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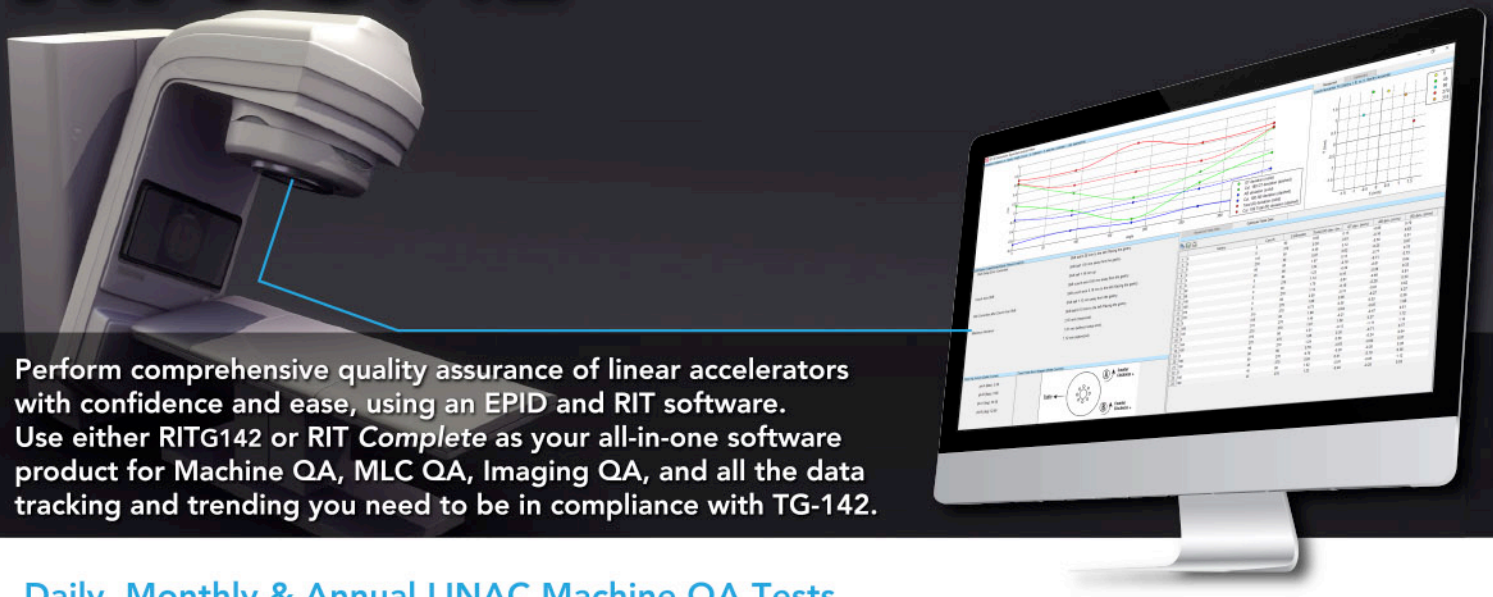

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POINT/COUNTERPOINT

Suggestions for topics suitable for these Point/Counterpoint debates should be addressed to Habib Zaidi, Geneva University Hospital, Geneva, Switzerland: habib.zaidi@hcuge.ch; Jing Cai, The Hong Kong Polytechnic University, Hong Kong: jing.cai@polyu.edu.hk; and/or Gerald White, Colorado Associates in Medical Physics: gerald.white@mindspring.com. Persons participating in Point/Counterpoint discussions are selected for their knowledge and communicative skill. Their positions for or against a proposition may or may not reflect their personal opinions or the positions of their employers.

An increase in retractions of research publications is an issue for Medical Physics

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OVERVIEW

Medical physics can be one of the most rewarding applications of physics in day-to-day society's life. Hence, translational research in this particular field attracts a lot of interest given its potential impact on the delivery of patient care. The credibility of scientific discoveries and research outcomes reported in the scientific literature is driven by confidence in the integrity of scientists performing this research. However, scientific misconduct often blackens the image of scientific research and negatively impacts the faith society has in science. The reasons for this are multiple and multifaceted. An important feature of integrity in scientific research is how scientists deal with potential errors and with studies conducted erroneously. To maintain the scientific literature free from known sources of corrupted or misleading information, a common practice is to retract scientific articles having issues. While some think that an increase in retractions of research publications is an issue for *Medical Physics*, others think that this is a logical consequence of additional transparency in scientific publishing that will undoubtedly result in better science and will definitely enhance the quality of the journal. This is the topic addressed in this month's Point/Counterpoint debate.

Arguing for the proposition is

Clive Baldock, PhD. Dr. Baldock received his Ph.D. from King's College London with research undertaken in the field of gel dosimetry for improved three-dimensional radiation therapy dosimetry. He subsequently moved to Queensland University of Technology, Brisbane, Australia in 1997 to the Centre for Medical, Health and Environmental Physics. In 2003, he moved to the University of Sydney as the Director of the Institute of Medical Physics and later as Head of the School of Physics. In 2012, he was appointed the Executive Dean of Science at Macquarie University, Sydney. In 2014, he joined the University of Tasmania as Acting Dean of the Faculty of Science, Engineering and Technology followed in 2016 by his appointment as the Pro Vice-Chancellor for Research Development and Dean of Graduate Research. In 2020, he joined the University of Wollongong as Dean of Graduate Research. His research interests continue to be in the fields of gel dosimetry, radiation therapy, dosimetry, and medical imaging in which he has published over 170 research journal papers. He has been awarded the Fellowships of the Australian Institute of Physics, the Australasian College of Physical Scientists and Engineers in Medicine, the Institute

of Physics (UK), and the Institute of Physics and Engineering in Medicine (UK).

Arguing against the proposition is Parminder S. Basran, PhD. Dr. Basran obtained his M.Sc. in Medical Physics from the University of Alberta in 1998, and his Ph.D. in medical physics from the University of Calgary in 2003. Since 2004, he has been a certified clinical medical physicist, practicing for Sunnybrook Hospital in Toronto, and for BC Cancer in Victoria. He has had a variety of leadership roles throughout his career and has a keen interest in cultivating and fostering future leaders into the profession of medical physics. In 2019, he joined Cornell University as an Associate Research Professor within the College of Veterinary Medicine. His lab focuses on medical image analysis, precision radiation oncology, and medical physics training and education. He participates in a number of AAMP, COMP, and international medical physics activities, and is currently the Director of Communications for Medical Physics for World Benefit.

FOR THE PROPOSITION: CLIVE BALDOCK, PH.D

Opening Statement

Retractions of published journal articles are a result of research misconduct such as fraud, fabrication of data and plagiarism and are essential in keeping the scientific literature trustworthy.[1] Other reasons for retractions include author-identified errors or other issues associated with their publications as was the case in 2019 of Frances Arnold, who won the Nobel Prize for chemistry in 2018.[2]

With the rapidly increasing number of journal articles being published each year, the number of journal retractions continues to increase, year-on-year,[3] with nearly 1500 counted in 2019.[4] Further, one can speculate that, although there are an increasing number of retractions, this is just the tip of an iceberg[5] with the majority of the thousands of journals in the Web of Science not reporting any retractions since 2003.[6] This large number of undetected (and/or unretracted) incidents of scientific misconduct or serious error has potentially contributed to the so-called replication, replicability, or reproducibility crisis in science in which there is an increasing concern that most reported research findings may be false.[7]

It has been stated that journals with low numbers of reported retractions maybe harboring an increased number of articles that should have been retracted but have not, as of yet, been detected by those journals.[8] *Medical Physics* has a relatively low number of published retractions and, at face-value, suggesting that retractions are not an issue for the Journal. However, the overall increase in retractions of publications in the scientific literature is potentially an issue for *Medical Physics*, suggesting that there are articles that should have been retracted in the Journal which have not, as of yet, been detected. If this is the case, then some of its published research maybe erroneous, which could have a potentially negative impact on patient outcomes, for example, diagnosis and treatment of cancer.

AGAINST THE PROPOSITION: PARMINDER S. BASRAN, PH.D

Opening Statement

When journals like *Science* report a looming and disturbing tenfold increase in the number of retractions over the span of a decade — where upwards of 60% of retractions were attributed to academic fraud — and the *Lancet* retracts a paper on hydroxychloroquine as a promising drug for COVID-19 patients, the scientific community takes note.[6,9] Media coverage of retractions generally associates them with academic fraud. It is natural to assert that an increase in retractions in *Medical Physics* indicates increased fraudulent activity. This singular perspective, however, misunderstands, uncontextualizes, and even undervalues retractions. While the majority retractions are indeed the result of nefarious academic activity (such as data fabrication or falsification, plagiarism or the dreaded "salami slicing"), other reasons for retractions are much less worrisome.[10,11]

An analysis of retractions suggests that 1–2% retracting authors with five or more retractions are responsible for 10% of all retractions, and of those authors with five or more retractions, 26–37% of them are more likely to have another retracted article within the next 5 years: there are a few bad apples, and they are productive.[12] Arguably, these bad actors existed within our community all along but have only recently been unearthed as a result of formalized retraction policies and procedures instituted by journals.[13]

In fact, a rise in retractions naturally follows from improved journal oversight and the adoption of software to detect plagiarism.[6] High impact-factor journals that institute such measures report a rapid increase in retractions followed by a decrease in the rate of retractions.[13] Thus an increase in retractions is expected in a journal like *Medical Physics*, which only recently modified their retraction policy in 2018 to include issues beyond just plagiarism.

Furthermore, a significant percentage of retractions are non-fraudulent in nature. They are caused by issues such as human error in data collection, failure to reproduce results, issues with data provenance, research protocol violations, fallouts from public pressure, undervaluing the influence socio-economic inequities, and even politics.[14,15] Retractions can provide a means of making research more transparent, as opposed to obfuscating it, which will inevitably result in better science. Moreover, the retraction of work by the honest researcher is not a form misbehavior, but rather an act of integrity. It should be supported by editorial boards and our community.

And finally, let us assume — in the absolute worst case — that an increase in retractions would give license for bad actors to increase fraudulent submissions to *Medical Physics*, and this work could have the potential to trickle into the clinic. Fortunately, the clinical practice of medical physics is founded on competencies, independence, and reproducibility. Unlike a physician who might introduce an intervention

based on a *Lancet* or *NEJM* article, there are sufficient motivations for a medical physicist not to implement "bad science" with patients. The consequences of bad science in *Medical Physics* is more likely to lead to wasted time, energy, and money in the laboratory than higher patient doses or poorer clinical outcomes.

To sum, we should not be asking if an increase in retractions of research publications is an issue for *Medical Physics*. I submit that if it were not increasing, the journal has a much bigger problem.

Rebuttal: Clive Baldock, Ph.D

The Retraction Watch database, founded in 2010 by Ivan Oransky and Adam Marcus provides information regarding retractions and their nature, distribution and cause. Currently it is the single most comprehensive available source of information regarding retracted papers. Although this resource has been available for over 10 yr, there is still an undeveloped understanding of the prevalence, cause and impact of retractions amongst researchers.[6]

My esteemed colleague has indicated that we are fortunate that *the clinical practice of medical physics is founded on competencies, independence, and reproducibility.* For many researchers, regardless of whether they work predominantly in a research laboratory or a more clinical environment, publishing papers in certain journals and increasing citations[16] is the primary route to earning grants, tenure, and promotions. Although there is a continued debate as to whether "publish or perish" plays a significant role in research misconduct,[17] paper metrics do have the potential to perversely influence behaviours of individuals undertaking research and their associated research outcomes. My esteemed colleague has indicated that *there are sufficient motivations for a medical physicist not to implement "bad science" with patients*. This author contends that as the publish or perish culture of earning grants, tenure, and promotions potentially exists in medical physics as individuals endeavour to advance their careers, there is every possibility of research misconduct through so-called bad science.

An apparent low rate of research misconduct decades ago may be due to the failure of journals at the time to adequately report cases of fraud and other inappropriate actions by authors in retraction notices.[18] In the broader scientific literature, many published papers deserve to be retracted but as of yet most journals have not had the appetite for purging their archives of such papers. Further, many journals maintain they have neither the time nor resources to devote to such an activity. My esteemed colleague has indicated that *Medical Physics*, which is a member of the Committee on Publication Ethics (COPE), modified the journal's retraction policy only as recently as 2018 to include issues beyond plagiarism. This may indicate that there are papers published pre-2018 in Medical Physics that should be retracted to correct the historical record. Otherwise, this lack of retractions of research publications will be a potential issue for *Medical Physics*.

As long as the research rewards system reinforces the published academic paper and associated citations as the primary metric of impact and success, there will exist the potential for research misconduct and the publishing of papers that will require retracting.

It is important for all of us to remain vigilant and contribute to ensuring the ongoing high quality and standards of research published in *Medical Physics*. Only time will tell whether retractions are an ongoing issue for the journal.

Rebuttal: Parminder S. Basran, Ph.D

I am in agreement with the majority of my esteemed colleague's arguments but address two points raised in my colleague's opening statement.

First, with respect to the number of retractions being a problem, the rate of change in retractions per year over the next 5–10 yr is more important than the number of retractions per year. But even if the rate does not drop, retractions have the potential to transmit considerable information to the readership: they highlight the value of the peer-review process and elucidate possible points of failure when presenting and sharing science. When viewed this way, retractions become both an instrumental and educational tool. This perspective should be supported or considered given the increasing number of predatory journals and non-peer reviewed publication platforms where little to no peer-review and quality assurance exists. Indeed, the retraction process *adds value* to the publication by providing a service not offered in non-peer reviewed platforms and the mere number of retractions in a journal is of far less value than are the insights from — and rationales for — those retractions.

Second, the risk that an increase of retractions could affect patient care is, in my estimation, low. There are too many disincentives for healthcare works and institutions to permit work published in this journal to lead to unfavorable patient outcomes, mistreatments or misdiagnoses. Even a hacked AI model (that might be challenging to "commission" in the traditional sense) would eventually be subjected to regulatory and institutional oversight prior to use.

We need not identify an increase in retractions as a "problem" but instead a natural consequence of journals becoming more transparent, and the science contained therein becoming more interpretable and reproducible. Retractions invariably improve the quality of science in our journal and should not just be brandished as nefarious academic behavior, but rather an instrument for the publisher and learning opportunity for our community.

CONFLICT OF INTEREST

Dr. Baldock and Dr. Basran have no relevant conflict of interests.

Editor-in-Chief's Note: Our policies on scientific misconduct, while revised in 2018, are understood to apply retroactivelty to all published content in

Medical Physics. Any potential instance of fraud or other form of scientific misconduct brought to the attention of the Editors, may subject the article in question to retraction or other intervention regardless of its date of publication.

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