colleagues present a rare case of extensive Stanford Type A aortic dissection extending from the ascending aorta superiorly to the carotids and inferiorly to the infra-renal abdominal aorta in a 34-year-old male with history of hypertension and tobacco use, who reported acute chest pain, dyspnoea, slurred speech and altered mental status.[14] They review the utility of imaging using computed tomography in this clinical entity and remind us of the seriousness of aortic dissection, which still carries a high mortality even in high volume centres. The Image in Cardiology is a case of atrial flutter ablation through the azygous continuation in a patient with mirror image dextrocardia and interrupted vena cava by Drs Greyling and Potts.[15]

It is my hope that the readers of the Journal will enjoy this issue. It is also my hope that this issue will stimulate conversation and reflection on integrity in science and scientific writing. For a scientist, integrity embodies the individual's commitment to intellectual honesty and personal responsibility. For an institution, it is a commitment to creating an environment that promotes responsible conduct by embracing standards of excellence, trustworthiness, and lawfulness and then assessing whether researchers and administrators perceive that an environment with high levels of integrity has been created. It is only by ensuring that integrity is at the centre of every aspect of the scientific endeavour and communication, that we can ensure, as Pasteur had envisioned, that "science is the torch that illuminates the world".

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