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Review Article

The role of international journals in legal/forensic medicine

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ABSTRACT

The foremost task for scientific journals is the dissemination of knowledge and advancement of new ideas and theories, as science does not exist until it has been published. The first prerequisite for scientific information to become effective is determined by a favourable outcome in the publishing process after which the information is made available to the scientific community for affirmation or rejection. The world of scientific publishing has changed substantially during the past decade and these changes have affected all parties involved in the publishing process, as well as the readership. Web-based editorial systems allow on-line submission, reviewing and often immediate access to an electronic version of the paper as soon as it has been accepted. With these changes, the pace of the whole publishing process has changed. Publication puts intellectual property at the disposal of other scientists, who when using it, should credit this by citation. The accumulation of citations is in turn capitalized into the asset called 'reputation'. As the scientific quality and the merit of a scientific publication is very difficult to assess by anyone other than other experts in the same field, peer review is the traditional method of assessing the quality of research.

Bibliometrics have provided the scientific community with new and interesting parameters to analyze scientific literature. As human nature is prone to seek facile solutions, these parameters, such as the Impact Factor, have become very popular among university administrators and have been used as short cuts to "measure" scientific performance and quality, despite the well known limitations and unsuitability of citations as a measure of research quality.

1. Introduction

Public awareness of the importance of the forensic community delivering good quality services to society has varied from time to time, but following the atrocities and natural catastrophes of recent years in various parts of the world, this appreciation has probably now reached its highest point. It is therefore common sense that society, particularly in the administration of justice, will benefit from high quality forensic and medico-legal systems. However, the impact of forensic sciences and legal medicine is a complex and multifaceted process where the beneficial effects cannot always be easily evaluated.

Before advances of scientific knowledge can be utilized and become beneficial to society, several prerequisites in infrastructure are necessary. Scientific theories and facts are often complex and can usually be understood only by those who work within the same field of science. This means that society has to be able to provide academic education, train specialists and give them access to scientific information. Furthermore, it must fund scientific research and provide the scientific community with laboratories with appropriate instrumentation and materials, as science cannot fully flourish without all these essential elements. This is a considerable problem in developing countries due to lack of resources and scientists. There is usually limited access to scientific journals or electronic publication databases or libraries, whereas in industrialized countries we are suffering from information overload. A medico-legal system also needs a legal framework and a judiciary concerned with the administration of justice as well as a properly trained service providing specialists.

2. The task of scientific journals

Jan Vandenbroucke asks, in his article in The Lancet, based on the 175th anniversary lecture at the Royal Society of Arts in London, the question about the interplay between fact and theory and refers to a conversation with Henrik Wulff from Denmark. In Wulff's opinion, completely empirical knowledge cannot exist, as it would be a collection of facts like a pile of grains of sand, without any structure or purpose. Therefore, we need a theory to give it structure and purpose and scientific journals to disseminate it [1].

The freedom to publish was not always as self-evident as we may think today. In the 17th century uncensored publishing was a privilege granted to some of the learned societies by the rulers.

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For example, in 1662 the Royal Society in London was permitted by Royal Charter to publish and in 1665 appeared the first issue of *Philosophical Transactions* founded and edited by Henry Oldenburg, the Society's Secretary. He was German, and became the first science-journal Editor and the inventor of peer review of manuscripts prior to publication [2]. Similarly, *Academia Naturae Curiosorum* in the Free Imperial City of Schweinfurt, founded in 1652, now known as the German Academy of Sciences Leopoldina, was ultimately recognised by King Leopold I in 1677 when he awarded it the title of *Sacri Romani Imperii Academia Naturae Curiosorum* and granted it, among others, the privilege of publishing without censorship [3].

3. Market economy of information exchange and the role of citations

Georg Franck has developed an interesting concept of "the scientific economy of attention". He describes science as a highly developed market economy where information is exchanged for attention and the value of a piece of scientific information is measured in terms of the attention it earns. Publication puts intellectual property at the disposal of other scientists, who if using it, should credit this by citation. The accumulation of citations is in turn capitalized into the asset called 'reputation' [4–6]. This reputation is again crucial for the career development of the scientist, for allocation of university resources or positions, and assessment of grant applications, but is also important means for the ranking of scientific journals.

As scientific quality and the merit of a scientific publication is very difficult to assess by anyone other than other experts in the same field, peer review is the traditional method of assessing the quality of research. However, because peer review can also be problematic, various short cuts have been sought to solve this problem, mainly using bibliometric methods [7]. These are based on the assumption that the influence and quality of an article can be measured by the number of citations [8].

In 1955 Eugene Garfield published the idea of a bibliographic system for science literature, "that can eliminate the uncritical citation of fraudulent, incomplete, or obsolete data by making it possible for the conscientious scholar to be aware of criticisms of earlier papers" [9]. In 1960 Garfield founded the Institute for Scientific Information (ISI®), that has published the Current Contents® and developed bibliometric indicators, such as the Science Citation Index (SCI) and Journal Citation Reports (JCR®). The ISI® was later acquired by the Thomson Corporation and is now a component of the Thomson Reuters Corporation. The Science Citation Index has been used to calculate the annual citation rates of papers by individual scientists and research groups, as well as, for calculating the impact factor of scientific journals. The Impact Factor of journals is published each year by the Thomson Reuters Corporation for those journals which it indexes, and the factors and indices are published in the JCR®. The impact factor is calculated by dividing the number of citations to any item in a journal in the calendar year by the total number of source items published in the two previous years. The source items refer to full papers: original articles, reviews, full length proceedings papers, rapid or short communications but not to items, such as editorials, short meeting abstracts or errata. An impact factor of 1.0 means that, on average, the articles published in a given journal one or two year ago, have been cited once by the journals included in the ISI database.

In addition to Impact Factor, the Journal Citation Reports® record other bibliographic parameters. The 'immediacy index' is a measure of how quickly articles in a journal get cited and it is calculated by dividing the citations a journal receives in a given year by the number of articles it has published in that same year. The cited half-life is a measure of the rate of decline of the citation curve and the number of years that after which 50% of lifetime citations will have been received. Table 3 shows a listing of forensic and medico-legal journals according to impact factor and some other bibliometric details for the publication year 2007, as published in the 2007 JCR Science Edition subject category Medicine, legal.

The Impact Factor has been criticised being skewed, e.g. being not statistically representative of individual journal articles and showing no detectable correlation with citation rate of individual articles [10–12]. Therefore alternate metrics have been sought in recent years. Two such examples, which quantify different aspects of a journal's performance, are the SCImago Journal Rank Indicator and the EigenFactor™, both freely available at: www.scimagojr.com and www.eigenfactor.org. They use broadly the same methodology but different sources of raw citation data to provide their rankings. Their analysis relies on eigenvector algorithms, which allow for the quality of the citing source to be factored into the ranking equation, rather than simply the number of citations. For instance, a citation from a more prestigious journal will carry more weight than a citation from a less prestigious source. The SCImago Journal Rank was developed by a research group from the University of Granada, Extremadura, Carlos III (Madrid) and Alcalá de Henares, dedicated to information analysis, representation and retrieval by means of visualization techniques. SCImago Journal Rank is based on citation data of the more than 15,000 peer reviewed journals indexed by Scopus from 1996 onwards [13].

The Eigenfactor™ and Article Influence are recently developed metrics based on data held in Thomson Reuters' Journal Citation Reports by a non-commercial academic research project sponsored by the Bergstrom lab in the Department of Biology at the University of Washington. Eigenfactor™Score (EF) is a measure of the overall value provided by all of the articles published in a given journal in a year (Table 1), whereas Article Influence is calculated by dividing the Eigenfactor by the percentage of all articles recorded in the Journal Citation Reports that were published in the journal. Article Influence is therefore conceptually similar to the Impact Factor and SCImago Journal Rank.

The h-index was proposed in 2005 by Professor Jorge Hirsch as a metric for evaluating individual scientists. The h-index can be applied to any group of articles, including those published in a particular journal in any given year (Table 2) [14].

4. Problems of citation analysis

Although the original intent of Garfield was to 'eliminate the uncritical citation of fraudulent, incomplete, or obsolete data' [9], the use of the term 'impact factor' has gradually been broadened to describe both journal and author impact. According to this ideology and the 2007 JCR Science Edition, an article published in the *New England Journal of Medicine* (IF 52,589) is supposed to be more than five times worth an article published in the *British Medical Journal* (IF 9723). However, Seglen has pointed out that the most cited 15% of the articles of a journal account for 50% of the citations

Table 1
Eigenfactor™Score (EF) of some Forensic Journals in 2006. Retrieved November 12, 2008, from http://www.eigenfactor.org, Thomson JCR® subject category, Medicine, legal. Copyright © 2008 The Thomson Corporation.

Journal title	Eigenfactor™ Score
Forensic Science International	0.015149
Journal of Forensic Sciences	0.011045
International Journal of Legal Medicine	0.0047797
American Journal of Forensic Medicine and Pathology	0.0023625
Science and Justice	0.00083003
Medicine Science and the Law	0.00062295

Table 2
Forensic Journals by h-index in 2007. SCImago (2007) SJR – SCImago Journal & Country Rank. Retrieved November 12, 2008, from http://www.scimagojr.com.

Journal title	H-index
Forensic Science International	40
International Journal of Legal Medicine	37
Journal of Forensic Sciences	36
American Journal of Forensic Medicine and Pathology	22
Science and Justice	14
Legal Medicine	13

and the most cited 50% of the articles account for 90% of the citations, and hence, there is very little correlation between the impact of an article and the journal in which it is published. Therefore, if the same IF-score is assigned to all articles, even the uncited articles of the same journal are given full credit for the impact of the highly cited minority [11]. Similarly, in a citation analysis of individual papers published in *Nature*, it was found that 89% of the 2004 IF was generated by only 25% of their papers [15].

It is also erroneous to compare journals in different disciplines or even within the same subject area if the scope of the journals in question is not similar. According to Smith, the Higher Education Council in Britain came to understand that it was assessing science in a fundamentally unscientific way by using the impact factor of journals as a surrogate for the impact of articles published in them [16].

ISI has cautioned against using journal impact factors to evaluate individuals and also Amin and Mabe consider it highly suspect to extend the use of journal impact factor to the authors [17–19].

While citation analysis is considered to be concrete – not an anecdotal measure of scientific impact – there are several problems associated with citation analysis in general. It has been criticized in that nobody has independently audited the underlying data to validate their reliability. It has been further claimed, that due to technical problems, 20% of the ISI's citation indexes might be erroneous [7,20–24]. Albeit a minor problem but an interesting phenomenon is also that citation of invalid scientific literature seems to continue even after the article found erroneous has been retracted. Scientific invalidity can be generated due unintentional errors or intentional action including plagiarism or even fraudulent fabrication of data. Since 1984, the National Library of Medicine has been tagging in their MEDLINE® database publications that have been retracted after publication due to invalidity. Gabehart analyzed citations to 211 retracted articles published between 1996 and 2000 and found, that about 30% of the citations occurred after the articles had been retracted [25]. Although the absolute figures of retracted papers are low, in comparison to the total number of scientific papers published annually, the trend appears to be rising; with 130 retracted publications in the 1980's, 313 in 1990's and 587 by November 4th, 2008, since the beginning of the year 2000. An analysis of the database showed that there were only two articles that had been retracted from a medico-legal or forensic journal of the total of 1069 articles currently retrievable in the database.

Testing the claim of citation analysts, that scientists cite their influences, Michael and Barbara MacRoberts examined 15 randomly selected scientific papers on the history of genetics to see how much influence appears as references in bibliographies. They found that of the minimum of 719 references expected to have been cited to cover the influence in them, they contained only 216 (30%), meaning that the authors of the papers examined had hardly been citing influences appropriately [26]. In another experiment testing the correctness of citation of 13 known facts in 23 subsequent papers, they found that 37% had been correctly credited, 41% had not been credited at all and 22% had been credited to a secondary source [27]. Due to these and other problems associated with the citing behaviour of scientists, such as ignorance of the literature, citer motivation, self-citation and variation in citation rates with disciplines, nationality and time period, it is highly unlikely that citations can be used as indicators for quality [23].

5. International forensic/medico-legal journals

The term 'international journal' could be understood as a journal published by an internationally-operating publishing house, as a rule in the English language, with editors/editorial board members representing various nationalities and with a good international coverage by high circulation or, what is nowadays even more important, with easy electronic access via various bibliographic databases. Quite a few, though not all of the journals referred to in the following list, fulfill many of these criteria.

The JCR® has various journal categories and a sub-category, "Medicine, legal", comprises 9 titles in the 2007 JCR® Science Edition, of which only 6 belong to the actual core of forensic science and legal medicine journals (Table 3). These are: the *International Journal of Legal Medicine*, *Forensic Science International*, *Journal of Forensic Sciences*, *American Journal of Forensic Medicine and Pathology*, *Science and Justice*, and *Medicine, Science and Law*. Of the three others: *Regulatory Toxicology and Pharmacology* is devoted to the legal aspects of toxicological and pharmacological regulations, *Expert Opinion on Therapeutic Patents*, to the technological advances and developments in pharmaceutical patents and *The Journal of Law, Medicine & Ethics* covers issues related to public health, health disparities, patient safety and quality of care, and biomedical science and research.

All forensic and medico-legal journals have other properties than just the IF or other bibliometric parameters and that have significance to authors and have to be taken into account before submission of a manuscript. For instance, the relevance of the manuscript to the journal's subject area, reputation of the journal, quality and timeliness of the peer-review process, probability of acceptance, publication time and possible costs associated with the publication.

There are all-round forensic journals, such as the bi-monthly *Journal of Forensic Sciences* (JFS), the official journal of the American Academy of Forensic Sciences (AAFS) published by Wiley–Blackwell and *Forensic Science International* (FSI), published by Elsevier, that accept both forensic science as well as medico-legal topics. They are similar as to the scope, publication frequency, number of printed articles and pages as well as total cites *per annum*. Recently the FSI has had higher impact factor and immediacy index than the JFS (Table 3).

There are other journals some of which are more focussed on legal-medicine including forensic haemogenetics, such as the *International Journal of Legal Medicine* (Int J Leg Med), published by

Table 3
Listing of forensic and medico-legal journals according to impact factor and some other bibliometric details according to the 2007 JCR® Science Edition subject category Medicine, legal. Copyright © 2008 The Thomson Corporation.

Journal title	IF	Articles 2007	Total cites	Immediacy index	Cited half-life
International Journal of Legal Medicine	3.030	80	1520	0.300	5.8
Forensic Science International	2.015	289	4705	0.336	5.3
Journal of Forensic Sciences	1.037	227	3713	0.137	8.4
American Journal of Forensic Medicine and Pathology	0.603	80	894	0.050	9.1
Science and Justice	0.537	16	161	0.062	6.0
Medicine, Science and Law	0.375	56	404	0.018	>10.0

Springer, the official journal of the International Academy of Legal Medicine (IALM) with 5 annual issues in 2008 and which has currently the highest impact factor in the JCR® sub-category, "Medicine, legal". *The American Journal of Forensic Medicine and Pathology* (Am J Forensic Med Pathol) the official journal of the National Association of Medical Examiners (NAME) in the United States, which is published quarterly by Lippincott Williams & Wilkins. *Science & Justice* (before 1995, *Journal of the Forensic Science Society*) the official, quarterly publication of the Forensic Science Society, UK, the publication of which was outsourced to Elsevier two years ago. *Medicine, Science and the Law*, published by Barnsbury Publishing, is a quarterly journal and the official publication of the British Academy of Forensic Sciences.

Other English language journals that are not yet covered by the ISI are: Journal of *Forensic and Legal Medicine* (before 2007, *the Journal of Clinical Forensic Medicine*) by Elsevier and the official journal of the Faculty of Legal and Forensic Medicine, the Australian College of Legal Medicine and the British Association in Forensic Medicine, publishing 8 issues in 2009, *Legal Medicine* (Tokyo), the official English language journal of the Japanese Society of Legal Medicine, published 6 times a year, *FSI Genetics*, a recent spin-off of the FSI-Brand – specifically devoted to Forensic Genetics, both published by Elsevier and *Forensic Science, Medicine, and Pathology,* published 3 times a year by Humana Press.

There are several other English language journals of national societies such as the *Scandinavian Journal of Forensic Science*, the official journal of the Danish, Norwegian and the Swedish societies for forensic medicine, the *Canadian Society of Forensic Science Journal*, published quarterly, the *Romanian Journal of Legal Medicine*, published quarterly by the Romanian Society of Legal Medicine, and *the Australian Journal of Forensic Sciences*, official publication of the Australian Academy of Forensic Sciences published bi-annually by Taylor & Francis.

It would be interesting to characterize individual forensic journals in more detail as to the type of papers they publish. In principle, the existing huge reference databases such as the SCOPUS, the largest abstract and citation database of peer-reviewed literature, should give the possibility of a field-specific and more detailed comparison. However, detailed assessment of individual publications retrieved from the database in a test run, showed such an overlapping and inaccuracy of the subject areas, that the field-specificity cannot be considered reliable enough for this type of analysis. The data may show rough tendencies but the error rate is too high and does not allow any definite conclusions. This is mainly due to non-uniformity of keyword practices and overlapping of the subject areas. For example, a paper dealing with bullet wounds can have the key words "wound" suggesting pathology as well as "ballistics" and could be retrieved into two groups, pathology as well as physical science.

Bibliometrics have provided the scientific community with new and interesting parameters to analyze scientific literature. However, the worrying phenomenon is that, as human nature is prone to seek facile solutions, university administrators have overenthusiastically used these bibliometric parameters, such as the Impact Factor, as a surrogate measure to assess the quality of scientific output, despite the well-known limitations and unsuitability of citations as a measure of research quality.

David Colquhoun, from the Department of Pharmacology at the University College, London, UK, in his paper 'How to get good science', strongly criticizes the trends of corporatisation that are becoming more common in universities when these are run by managers who confront the academics with publication scores. I quote: 'The problem arises when people with little understanding of scholarship, or of statistics, attempt to measure numerically things that cannot be so measured. That is a plague of our age but it is a process loved by politicians, 'human resources'-people and university managers'. Colquhoun also refers to two scientists, Erwin Neher and Bert Saksman, the latter of whom failed to meet the publication target set by the Imperial College Medical School in London in six of the ten years from 1976 to 1985. In 1991 these men got the Nobel Prize for physiology or medicine [12].

Conflict of interest

None.

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