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A history and development of peer-review process

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The paper shows the importance of peer review process in the scholarly communication system and discusses both the closed and the newly emerging open peer review models. It also examines the peer review system at the scholarly academies or societies in their nomination systems for prizes, rewards, etc. It also discusses the various facets of the newly developed open peer review models now prevalent in various journals. The paper may help to understand and appreciate the role played by peer review in the scholarly communication system and the efforts being made to make it more transparent.

Keywords: Double-blind peer review; Open access; Open peer review; Peer review; Scholarly communication; Single-blind peer review

Introduction

Peer review is the quality control mechanism in the entire ecology of the scholarly communication system. International Committee of Medical Journal Editors (ICMJE) defines peer review as the critical assessment of manuscripts submitted to journals by experts who are usually not part of the editorial staff[1]. Reviewers are the experts on the same subject on which an author has submitted his or her paper for consideration of publication in a scholarly journal. It is also applied in cases of research grant allocation and in such other academic endeavours. In short, it is a review mechanism by the experts on the topic under discussion. These experts are called reviewers or referees. Peer review has been in existence as a means of assessing the content before publication for more than 300 years. Possibly, it goes to the credit of the Royal Society that introduced peer review in *Philosophical Transactions* in 1752[2].

However, the adoption of peer review to check the academic soundness of the submitted scholarly literature for publication was not an easy one. Editors had different reasons for not adopting it in the initial years. These reasons were: not receiving enough materials for publication; doctors with MD degree are specialized enough themselves and need not send their papers to another doctor for reviewing his or her papers (specially in the USA); pressure from the learned organisations to publish any material submitted by its members, etc. These factors resulted in the uneven growth of peer review as a means of controlling the quality of the publishable materials[3]. Recent reports of peer review fraud also raise concerns about its efficacy and future[4,5,6].

It may also be noted that peer review is not limited only to the scholarly publication system. It is also involved in the nomination of scientists and scholars to the scholarly societies like science academies, as well as in selecting the recipients of prestigious prizes including the Nobel Prize.

Objectives of the study

- To discuss the purpose and importance of peer review in the scholarly communication system;
- To analyze the roles of various stakeholders in the peer review system;
- To explain the traditional peer review, i.e. closed peer review system;
- To show the shortcomings of the peer review process;
- To present the emerging models of open peer review systems;

- To critically analyze the pros and cons of the developing landscape of the open peer review process; and
- To make observations on the peer review system of the various scholarly academies or societies.

Review of literature

The steady stream of scholarly literature on peer review and its various aspects show that researchers placed much importance on the peer review mechanism. Weller[7] throws light on the editorial peer review practices followed in the publication of scientific journals. The role of peer review to maintain the flow of publishable scholarly content cannot be overemphasised. Many authors analysed this vital aspect of scholarly communication system[8,9,10]. Gannon[8] discussed the needs and benefits of peer review in his editorial piece. While emphasising the importance of present peer review system, Sowards[9] also analysed the various aspects of it, like the motivation behind this process, how it is done, its validity and reliability, etc. He also undertook the discussion on the impact of technology on this and its future. Kasper[10] emphasised on the importance of peer review. While looking at the Boyer's model of scholarship, he clearly stated that peer review is the process of evaluating the new knowledge created by a researcher. Wicherts[11] tried to compare the quality and transparency of the peer review procedure between the open access and toll-access journals.

According to Boldt[12], the present peer review system in place is long and cumbersome. He offered an innovative idea of upgrading submitted pre-prints to the level of published items after the open and signed peer review of them. Baldwin[13] looked at the refereeing system with an emphasis on the important aspect of the credibility of peer review. Björk and Hedlund[14] looked at the new methods adopted by the scholarly journals for peer reviewing the submissions. Ford[15] argued for the adoption of an open ethos with respect to the peer review process.

The various emerging models of open peer review (OPR) have attracted the attention of researchers in this area. Morrison[16] presented the case of OPR in a favourable manner. Hachani[17] opined that the Internet provided an opportunity for making the traditional peer review system more transparent and objective. Nobarany and Booth[18] took up the importance of politeness in signed open peer review system. They found that it is the senior researchers who use unqualified criticisms against the reviewers. However, amid the clamour for OPR, Almquist[19] and his co-authors' study showed that there was a lukewarm response to the idea of open online peer review system. The works of DeCoursey[20] and Tattersall[21] are also of importance about OPR.

The future of peer review, specially with the emergence of open access scholarship and the Internet is an important topic of discussion these days. Weller[22] took up the issue of peer review in electronic journals. Mulligan and Raphael[23] undertook an international survey to understand the changing and emerging landscape of the peer review process. Their research showed that while people accept the importance of peer review, they also want change in the present system. Walker and Rocha da Silva[24] undertook a survey to understand the evolving models of peer review. Amongst others, they identified two important trends in this sphere: first, the emergence of preprint archives and the resultant refusal to adhere to the traditional peer review altogether and the recent tendency of reviewing the scientific rigour rather than the novelty of the new researches. Helmer *et al.*[25] discussed the aspect of gender bias in the present peer review scenario. Their work showed that women are less in number in the peer review panels of journals.

Peer review: purposes

Nobel laureate Francis Crick noted that communication is the essence of science[26] (Quoted by Garvey). This statement does hold for not just science, but all the areas of scholarly endeavours. And peer review is a crucial element in this whole chain. Peer review ensures that only those works which stand the test of quality are published and the frivolous ones receive the opposite fate. So, it may be said that it plays the role of a gatekeeper in allowing the sound work to be entered in the list of scholarly communication deposits.

Hence, in a nutshell, we may say that the purposes of the peer review system are: ensuring the publication of quality research; identifying works of dubious quality, ensuring that research based on wrong procedures do not get published; research with sound research design and methodology only gets published; relevant published literature are studied

and properly referred in the text; no imaginary conclusions are drawn and no primary results which may not stand later scrutiny are included in the publication; experiment results are stated properly and explained from every possible angle; selection of only those papers which match the stated objectives or areas covered by the journal; reproducibility of the research findings wherever applicable; helping the author of a quality work to improve his/her paper by proper editing and modification[27,28,29].

Peer review: importance

Discussing the importance of peer review, Ziman noted that a scientific paper does not contain only the thoughts and opinions of a writer, but it also bears the imprimatur of scientific authenticity. It is so because of an expert from his subject vets this writing. Hence, Ziman opined that the referee is the lynchpin on which the whole business of science is pivoted[30]. The primary aim of peer review is to help the journal to publish those papers which are worth publishing and describe and explain the research done appropriately.

With the advent of the internet and Web, it is argued by some that all research works may be allowed to publish without the rigour of peer review. If that is allowed to happen, it may bring several problems to the fore. Firstly, the majority of the population, i.e. non-experts, will not be able to understand which research results are to be believed and accepted as truth. Secondly, this system may play havoc specially in case of medical science research. It may result in the using and following of wrong medical procedures for different medical conditions of the patients. Thus, it will result in medical emergencies and even life-threatening situation of a patient who has gone there to be cured of his illness. If we look at this issue from this perspective that with time the number of research workers and their number of research papers have increased manifold, peer review is much more important and critical today to validate their results and allowing the publications of only the validated researches[27].

Peer review: roles of stakeholders

It is imperative on the part of the editors of the scholarly journals that they ensure proper peer review of their journals. The reviewers are important stakeholders of this system. The reviewers need to know the paper selection policies and procedures of the journal to which he/she is attached. The reviewers need to satisfy themselves that they understand the reported work; they believe the reported results and they do care about the fact that the present research work shall make a difference to the existing body of knowledge[31].

The onus also lies on the journal authority to sensitise the reviewers about these rules and regulations. It shall help the would-be authors to keep these aspects in mind while preparing and submitting their research paper to any journal. It is the responsibility of the editor to decide the prospective reviewers for a submitted paper keeping in view of the content of the paper. It is also the editor's responsibility to maintain a panel of reputed reviewers commensurate with the areas of research published in the journal for the smooth review process. In the end analysis, it may be said it is the responsibility of the editor or the editorial board to ensure the error-free publication of a rightly done work after a rightly done review. The recent activities of the Committee on Publication Ethics (COPE) concerning peer review are a step forward in streamlining the peer review process in the journals published by its member publishers[32].

Peer review: types

Generally, peer review is of three types—single-blind review, double-blind review, and open review. The traditional peer review system is of the first two types. In the single-blind review system, the reviewer knows the identity of the author and his affiliation(s) but not the other way round. This is the most prevalent peer review process in the scholarly communication system. The scientific disciplines apply it more. The double-blind review system is completely anonymous. Here, both the author(s) and the reviewer(s) are unaware of each other's identities. The fields of social science and humanities use this approach more. A new type of peer review is emerging in recent years in view of the open access publishing. It is called open peer review. In the new and the emerging model of the open peer review system, both the author(s) and the reviewer(s)' identities are revealed to each other[33,34].

Traditional peer review system

The basic process of the traditional peer review is represented in Figure 1. Several scholars are engaged in the discussions on the pros and cons of traditional

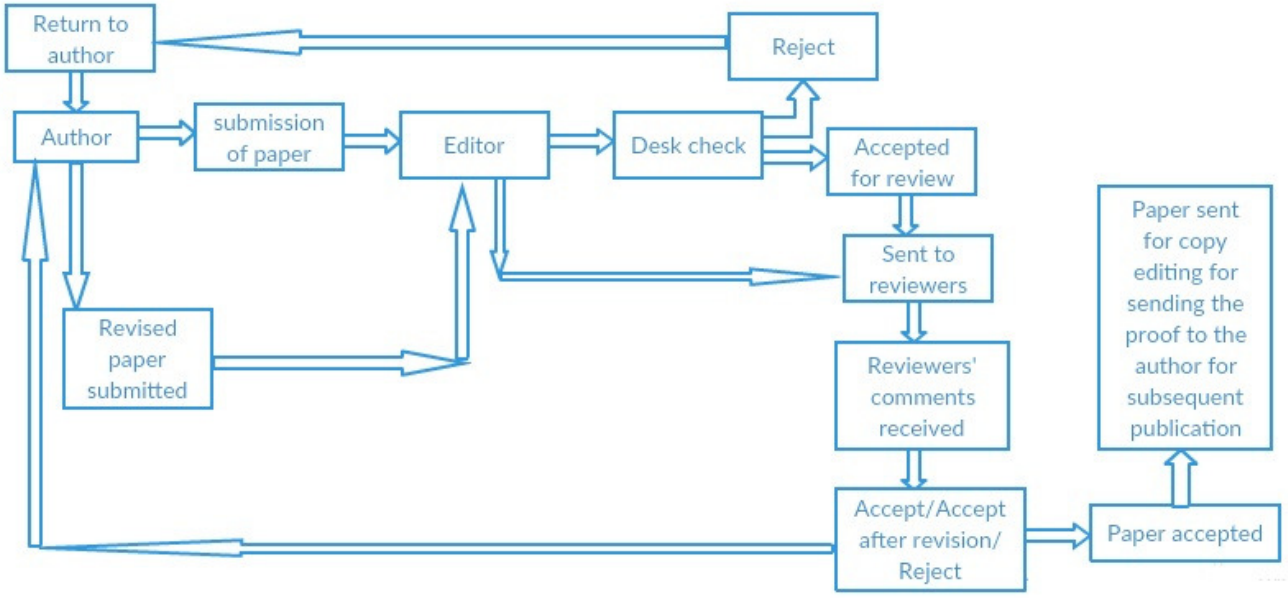

Fig. 1—Traditional peer review system

peer review system[35,36,37]. The strengths of the traditional peer review system may be described as: single-blind peer review system helps the reviewer to write his review report freely; and thus encourage the comparatively junior scholars to review the papers of their seniors without any apprehension of their identities being disclosed; double-blind peer review helps both the author(s) and the reviewers in not apprehending biases and writing review reports without any pressure, respectively[34].

Shortcomings of peer review systems

There are several criticisms of the traditional peer review process from several quarters on several accounts. These are mainly as follows:

1. Biases about gender, language, geographic location, etc.
2. It does not encourage new and innovative methods used in a study or uncommon results of new types of research.
3. It is expensive and causes publication delays.
4. With the possible exceptions, in single-blind peer review process, the reviewer in the guise of their anonymity makes harsh comments, reject papers without assigning enough explanations.
5. Single-blind peer review system helps the reviewer not to shoulder the complete responsibility.
6. In double-blind peer review system, it is often hard for the authors to suppress their identities; these may be revealed by self-citations, writing style, etc.
7. There are evidences of using the author-suggested reviewers in the review process, which is not a healthy practice.
8. An anonymous reviewer may lift the ideas of a submitted paper and write another one himself on the same topic after rejecting the original paper.
9. The system is not foolproof to detect the possible errors made by the authors, thus raises the question of the efficacy of the whole process[37,34,36].
10. Possible lack of out-of-box thinking on the part of an anonymous referee may turn away an important contribution and even get away with it.

Recently, Royal Society of Chemistry (RSC) has announced shifting from single-blind peer review process to the double-blind peer review process for their journal *ChemComm* on a trial basis for 12 months starting from 03 July 2017. They mentioned that they are doing this in response to the interest of the scientific fraternity towards this system to remove the reported biases in the single-blind peer review process. It may be mentioned that RSC, in general, follows single-blind peer review system for their journals[38].

There are also controversies regarding the nomination by peers for the Nobel Prize. Amongst the Indian scientists whose names were recommended by their peers for the Nobel Prize, but did not make it. The names of S. N. Bose (1894-1974), M. N. Saha (1893-1956) and E. C. G. Sudarshan (1931-2018) come to the mind immediately. Bose was nominated for Nobel prize several times for his contributions towards Bose-Einstein statistics, Bose-Einstein condensates and the unified field theory. He was nominated for it by scientists including K. Banerji (1956), D.S. Kothari (1959), S.N. Bagchi (1962) and A.K. Dutta (1962). But his contributions were not found worthy of a Nobel prize by the selection committee[39]. In 2012, the then Director General of European Organization for Nuclear Research (CERN), Rolf-Dieter Heuer rued the fact that Bose did not receive the Nobel Prize[40].

So is the case of Saha. He was nominated for the Nobel Prize several times for his work on ionization equation. He was nominated by Debendra Mohan Bose and Sisir Kumar Mitra (1930). Later, Mitra again nominated him in the years 1939, 1951 and 1955. Arthur Compton nominated him in 1937 and 1940. In 1940, Compton nominated three scientists for Nobel Prize in physics. They are Ernest O Lawrence, Saha and Otto Stern in that order of choice. The interesting point here is that except Saha, both of them got the prize. Lawrence received it in 1939 and Stern got it in 1943. But not Saha. In between, Arnold Sommerfeld nominated him in 1951. Irrespective of the nominations by the peers, the prize eluded him[41]. The curious case of Sudarshan is the latest addition to the examples of missed Nobel Prize in India. While the other scientists of Sudarshan–Glauber representation, Roy. J. Glauber (1925-2018) got the Nobel prize in 2005, Sudarshan missed out. And this was continued even after ten scientists appealed to the Nobel Prize Committee to give Sudarshan his due credit for the discovery[42].

Emerging new system: open peer review (OPR)

Many changes have been proposed to overcome the shortcomings and the lacunae inherent in the traditional peer review process. The open peer review is one such proposed change. An analysis of the available literature shows that there is no uniform definition of OPR. At the same time, it may be noted that the practice of OPR is sometimes varied depending on the subject[43]. Sumner and Shum[44] characterize it as an environment in which authors, reviewers and readers can engage in debate. Mulligan and others[45] defined it as the process where the reviewers' names and authors' names are known to one another, and often also to the public at large. McCormack[46] defined it as a system which tries to conceal the identity of authors or reviewers. On the other hand, keeping the *Shakespeare Quarterly* (SQ)'s open peer review experiment in the background, Fitzpatrick and Rowe[47] mentioned that it is a process of a public and named phase of vetting, open to any reviewer but actively inviting those with relevant expertise.

While discussing OPR, Ware[37] contrasts it with the double-blind peer review system. He defines it as the process where authors' and reviewers' identities are both known to each other (and sometimes publicly disclosed). But the discussion is complicated by the fact that it is also used to describe other approaches, such as where the reviewers remain anonymous, but their reports are published. According to Perakakis, Taylor, Mazza, and Trachana[48] OPR is that form peer review where the reviews are posted online and tagged to the article in question.

Shotton[49] defined it by using its characteristics. For him, it is, first of all, a transparent process. Each submitted manuscript is immediately made available on the journal's website. Reviews and comments from readers are welcomed and are considered alongside the formal peer reviews solicited from experts by the journal. And later all the related documents like reviewers' reports, author(s)' responses and the names of the reviewers, editors, etc. are publicly disclosed. Ford[43], while analyzing different prevailing definitions, mentioned that it is that kind of a process where, in the course of the review and publication of a scholarly paper, the identities of the reviewers are disclosed. Later she[50] added that OPR includes public commentary on published or pre-publication articles, and various implementations like making the comments of the referee and the author publicly available.

According to Clobridge[51], OPR is that type of peer review process where some or all of the process is transparent. Ross-Hellauer[52] defined it as an umbrella term for a number of overlapping ways that peer review models can be adapted in line with the ethos of open science, including making reviewer and author

identities open, publishing review reports and enabling greater participation in the peer review process.

From the above discussion, it is clear that OPR is a process in the opposite direction of the blind peer review. OPR believes not in secrecy but in openness; openness in unmasking the identities of the reviewers and the authors to each other and to the general audience of the scholarly literature at large. Its main aim is to make the whole vetting process of scholarly communication more transparent and less controversial.

Types and features of open peer review (OPR)

The above definitions of OPR lead us to delineate its types and their characteristic features. Ford[43] categorized these into two broad categories: openness and timing. The characteristics under the openness of the reviews process are: signed review, disclosed review, editor-mediated review, transparent review, and crowd-sourced review. The features of the timing of the review process are pre-publication review, synchronous review, and post-publication review.

Types based on openness

1. *Signed review*: In this system, the signed review reports are either published along with the published paper or delivered to the author(s). For example, *F1000Research* (Figure 2) follows the first procedure and the *Current Science* follows the second system.
2. *Disclosed review*: Under this system, both the author(s) and the reviewer(s) are known to each other during the review process. This may help them to discuss the issues concerning the paper with each other. For example, the *Journal of Interactive Media in Education* (JIME) follows this procedure.
3. *Editor-mediated review*: Under this system, the editor facilitates the open peer review by either pre-selecting the papers to be sent to the reviewers or taking the final decision of a paper's acceptance or rejection after the formal review process is over. However, it may be noted that the editor's decisions here may or may not be disclosed publicly.
4. *Transparent review*: Transparent review stands for the fact that here the identities and the reports are all available to all the stakeholders of the process. The identities of the reviewers and authors are known to each other. It is available to the readers also. And the review reports are also available in the public domain for anyone's scrutiny. *F1000research* practices this kind of OPR.
5. *Crowd-sourced review*: It is a kind of OPR where the public may start or initiate the discussion on a paper submitted for consideration of publication in the journal. For example, the journal *The Cryosphere* of the European Geosciences Union (EGU) employs in this model. After the submission of the paper, upon technical corrections, if required, the journal places the submitted papers in the public domain (*The*

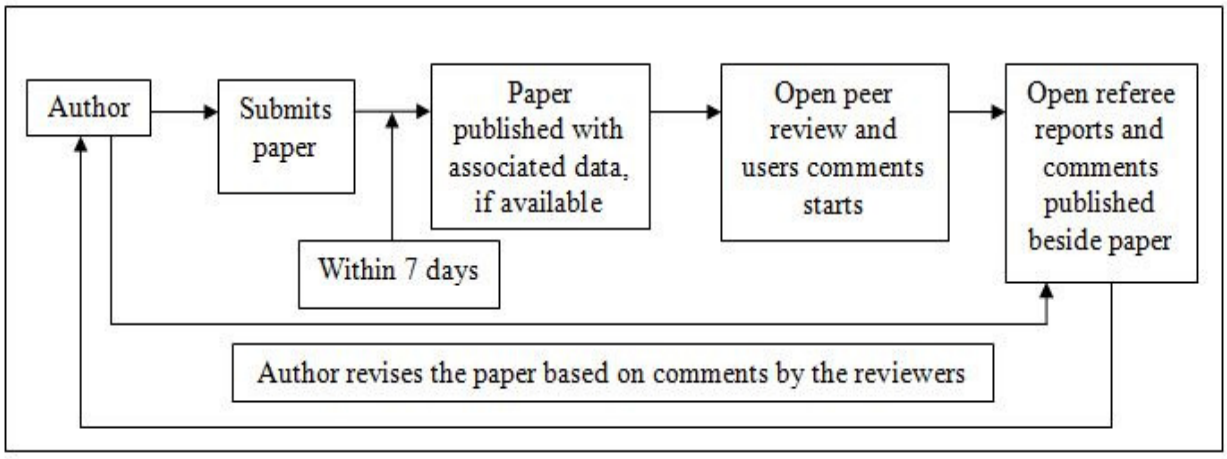

Fig. 2—Open peer review model of *F1000* journal

Cryosphere Discussion) for comments by the designated reviewers (anonymous or open) and the general scientific audience. The journal allows eight weeks' for this process to complete. After this, the editor allows the author(s) to respond and submit the final corrected manuscript for the final decision to be taken by him.

There are differences between this process and the crowd-based peer review proposed by List[53]. The crowd-based peer review proposed by him is not an example of OPR. Rather it was a closed system where the general public can contribute with their comments on the submitted manuscripts, but anonymously.

6. *Consensus review*: The review reports of all the reviewers are consolidated into a single document after internal discussions amongst the reviewers. *eLife* practices this type of peer review process[54] .

OPR types based on timing

1. ***Pre-publication review*:** It happens before the formal publication of a paper. *British Medical Journal* (*BMJ*) follows this procedure.
2. ***Synchronous review*:** Ford[44] noted that this type of review occurs at the same time the publication of the paper. But, she sounds confusing when she again adds that this type of review is approached only theoretically in the field of literature. Ross-Hellauer (2017) criticised her on this aspect.
3. ***Post-publication review*:** It happens after a paper is published, mostly online. F1000 (Figure 2), bioArxiv etc. follow this process. Knoepfler[55] discusses this in detail in his paper.

Innovations in peer review

While trying to define OPR, Ross-Hellauer[56] tried to enlist its seven characteristic traits. These are—open identities, open reports, open participation, open interaction, open pre-review manuscripts, open final-version commenting, open platforms. The journal *Synlett*, published by the German publisher Thieme tried to use an intelligent crowd peer review system. The journal selected and allowed 100 researchers to review and offer their viewpoints on the submitted papers[57].

Apart from the OPR, another innovative but possibly short-lived new type of peer review system was the portable peer review. Here, some agencies offer the peer review of the manuscripts before their publication. The authors can include these reviews while submitting their papers to the journals. These journal publishers accept the reviews as valid ones while deciding on the suitability of the papers for their journal. Some firms like Rubriq, Axios Review, Peerage of Science were involved in this type of service[58]. However, this service has not become popular. For example, Rubriq stopped offering its service in early 2017 to the authors. So is Axios Review. Though Peerage of Science, its activities are reportedly limited[59].

Public Library of Science (PLOS) began allowing the reviewers to decide whether to sign their review reports[60]. Recently, BioMed Central (BMC) took several steps to streamline and open up new vistas in their peer review process. They are trying to automate some of the works related to this process, like checking the ethics, image, etc. This they think may lighten up the workload of their reviewers. For their journals like *BMC Biology*, *BMC Medicine* and *BMC Ecology*, they allow prospective authors to submit their rationale and methods for peer review before experiments are conducted. If their reviewers accept this in principle, and later if the authors complete their work as mentioned in the previously submitted method, their work shall be published in these journals[61].

American Association for the Advancement of Science (AAAS), publisher of the famous journal *Science* introduced Peer Review Evaluation (PRE) programme for their journals in 2016. PRE aims to make the peer review process at the AAAS-published journals more transparent, thereby making it more accountable and transparent. It tries to add new technologies with the existing peer review system to analyse data of the manuscript processing flow in a journal article submission system[62].

Discussion

With the growing number of research areas and the subsequent pressure of publishing a huge amount of research papers, there is a need for a quick and robust peer review system. It may be true that information and communication technologies (ICT) have enhanced the speed of the traditional peer review process. Even then, it did not match with the pressure of time and transparency because of publish or perish or other pressures. OPR is a step to correct and improve the present system. At the same time, it

needs to be borne in mind that with the huge output of research publications throughout the world, the need for quality peer review cannot be wished away.

With more research and limited specialists to do reviews, the traditional peer review process poses challenges. OPR is an effort to overcome the limitations of the traditional peer review system from these criticisms and make it transparent and quick. However, it needs to be accepted that it is not a panacea in itself. Even though PLOS allowed the reviewers to reveal themselves by submitting signed reviews, only 15% of the reviewers are signing their reports. This is against the wish of almost 50% of the authors who want to receive a signed review report[63].

Martins *et al*[64] showed the impact of geographic and gender bias in the research funding applications received by the Swiss National Science Foundation. Lerback and Hanson[65] reported that there is a lack of female representation in earth and space science journals. They conducted the study on the journals published by American Geophysical Union (AGU). Forsythe *et al*.[66] reported an interesting innovation of taking the service of patients as reviewers by some medical organisations. Schroter *et al*.[67] also reported the same type of effort on the part of the *British Medical Journal* (BMJ). Their work showed that at least in some cases the patients' feedback threw light on some aspects which were not highlighted by the reviewers.

The menace of predatory publishing made it more important. The recent series of articles on predatory publishers highlighted the gravity of this problem[68-71]. Only a credible peer review system can stop this production of banal scholarship. The new peer review landscape aims to broaden the horizon of this process, by making it more diverse and socially inclusive. And the role of the editor is important for all these to happen and to happen in a proper manner. In today's peer review scenario, transparency is the key.

Editors have the responsibility of selecting the right reviewers, checking the suggestions made by the reviewers, taking the decision on the acceptability of the submissions, reporting to the editorial board or other responsible boards in case of issues related to the journal's overall peer review policy or in case of controversies etc. In essence, the peer review chain is incomplete without the due importance of the editor or the editor-in-chief[72].

The secrecy surrounding the nominations of the Nobel Prize perhaps is the prime reason for fuelling the controversies regarding the selection of its recipient(s). The policy of the Nobel Foundations prohibits it from disclosing any information including nominees, nominators, investigations and opinions for 50 years. In today's competitive world, especially in science, possibly it is too long a period[73].

Conclusion

Time, technology and some valid criticisms over the traditional peer review system may have ushered in a change in this process, but it does not do away with it. Rather the prime objective in the changing scenario with OPR is to make it more relevant and acceptable to all. It also aims to make everyone accountable in this whole process. It tried to do away with the accusation of biases on the part of the reviewers. It is even more relevant in case of a specialised research area where the experts may know each other and in their areas of research.

Possibly, there can be no argument on whether peer review should change. It should. But the relevant question here is what is being done to change it. The fact is that change is always a part of the peer review process. There are discussions whether artificial intelligence can be used in peer review process[74].

Whether there should be two reviewers or three, closed or open, signed or unsigned review report; questions on ethics of research undertaken etc., need to be decided based on the situation at hand. It may change from subject to subject, journal policy, etc. At the same time, it is essential that the reviewers who do an important task need to be recognized for their hard work. Publons is a recent initiative in this direction. Publons aims at recognizing the contributions of the peer reviewers through Publons Merit[75].

With the fragmentation of the research areas, it is becoming difficult, day by day, for the reviewers to review all kinds of research results. Under these circumstances, it may be helpful if the journal publishers of the same research areas may jointly develop a commonly acceptable guideline on the peer review process for research papers on those subjects. The publication of the open access mega-journals (OAMJ) like *Scientific Reports* and *PLoS One* have opened up new vistas and challenges in the peer review system. These journals generally follow the

soundness-only review process which means that the review process of these journals, in general, follow the technical soundness of the methodology followed in the work. These journals do not necessarily give lot of importance on the novelty or uniqueness of the research work reported[76].

The latest initiative in the peer review process is the plan of using blockchain technology. It is aimed at ensuring recognition of the reviewers, overcoming the problems of lack of enough reviewers, removing biases against the women in the review system, etc. using new metrics. It is claimed that the encryption of this technology may not help the reviews to be validated and stored securely but also allow reviewers to remain anonymous. It is also claimed that the various types of post-publication peer-review may be amalgamated in an easy manner using this technology[77]. These are in preliminary stages of development, but it holds the promise of the re-orientation of the peer-review process in the near future.

The Nobel Foundation may consider taking a step in the direction of making open the details about the nominations and the related information at an early date, rather than keeping this information under wraps for such a long period of 50 years. It is a too long a period to give rise to speculations and controversies. So is the case of nominating fellows of the science academies. For example, in the case of the National Academy Sciences, India (NASI), only the previous fellows of the Academy are aware of the information regarding the nomination of the fellows in a particular year[78]. Ordinary people, including the nominees, cannot know who were nominated and whose nominations were rejected. The nominees whose nominations were rejected may not even know the reason for which their nominations were rejected. This is true even after they themselves were nominated by two existing fellows of good standing. The academies may consider making this whole process more transparent by publishing all the details of the nominees, nominators, reasons for nomination and the subsequent reason for non-selection also in the public domain after the nomination process is over. As nomination at NASI is valid for five years, NASI may consider revealing all the details publicly after this period.

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