A Bibliometric Study of Highly Cited Reviews in the *Science Citation Index Expanded*™

Yuh-Shan Ho
Trend Research Centre, Asia University, No. 500, Lioufeng Road, Wufeng, Taichung County 41354, Taiwan, China. E-mail: ysho@asia.edu.tw

Michael Kahn
Centre for Research on Evaluation, Science and Technology, Stellenbosch University, South Africa. E-mail: mjkahn@sun.ac.za

Some 1,857 highly cited reviews, namely those cited at least 1,000 times since publication to 2011, were identified using the data hosted on the *Science Citation Index Expanded*™ database (Thomson Reuters, New York, NY) between 1899 and 2011. The data are disaggregated by publication date, citation counts, journals, Web of Science® (Thomson Reuters) subject areas, citation life cycles, and publications by Nobel Prize winners. Six indicators, total publications, independent publications, collaborative publications, first-author publications, corresponding-author publications, and single-author publications were applied to evaluate publication of institutions and countries. Among the highly cited reviews, 33% were single-author, 61% were single-institution, and 83% were single-country reviews. The United States ranked top for all 6 indicators. The G7 (United States, United Kingdom, Germany, Canada, France, Japan, and Italy) countries were the site of almost all the highly cited reviews. The top 12 most productive institutions were all located in the United States with Harvard University (Cambridge, MA) the leader. The top 3 most productive journals were *Chemical Reviews*, *Nature*, and the *Annual Review of Biochemistry*. In addition, the impact of the reviews was analyzed by total citations from publication to 2011, citations in 2011, and citation in publication year.

Introduction

Publication is vital for the transmission and dissemination of scientific knowledge because without publication, "science is dead" (Piel, 1986, p. 201). The contribution of scientific articles resides not only in their originality and creativity, but also in their continuity and contribution to the discipline (Ho, 2004). Citing the original article not only conveys respect for the work of the authors who presented their research for critical appreciation, but also adds to the knowledge base through further discussion (Ho, 2011). Citation analysis is a common method for quantifying this scholarly contribution or research visibility (Lefaivre, Shadgan, & O'Brien, 2011), with articles of highest quality more likely to be found in the most-cited quintile than in the least-cited (Patterson & Harris, 2009). Citation is useful to identify classic works and high-impact journals (Dubin, Häfner, & Arndt, 1993).

An issue of considerable interest for bibliometrics relates to the attainment of a Nobel Prize, an award given for the highest scientific achievement in the various fields in which it is awarded (Shelton & Holdridge, 2004). Eugene Garfield, the founder of the Institute for Scientific Information (ISI, Philadelphia, PA, now Thomson Reuters, New York, NY), was one of the first systematically to use citation analysis to identify potential Nobel Prize winners based on their publication citation rankings (Garfield, 1970). Garfield and Welljamsdorof (1992) concluded that in the top 0.1% of authors, a significant percentage has won the Nobel Prize or will go on to win the prize in later years. A high correlation between bibliometric indicators and Nobel Prize successes was also found in chemistry, medicine/physiology, and physics (Rodríguez-Navarro, 2011).

In fields such as medical research, it has been found that large industry-funded trials in oncology or cardiology and involving large-group authorship, are associated with greater subsequent citations (Kulkarni, Busse, & Shams, 2007). However, it is also reported that citation frequencies do not appear to reflect methodological quality in lung cancer randomized trials (Berghmans et al., 2003).

An analysis of classic article citation rates reveals useful and interesting information about scientific progress in one

Received December 7, 2012; revised March 19, 2013; accepted March 19, 2013

 • Published online 6 November 2013 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/asi.22974

research field (Fardi, Kodonas, Gogos, & Economides, 2011). Numerous classic articles have been investigated in scientific journals including *Analytical Chemistry* (Riordon, Zubritsky, & Newman, 2000), *Indoor Air* (Sundell & Nazaroff, 2009), and *IEEE Software* (O'Leary, 2009), as well as fields such as the environmental sciences (Khan & Ho, 2012), chemical engineering (Ho, 2012), and obstetrics and gynecology (Brandt, Downing, Howard, Kofinas, & Chasen, 2010). Moreover, research topics, for example, adsorption (Fu, Wang, & Ho, 2012), water resources (Chuang, Wang, & Ho, 2011), anesthesia (Baltussen & Kindler, 2004), surgery (Brooke, Nathan, & Pawlik, 2009), Parkinson's disease (Ponce & Lozano, 2011), and depression (Lipsman & Lozano, 2011) have also been studied in relation to their article-citation rates. Research trends and classic articles' characteristics were analyzed in these studies.

By contrast, the typical review article involves no new experimentation, but draws on primary sources to present the state of art in a specific field and offer new perspectives. Reviews provide a special tool for practitioners in a given field, with organizations such as the nonprofit scientific publisher, Annual Reviews (Palo Alto, CA) devoted to producing reviews across the disciplines. However, there is no absolute way of determining the characteristics of a review article. After all, many articles commence with a literature review. Accordingly, a review article is recognized as such based on the choice of host journal, the declared scope of the article, its associated keywords, and the stated document type. These characteristics involve choices both on the part of the author and the parties who are indexing the publication, with the prior record of accomplishment of the authors also having an influence on the descriptors. If a leader in a field states he or she is presenting a review article, then few journal editors are likely to disagree. Rigorous systematic reviews are cited more often than narrative ones, an indirect endorsement of the hierarchy of evidence (Montori, Wilczynski, Morgan, Haynes, & the Hedges Team, 2003). Reviews also receive more citations than articles (Guimaraes & Carlini, 2004; Kulkarni, Aziz, Shams, & Busse, 2009).

The rapid increase in the volume of scientific activity has made it nearly impossible to identify research "stars" using the standard bibliometric tools (Gingras & Wallace, 2010). Classic or highly cited articles are thus of particular importance because a high citation count is an indication of high impact or visibility in the research community (Wohlin, 2005). Highly cited articles provide an interesting and useful insight into which authors, articles, and topics are influencing a research discipline over time (Smith, 2008). For example, Picknett and Davis (1999) show how the most highly cited articles have influenced subsequent advances in molecular biology. Classic articles also play an important role in teaching students (Raff, 2005) and developing presentation skills (McGeown, 2006), in addition to subspecialties such as organometallic chemistry (Duncan & Johnson, 2007), and specialty topics such as capillary filtration (Lauer & McManigill, 1986).

For the purposes of this study, highly cited reviews defined by the Web of Science® (WoS) were considered. We used the *Science Citation Index Expanded*™ (*SCI Ex*; WoS, Thomson Reuters, New York, NY) to identify highly cited reviews and analyzed these with regard to authors, institutions, and countries with citation histories, total citations, and citations.

Methods

Specifically data used in this study were retrieved by searching for the word "review" in the document type field from 1899 to 2011 based on *SCI Ex* (updated on November 29, 2012); 938,156 reviews were found. Another filter, *TC2011* was employed to retrieve reviews. The total number of times a review was cited from its publication to the end of 2011 was recorded as *TC2011* (Chuang et al., 2011; Wang, Yu, & Ho, 2010). The criterion $TC2011 \geq 1{,}000$ was used to select the reviews as the highly cited reviews (HCRs). The advantage of this indicator is its relative stability. Likewise, *C2011*—the total number of citations of a review in 2011, and *C0*—the total number of citations of a review in its publication year, were employed to characterize the HCRs. The records were downloaded into standard spreadsheet software, and then manipulated, with careful cleaning of addresses, an attribute that remains problematic for bibliometric analysis. Affiliations for the Federal Republic of Germany (Fed Rep Ger), West Germany, Bundes Republik, and Germany were reclassified as being from Germany (Ho, 2012). Affiliations for the Union of Soviet Socialist Republics (USSR) and Russia were reclassified as being from Russia (Ho, 2012). Reviews originating from England, Scotland, Northern Ireland, and Wales were reclassified as being from the UK (Chiu & Ho, 2005). Reviews published before 1997 from Hong Kong were included in the count for the People's Republic of China (Wang et al., 2010).

Collaboration type was determined by the affiliation of the authors, the term *country-independent review* was assigned if the researchers' affiliations were from the same country. The term *internationally collaborative review* was given to reviews that were coauthored by researchers from multiple countries. The term *institution independent review* was assigned if the researchers' affiliations were from the same institution. The term *interinstitutionally collaborative review* was assigned if authors were from different institutions. The impact factor (IF) of a journal as reported in *Journal Citation Reports 2011* was determined for each review (Thomson Reuters, 2012).

Results and Discussion

Effect of Time on Citation Analysis

It is accepted that citation frequency is a better measure of the impact of an individual's works than how many articles a person has authored (Stern & Arndt, 1999). With this in mind, we identified 1,857 HCRs (0.20% of 938,156

DOI: 10.1002/asi

reviews) in *SCI Ex* between 1906 and 2010. The average number of authors for these HCRs was 4.8 with 420 as the largest number. Before 1952, HCRs were generally contributed by single authors. The average number of authors per HCR increased from 1.6 in the 1950s to 3.7 in the 1990s, and to 10.0 in the 2000s. Of the 1,857 HCRs, 604 (33%) were written by single authors, 665 (36%) by two authors, 273 (15%) by three, 112 (6.0%) by four, with 203 (11%) involving more than four authors. The preponderance of single-authored reviews was found in all fields except in the biomedical and life sciences (Foo, 2011) as well as research related to ocean circulation (Zhang, Qian, & Ho, 2009) and biosorption technology in water-treatment research (Ho, 2008).

English was the dominant language of HCRs, with only one HCR published in German and Russian. “Concerning Adsorption in Solutions” (Freundlich, 1906) was not only the earliest HCR (*TC2011* = 1,395), but also the only one written in German. In it the author introduced the “Freundlich isotherm” one of the most-applied adsorption equilibrium isotherms. The most recent HCR in this study was published in 2010, “Review of Particle Physics” (Nakamura et al., 2010) with *TC2011* = 1,316. In addition, “Double-Time Green Functions in Statistical Physics” (Zubarev, 1960) with *TC2011* = 1,267 was the only HCR written by a Russian. Figure 1 shows the publication years of the HCRs, with the 1990s accounting for the most at 789, followed by the 2000s with 442 and the 1980s with 421. Figure 1 also shows that the trend in citations per HCR (CPP; citations per paper) was different from the number of HCRs across the decades, with the highest score occurring in the 1940s.

Cited Reference Count

From 1906 to 2010, the average-cited-reference count per HCR was 232, ranging from 0 to 5,366 cited references. Of the 1,857 HCRs, 29 (1.6%) cited at least 1,000 references, 132 (7.1%) cited 500–1,000 references, 556 (30%) cited 200–500 references, 1,140 (61%) cited 0–200 references, and 9 HCRs cited none. “Review of Particle Physics” was published in the *Journal of Physics G–Nuclear and Particle Physics* in 2010 by 635 authors with 5,366 references. This review probably cites the most references in *SCI Ex*. “Review of Particle Physics” in 2008, “Energy-Levels of A = 21–44 Nuclei (VI)” in 1978, and “Review of Particle Physics” in 2002 also cited copious references totaling 4,759, 3,760, and 3,085, respectively. It has been reported that a citation to a multiple-authored article is worth more to its author than a citation to a single-authored article (Bridgstock, 1991; Diamond, 1985). However, this is inconsistent with our analysis of the HCRs. Thirty-four percent of the top *TC2011*

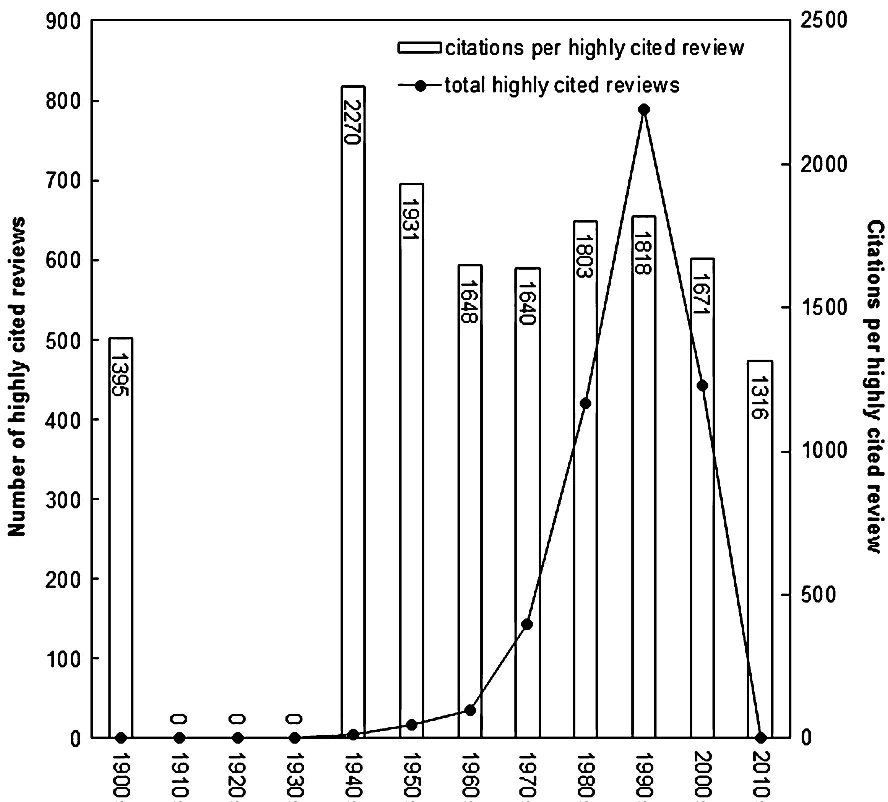

FIG. 1. Illustration showing the number of the highly cited reviews and citations per review by decade of publication.

DOI: 10.1002/asi

HCRs were published by single authors, 30% by two authors, 10% by three authors, and 26% by more than four authors.

Journals and Web of Science® Categories

According to *Journal Citation Reports 2011*, the WoS indexes 8,336 journals with citation references across 176 WoS categories in the science edition (Thomson Reuters, 2012). The HCRs were published in 376 journals and cover 113 WoS categories. These journals were published in 12 countries including 223 from the United States, followed by the UK with 91, The Netherlands with 25, Germany with eight, Switzerland with eight, Denmark with five, Ireland with two, and one each from Italy, Canada, France, Singapore, and Russia. Classic articles in medical fields follow a different pattern, so that the top-100-cited articles were found in 11 journals of obstetrics and gynecology (Brandt et al., 2010), 10 journals of general surgery (Paladugu, Schein, Gardezi, & Wise, 2002), seven journals of orthopedic surgery (Kelly, Glynn, O'Briain, Felle, & McCabe, 2010), 15 journals of urology (Hennessey, Afshar, & MacNeily, 2009), five journals of anesthetic citation classics (Baltussen & Kindler, 2004), and 13 journals of ophthalmology (Ohba, Nakao, Isashiki, & Ohba, 2007). Of these 376 journals, 199 (53%) journals contained only one HCR, 115 (31%) journals contained two to four HCRs, and 62 (17%) journals contained more than four HCRs. Eighty-four journals had IFs > 10 in 2011; 184 journals with IFs between 5–10; 171 were between 3 and 5; 109 < 3; and 63 journals had no IFs in *JCR* in 2011. *Chemical Reviews* published the most HCRs with 127 reviews (6.8%), followed by *Nature* with 113 reviews and *Annual Review of Biochemistry* with 96 reviews, and their IFs were 40.197, 36.280, and 34.317, respectively (Table 1). As expected, the top articles were published in journals with high IFs, similar to anesthetics (Baltussen & Kindler, 2004). Classic articles are mainly presented in high-impact journals (Aksnes, 2003). The leading journals attracted the classic publications, which in turn maintained the high IFs for these journals (Schein, Paladugu, & Sutija, 2000). In addition, HCRs with *TC2011* > 1,000 could also be found in journals with lower IFs such as *Knowledge Engineering Review* with IF = 0.545 and *Studies in Applied Mathematics* with IF = 0.819. Furthermore, a classic article "Pseudo-Second Order Model for Sorption Processes" published in *Process Biochemistry* with an IF of 2.648 in 2010 has been ranked the top in annual citation in the chemical engineering field since 2008 (Ho, 2012). The distribution of journals that published HCRs with their IF was as follows: 65% of total HCR had an IF of ≥10, 9.9% had an IF of 5–10, 5.5% had an IF of 4–5, 3.8% had an IF of 3–4, 4.6% had an IF of 2–3, 1.2% had an IF of 1–2, 0.11% had an IF < 1, and 10% had no IF information in 2011. The mean IF of the journals was 23.336. The journal with the highest IF (53.298) was the *New England Journal of Medicine*; *Knowledge Engineering Review* had the lowest IF (0.545).

Within the 113 WoS categories, 62 categories (55%) generated 0–5 HCRs, 14 categories (12%) generated 6–10 reviews, 16 categories (14%) 11–30 reviews, 11 categories (9.7%) 31–50 reviews, and 10 categories (8.9%) generated more than 50 reviews. The top four categories included biochemistry and molecular biology with 386 HCRs, multidisciplinary chemistry with 221 reviews, multidisciplinary sciences with 202 reviews, and cell biology with 189 reviews; these four had a majority of the total HCRs, with the percentage of 47%.

TABLE 1. Characteristics of the top 15 journals with highly cited reviews.

Journal	TP (%)	IF2011	PC	Web of Science® category	Rank
Chemical Reviews	127 (6.8)	40.197	US	Multidisciplinary chemistry	5
Nature	113 (6.1)	36.280	UK	Multidisciplinary sciences	11
Annual Review of Biochemistry	96 (5.2)	34.317	US	Biochemistry and molecular biology	13
Cell	92 (5.0)	32.403	US	Biochemistry and molecular biology Cell biology	19
Science	83 (4.5)	31.201	US	Multidisciplinary sciences	24
Reviews of Modern Physics	57 (3.1)	43.933	US	Multidisciplinary physics	4
New England Journal of Medicine	53 (2.9)	53.298	US	General and internal medicine	2
Annual Review of Immunology	51 (2.7)	52.761	US	Immunology	3
Physiological Reviews	45 (2.4)	26.866	US	Physiology	34
Pharmacological Reviews	29 (1.6)	20.225	US	Pharmacology and pharmacy	61
Methods in Enzymology	27 (1.5)	2.042	US	Biochemical research methods Biochemistry and molecular biology	4400
Angewandte Chemie-International Edition	27 (1.5)	13.455	Germany	Multidisciplinary chemistry	136
Psychological Bulletin	23 (1.2)	14.457	US	Psychology Multidisciplinary psychology	98
Journal of Biological Chemistry	23 (1.2)	4.773	US	Biochemistry and molecular biology	934
Psychological Review	22 (1.2)	7.756	US	Psychology Multidisciplinary psychology	357

Note. TP = total number of HCRs; PC = issued country; *IF2011* = impact factor in 2011; Rank = impact factor rank in 8,336 journals in *2011 Journal Citation Reports, Science Edition*; UK = United Kingdom; US = United States.

Citation Life Cycles of Highly Cited Reviews

Citation frequency over time has long been a topic for investigation (Avramescu, 1979). Highly cited articles published in *SCI Ex* were clustered according to delayed rise, slow decline and early rise, rapid decline patterns (Aversa, 1985). The life cycle of the most frequently cited articles in water resources (Chuang, Wang, & Ho, 2011), the citation life cycles of the top-cited adsorption-related articles (Fu et al., 2012) and top-cited articles in chemical engineering in *SCI Ex* (Ho, 2012) have also been studied in recent years. Five typical citation frequency curves of individual articles including (a) initially much-praised articles; (b) recognized basic work; (c) scarcely reflected work; (d) well-received, but later erroneous qualified work; and (e) general work were reported early (Avramescu, 1979). Articles published earlier attracted more citations, compared to those published later (Lefaivre et al., 2011). Four hundred fifty-five HCRs (25% of 1,857 HCRs) had no citation in the publication year ($C0 = 0$) and 23 HCRs (1.2%) had citations of at least 100 ($C0 \geq 100$), including six in the 1990s and 17 in 2000s. HCRs with higher citations in the publication year ($C0$) were likely to rise appreciably in later years. One of reasons for this rise might be that the number of journals in the *SCI Ex* database increased from 4,963 in 1997 to 8,336 in 2011. Figure 2 shows the article life cycle for the top-10-most-cited HCRs in their publication year ($C0 \geq 140$). The HCR published by Lander et al. (2001) had 738 citations in the year of publication and 1,189 citations the year after publication. Garfield (2002) noted that a review with 350 citations within 1 year after publication was the highest citation recorded. The 10 HCRs were all published after 1991 and eight were published in the 2000s. A decrease in the number of citations after publication year or later years could be found in most HCRs. According to the five typical citation frequency curves (Avramescu, 1979), these HCRs were initially much-praised articles or recognized basic work. “MicroRNAs: Genomics, Biogenesis, Mechanism, and Function” (Bartel, 2004) published in *Cell* and “The Electronic Properties of Graphene” (Castro Neto, Guinea, Peres, Novoselov, & Geim, 2009) in *Reviews of Modern Physics* were the HCRs still keeping a sharp increase in citations since their publication year to 2011. However, this just might be the first part of the citation frequency curve of recognized basic work. In *SCI Ex*, “Initial Sequencing and Analysis of the Human Genome”

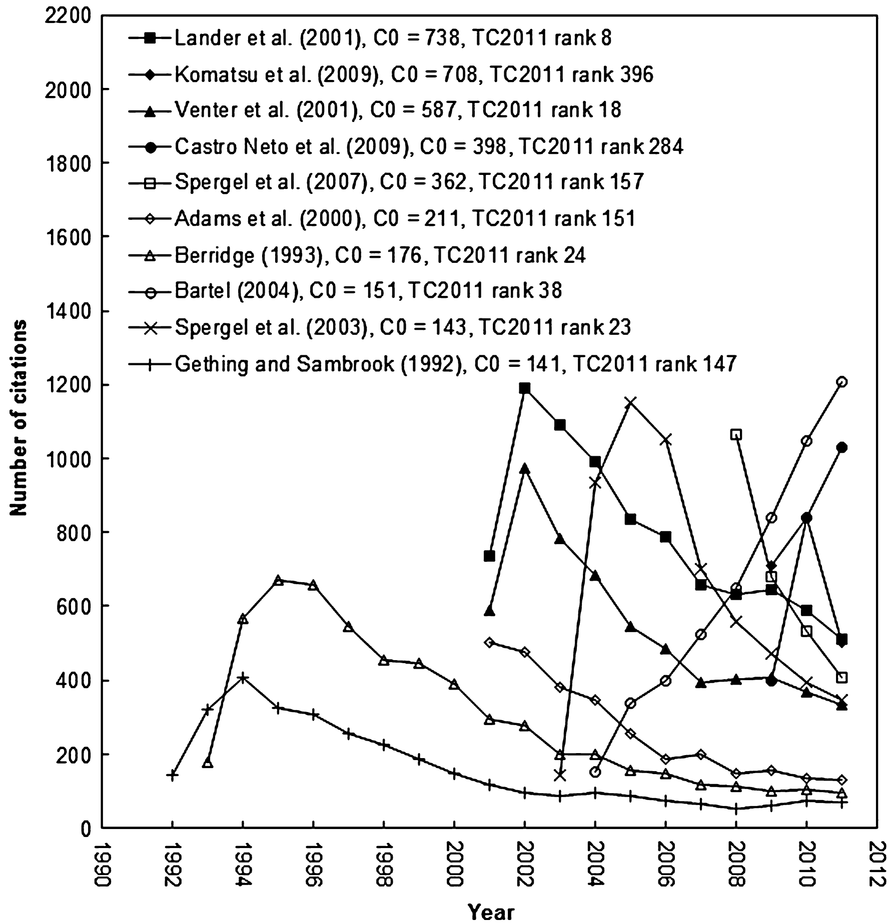

FIG. 2. Illustration showing the life of the top 10 most frequently cited reviews in their publication year ($C0 > 140$).

DOI: 10.1002/asi

(Lander et al., 2001) published in *Nature* had the highest citations (*C0* = 738) in its publication year by 243 authors from 53 institutions in the United States, UK, Japan, France, Germany, China, Ireland, and Israel. This was followed by "The Sequence of the Human Genome" (Venter et al., 2001) published in *Science*, with 587 citations by 274 authors from 15 institutions in the United States, Australia, Israel, and Spain.

In 2011, only five HCRs (0.21% of 1,857 HCRs) had no citations, 0.81% had one citation, and 0.59% HCRs had two citations. The citation life cycles of the top nine HCRs (*C2011* > 800) are shown in Figure 3. In *SCI Ex*, the HCR entitled, "Processing of X-Ray Diffraction Data Collected in Oscillation Mode" (Otwinowski & Minor, 1997) published in *Macromolecular Crystallography A* by Z. Otwinowski at the University of Texas and W. Minor at the University of Virginia was not only the most frequently cited HCR with *TC2011* = 23,401 citations, but also the most-cited HCR in 2011 with *C2011* = 1,674. In 2011, 749 (40%) HCRs cited at least 100 times included 394 reviews in the 2000s, 283 in the 1990s, 57 in the 1980s, 14 before the 1980s, and one in 2010. The ranking of HCRs still fluctuates over time. It turns out that 82% of the HCRs within the top 100 in *TC2011* were not ranked in the top 100 in *C2011*—that means the HCRs would not always have high impact or visibility after publication. Indeed, it has been reported that since 1988, 94% of the 50 most frequently cited articles published in the *American Journal of Roentgenology* have changed their rankings (Bui-Mansfield, 2005). An HCR with high-potential-citation frequency was "Review of Particle Physics" (Nakamura et al., 2010), which was published in 2010 by 179 authors from 104 institutions in 124 countries in the *Journal of Physics G–Nuclear and Particle Physics*. This recently published HCR ranked third in *C2011* with 1,240 citations in 2011. "MicroRNAs: Target Recognition and Regulatory Functions" (Bartel, 2009) in *Cell*, by single-author D. P. Bartel was also a high-potential HCR. Similarly, a high-potential HCR entitled, "The Electronic Properties of Graphene" (Castro Neto et al., 2009) was published by only five authors, two of whom (Geim and Novoselov) received the Nobel Prize in Physics in 2010 with the prize motivation "for groundbreaking experiments regarding the two-dimensional material graphene."

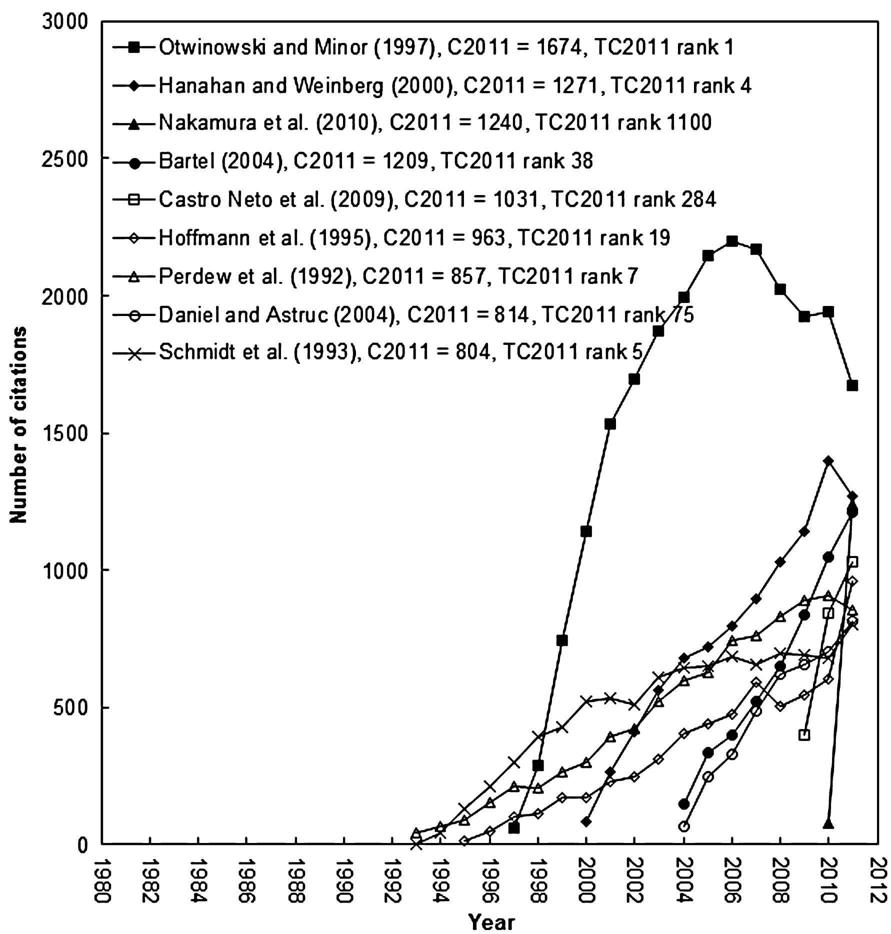

FIG. 3. Illustration showing the life of the top nine most frequently cited reviews in 2011 (*C2011* > 800).

DOI: 10.1002/asi

The citation life cycles of the top nine HCRs (*TC2011* > 8,000) are shown in Figure 4. Eight of these nine HCRs were published after 1990; the ninth one was published in 1981. Again, an increase in the number of citations after publication year could be found in the HCRs that were initially much-praised articles or that recognized basic work (Avramescu, 1979). In general, the seven latter HCRs by Otwinowski and Minor in 1997, Moncada, Palmer, and Higgs in 1991, Ross in 1999, Hanahan and Weinberg in 2000, Schmidt et al. in 1993, Lander et al. in 2001, and Hynes in 1992 follow the two typical citation frequency curves: initially much-praised articles or articles that recognized basic work. HCRs by Perdew and Zunger in 1981 and Perdew et al. in 1992 saw a continual upward trend since publication. In addition, the latest published HCR was "Review of Particle Physics" (Nakamura et al., 2010) published in 2010, ranked 1,100 in *TC2011*, displayed the sharpest increase in citations, and rose to second place in 2011. The most frequently cited HCR in *SCI Ex* by Otwinowski and Minor in 1997 had the typical citation frequency curve of initially much-praised articles or articles that recognized basic work. This HCR (Otwinowski & Minor, 1997) is the only one that has been decreasing after 2006. However, it still has the lead in terms of annual citations since 2000.

The article life of *CPP* for all the 1,857 HCRs is displayed in Figure 5. The *CPP* sharply increased up to a peak in 5 years. The peak year of *CPP* was found to be longer than other medical-related research disciplines where the peak could be in the second year (Chiu & Ho, 2005; Chuang et al., 2007). Table 2 presents information on "super" HCRs cited more than 6,000 times. Out of these 16 super HCRs, 4 (25%) were published before the 1990s, 10 (63%) in the 1990s, and 2 (13%) in the next decade. The first HCR to be cited more than 6,000 times was published in 1971 and the most recent was published in 2001. The IF of the journals in which these 16 super HCRs were published varied widely. Of the 16, *Nature* (IF = 36.280) had five articles, *Cell* (IF = 32.403) three, *Physical Review B* (IF = 3.691) two, and one each for *New England Journal of Medicine* (IF = 53.298), *Coordination Chemistry Reviews* (IF = 12.110), *Pharmacological Reviews* (IF = 20.225), *Chemical Reviews* (IF = 40.197), *Journal of Computational Chemistry* (IF = 4.583), and *Macromolecular Crystallography Part A,* respectively. The HCR by Otwinowski and

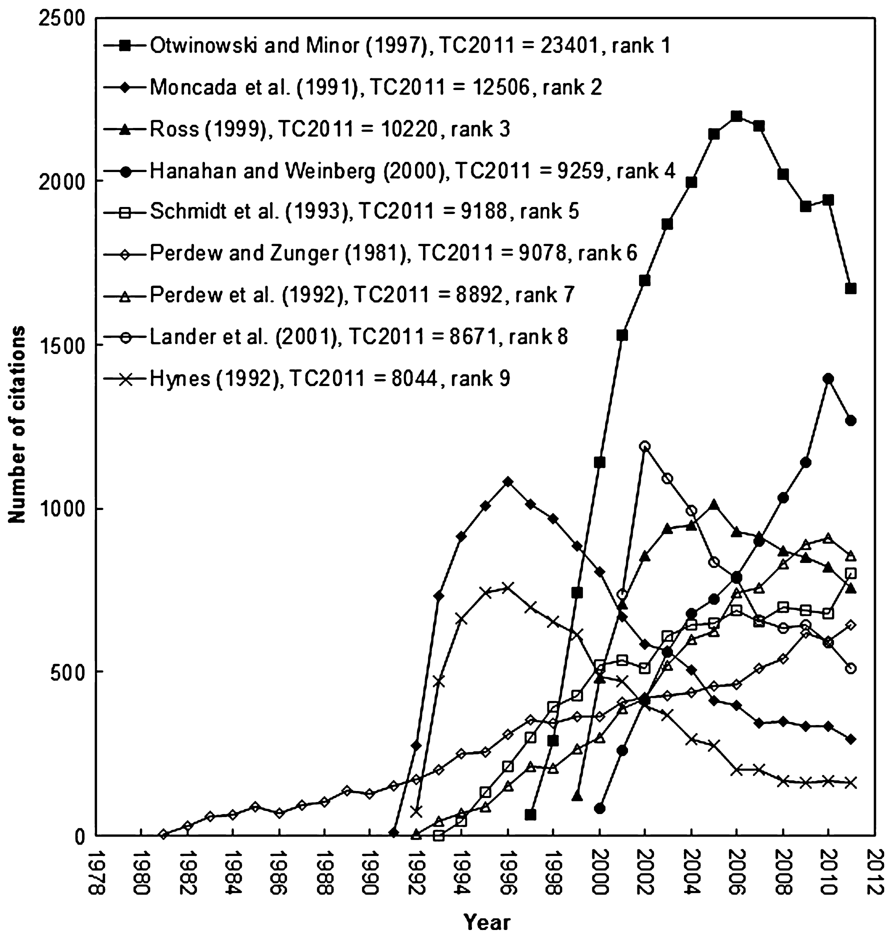

FIG. 4. Illustration showing the life of the top nine most frequently cited reviews (*TC2011* > 8,000).

DOI: 10.1002/asi

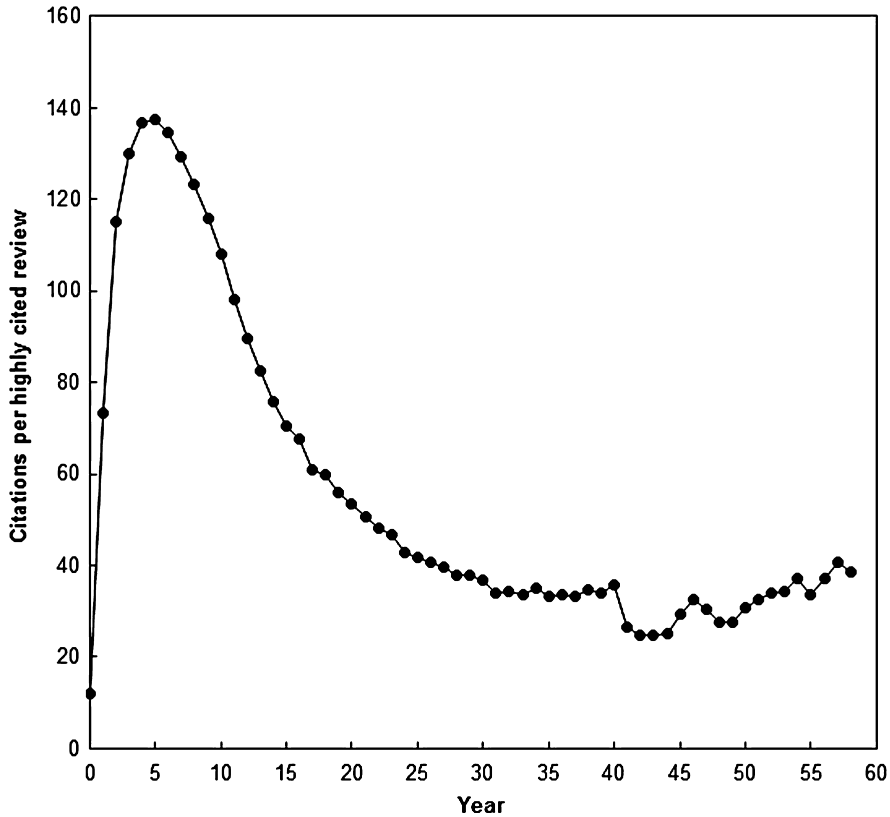

FIG. 5. Illustration showing the variation of citations per review with article life.

Minor in 1997 was the only one with more than 20,000 citations in *SCI Ex*. HCRs entitled, "Nitric Oxide: Physiology, Pathophysiology, and Pharmacology" by Moncada et al. (1991) from Wellcome Research Laboratories in the UK and "Mechanisms of Disease—Atherosclerosis: An Inflammatory Disease" by Ross (1999) from the University of Washington had *TC2011* > 10,000. Both R. Ross and J. P. Perdew were the only two authors who had two HCRs as the first author and corresponding author with *TC2011* > 6,000, respectively. (In the *SCI-Ex* database, the corresponding author is designated as the "reprint" author; this study uses as the term *corresponding author*). "Dendritic Cells and the Control of Immunity" (Banchereau & Steinman, 1998) was published in 1998 with *TC2011* = 7,701 ranked in the top-11 spot. Ralph M. Steinman, from Rockefeller University, received the Nobel Prize in Physiology or Medicine in 2011 with the prize motivation "for his discovery of the dendritic cell and its role in adaptive immunity." HCRs published by Schmidt et al. (1993) and Geary (1971) had no citations in their publication year, but ranked fifth and 13th in *TC2011*. The HCR by Schmidt et al. (1993) ranked ninth, but the HCR by Geary (1971) ranked 125th in the HCRs in C2011. Impact factors of the HCRs do change after their publication. Figures 2–4 depict the history of the HCRs' impact based on three indicators: *TC2011*, *C2011*, and *C0*.

Publications by Nobel Prize Winners

Of the 1,857 HCRs in *SCI Ex*, 66 (0.91%) authors were Nobel Prize winners, including 28 Nobel Laureates in Physiology or Medicine from 1963 to 2011, 22 Nobel Laureates in Chemistry from 1965 to 2010, and 16 Nobel Laureates in Physics from 1963 to 2011 (Table 3). Tony Hunter published the most HCRs with 10 reviews including five first and five corresponding author HCRs with *CPP* = 1,784 and highest *TC2011* = 3,992. Joseph L. Goldstein and Michael S. Brown received the Nobel Prize in Physiology or Medicine in 1985. They published eight HCRs together. Goldstein had five first and five corresponding author HCRs and Brown had two first and two corresponding author HCRs, with *CPP* = 1,861. "Regulation of the Mevalonate Pathway" (Goldstein & Brown, 1990) by Goldstein as the first and corresponding authors was the most-cited Goldstein review with *TC2011* = 3,120. Alfred Goodman Gilman published two single-author HCRs that had the highest *TC2011* in first author review and also the highest *TC2011* in corresponding author review as shown in Table 3. In addition, M. J. Berridge (Department of Zoology, University of Cambridge, UK) published four single-author reviews and eight HCRs in which all were first and corresponding authors reviews with *CPP* = 3,344 and highest *TC2011* = 5,828

DOI: 10.1002/asi

TABLE 2. The 16 most frequently cited reviews in *Science Citation Index Expanded*™ (*TC2011* > 6,000).

Rank (*TC2011*)	Rank (*C2011*)	Rank (*C0*)	Highly cited review information
1 (23,401)	1 (1674)	54 (63)	Otwinowski, Z., & Minor, W. (1997). Processing of x-ray diffraction data collected in oscillation mode. Macromolecular Crystallography A, 276, 307–326.
2 (12,506)	145 (297)	426 (12)	Moncada, S., et al. (1991). Nitric-oxide: Physiology, pathophysiology, and pharmacology. Pharmacological Reviews, 43(2), 109–142.
3 (10,220)	11 (759)	18 (121)	Ross, R. (1999). Mechanisms of disease—atherosclerosis—An inflammatory disease. New England Journal of Medicine, 340(2), 115–126.
4 (9,259)	2 (1271)	32 (83)	Hanahan, D., & Weinberg, R.A. (2000). The hallmarks of cancer. Cell, 100(1), 57–70.
5 (9,188)	9 (804)	1403 (0)	Schmidt, M.W., et al. (1993). General atomic and molecular electronic structure system. Journal of Computational Chemistry, 14(11), 1347–1363.
6 (9,078)	18 (643)	635 (7)	Perdew, J.P., & Zunger, A. (1981). Self-interaction correction to density functional approximations for many electron systems. *Physical Review B*, 23(10), 5048–5079.
7 (8,892)	7 (857)	893 (3)	Perdew, J.P., et al. (1992). Atoms, molecules, solids, and surfaces: Applications of the generalized gradient approximation for exchange and correlation. Physical Review B, 46(11), 6671–6687.
8 (8,671)	42 (512)	1 (738)	Lander, E.S., et al. (2001). Initial sequencing and analysis of the human genome. Nature, 409(6822), 860–921.
9 (8,044)	431 (162)	40 (74)	Hynes, R.O. (1992). Integrins: Versatility, modulation, and signaling in cell-adhesion. Cell, 69(1), 11–25.
10 (7,838)	1399 (31)	47 (68)	Nishizuka, Y. (1984). The role of protein kinase-C in cell-surface signal transduction and tumor promotion. Nature, 308(5961), 693–698.
11 (7,701)	57 (445)	42 (73)	Banchereau, J., & Steinman, R.M. (1998). Dendritic cells and the control of immunity. Nature, 392(6673), 245–252.
12 (7,697)	327 (197)	202 (27)	Ross, R. (1993). The pathogenesis of atherosclerosis: A perspective for the 1990s. Nature, 362(6423), 801–809.
13 (7,013)	125 (323)	1403 (0)	Geary, W.J. (1971). Use of conductivity measurements in organic solvents for characterisation of coordination compounds. Coordination Chemistry Reviews, 7(1), 81–122.
14 (6,773)	14 (706)	1171 (1)	Reed, A.E., et al. (1988). Intermolecular interactions from a natural bond orbital, donor–acceptor viewpoint. *Chemical Reviews,* 88(6), 899–926.
15 (6,548)	239 (231)	426 (12)	Fearon, E.R., & Vogelstein, B. (1990). A genetic model for colorectal tumorigenesis. Cell, 61(5), 759–767.
16 (6,138)	1037 (65)	405 (13)	Springer, T.A. (1990). Adhesion receptors of the immune-system. Nature, 346(6283), 425–434.

Note. TC2011 = number of citations to 2011; *C2011* = number of citations in 2011; *C0* = number of citations in publication year.

times. Marilyn Kozak published five single-author reviews with *CPP* = 2,159 and highest *TC2011* = 3,262 s.

Authors, Institutions, and Countries

In recent years, performance indicators of authors (Li & Ho, 2008), institutions (Ho et al., 2010), and countries (Wang et al., 2010) have been studied to compare publication records. Equal credit was not given to all of the contributors. At the individual level, a nonalphabetical name order in authorship sends a clear signal that the author who is listed first has actually contributed more (Engers et al., 1999; Gaeta, 1999). It has also been mentioned in guidelines on authorship of medical articles that the first author should have made major contributions in the conception of the work presented in the article, the design of the work, analysis and interpretation of data or other evidence presented in the article, as well as drafting the article or revising it for critically important content (Huth, 1986). The corresponding author is perceived as the author contributing most significantly to the article irrespective of the author position (Mattsson, Sundberg, & Laget, 2011). The corresponding author often supervises the planning and execution of the study and the writing of the article (Burman, 1982). At the institutional level, the institution of the corresponding author may be the home base of the study or origin of the article. Corresponding authors probably contribute more to the initial conception and supervision of study (Wren et al., 2007). In a single-author review where authorship is unspecified, the single author is both first and corresponding author. Similarly, in a single-institution review, the institution is classified as the first-author institution, as well as the corresponding-author institution. In a multiauthor review where authorship is unspecified, the first author is classified as the corresponding author. Of the 1,857 HCRs by 7,244 authors, 1,512 authors (11%) had both first- and corresponding-author HCRs, while 5,621 (78%) authors had no first-author HCR and 5,640 (78%) authors had no corresponding-author HCR. Seventeen of the 7,244 authors had more corresponding-author HCRs than first-author HCRs and seven authors had more first-author HCRs than corresponding-author HCRs, while 1,488 (21%) authors had the same numbers of first-author and corresponding-author HCRs. The authors who contributed the most HCRs were T. Hunter with 10 HCRs, followed by J. L. Goldstein, M. S. Brown, E. Birney, and M. J. Berridge, with eight HCRs, respectively. Joseph L. Goldstein and Michael S. Brown from the University of Texas received the Nobel Prize in Physiology or Medicine in 1985 "for their discoveries concerning the regulation of cholesterol metabolism."

DOI: 10.1002/asi

TABLE 3. Publications of Nobel Prize winners.

Author	Year	Nobel Prize	TP	FP	RP	MFP	MRP
Brown, M.S.	1985	Physiology or Medicine	8	2	2	1,931	1,931
Goldstein, J.L.	1985	Physiology or Medicine	8	5	5	3,120	3,120
Krebs, E.G.	1992	Physiology or Medicine	4	1	1	1,994	1,994
Ciechanover, A.	2004	Chemistry	4	1	1	1,185	1,185
Smoot, G.F.	2006	Physics	4	N/A	N/A	N/A	N/A
Steinman, R.M.	2011	Physiology or Medicine	4	2	2	3,582	3,582
Vane, J.R.	1982	Physiology or Medicine	3	2	2	1,618	1,618
Cohen, S.	1986	Physiology or Medicine	3	1	1	3,549	3,549
Steinberger, J.	1988	Physics	3	N/A	N/A	N/A	N/A
Furchgott, R.F.	1998	Physiology or Medicine	3	3	3	2,191	2,191
Suzuki, A.	2010	Chemistry	3	1	1	1,754	1,754
Deduve, C.	1974	Physiology or Medicine	2	2	2	2,089	2,089
Smith, H.O.	1978	Physiology or Medicine	2	N/A	N/A	N/A	N/A
Hoffmann, R.	1981	Chemistry	2	1	1	1,173	1,173
Bishop, J.M.	1989	physiology or Medicine	2	2	2	1,594	1,594
Thomas, E.D.	1990	Physiology or Medicine	2	2	2	2,078	2,078
Marcus, R.A.	1992	Chemistry	2	2	2	5,327	5,327
Gilman, A.G.	1994	Physiology or Medicine	2	2	2	5,590	5,590
Prusiner, S.B.	1997	Physiology or Medicine	2	2	2	2,818	2,818
Sharpless, K.B.	2001	Chemistry	2	N/A	1	N/A	3,006
Tanaka, K.	2002	Chemistry	2	1	N/A	1,189	N/A
Leggett, A.J.	2003	Physics	2	2	2	2,556	2,556
Hershko, A.	2004	Chemistry	2	2	2	3,720	3,720
Grubbs, R.H.	2005	Chemistry	2	1	2	2,055	2,332
Tsien, R.Y.	2008	Chemistry	2	1	1	2,579	2,579
Huxley, A.F.	1963	Physiology or Medicine	1	1	1	1,976	1,976
Wigner, E.P.	1963	Physics	1	N/A	N/A	N/A	N/A
Woodward, R.B.	1965	Chemistry	1	1	1	2,211	2,211
Feynman, R.P.	1965	Physics	1	1	1	1,801	1,801
Schrieffer, J.R.	1972	Physics	1	N/A	N/A	N/A	N/A
Baltimore, D.	1975	Physiology or Medicine	1	N/A	N/A	N/A	N/A
Mott, N.F.	1977	Physics	1	N/A	N/A	N/A	N/A
Brown, H.C.	1979	Chemistry	1	N/A	N/A	N/A	N/A
Weinberg, S.	1979	Physics	1	1	1	1,809	1,809
Fukui, K.	1981	Chemistry	1	1	1	1,334	1,334
Wilson, K.G.	1982	Physics	1	1	1	1,998	1,998
Chandrasekhar, S.	1983	Physics	1	1	1	5,354	5,354
Fowler, W.A.	1983	Physics	1	N/A	N/A	N/A	N/A
Jerne, N.K.	1984	Physiology or Medicine	1	1	1	3,328	3,328
Tonegawa, S.	1987	Physiology or Medicine	1	1	1	3,018	3,018
Mullis, K.B.	1993	Chemistry	1	1	1	3,465	3,465
Smith, M.	1993	Chemistry	1	N/A	N/A	N/A	N/A
Sharp, P.A.	1993	Physiology or Medicine	1	N/A	N/A	N/A	N/A
Roberts, R.J.	1993	Physiology or Medicine	1	N/A	N/A	N/A	N/A
Rodbell, M.	1994	Physiology or Medicine	1	1	1	1,812	1,812
Lewis, E.B.	1995	Physiology or Medicine	1	1	1	2,097	2,097
Skou, J.C.	1997	Chemistry	1	1	1	2,159	2,159
Kohn, W.	1998	Chemistry	1	1	1	1,010	1,010
Ignarro, L.J.	1998	Physiology or Medicine	1	1	1	1,064	1,064
Heeger, A.J.	2000	Chemistry	1	1	1	2,140	2,140
Kandel, E.R.	2000	Physiology or Medicine	1	1	1	1,120	1,120
Noyori, R.	2001	Chemistry	1	1	1	1,112	1,112
Hartwell, L.H.	2001	Physiology or Medicine	1	1	1	1,766	1,766
Fenn, J.B.	2002	Chemistry	1	1	1	1,206	1,206
Brenner, S.	2002	Physiology or Medicine	1	N/A	N/A	N/A	N/A
Horvitz, H.R.	2002	Physiology or Medicine	1	N/A	N/A	N/A	N/A
Kornberg, R.D.	2006	Chemistry	1	1	1	1,074	1,074
Blackburn, E.H.	2009	Physiology or Medicine	1	1	1	1,944	1,944
Steitz, T.A.	2009	Chemistry	1	N/A	N/A	N/A	N/A
Geim, A.K.	2010	Physics	1	N/A	N/A	N/A	N/A
Heck, R.F.	2010	Chemistry	1	1	1	1,396	1,396
Novoselov, K.S.	2010	Physics	1	N/A	N/A	N/A	N/A
Riess, A.G.	2011	Physics	1	1	1	5,416	5,416
Schmidt, B.P.	2011	Physics	1	N/A	N/A	N/A	N/A
Hoffmann, J.A.	2011	Physiology or Medicine	1	1	1	1,365	1,365
Perlmutter, S.	2011	Physics	1	1	1	5,129	5,129

Note. TP = total number of HCRs; FP = total number of first author HCRs; RP = total number of corresponding author HCRs; MFP = the highest *TC2011* with first author; MRP = the highest *TC2011* with corresponding author; N/A = not available.

On average, the research quality of a university improves some years after it appoints a president (vice chancellor) who is an accomplished scholar (Goodall, 2009). However, the participation of highly cited scientists in the top leadership of universities is limited (Ioannidis, 2010). There were 1,407 institutions contributing to the 1,773 HCRs. Within these institutions, 742 (42%) had no both first-author and corresponding-author HCRs; 661 (47%) institutions had the same number of first- and corresponding-author HCRs.

Eighty-four HCRs were excluded because they did not have any author address information in the WoS. The 1,773 HCRs that specified addresses were further analyzed regarding institutions and countries. Altogether, 1,773 HCRs originated from 1,407 institutions in 45 countries. The top 15 institutions are shown in Table 4, with Harvard University (97 HCRs), University of Texas (58 HCRs), University of Washington (53 HCRs), and Stanford University all in the United States (53 HCRs) leading the list. Of the total HCRs, 1,080 HCRs (61%) came from independent institutions and 693 HCRs (39%) from interinstitutional collaborations. The interinstitutional collaboration rate was observed to be smaller in top-cited articles, for example, 37% of the most frequently cited adsorption research articles (Fu et al., 2012), 12% of 100 top-cited articles in general surgical journals (Paladugu et al., 2002), and 8% of 100 ophthalmology class citations (Ohba et al., 2007). In contrast, the interinstitutional collaboration rate was higher in certain fields: 62% in global climate change (Li et al., 2011) and 53% in acupuncture research (Han & Ho, 2011). The University of Cambridge in the UK was the only institution not located in United States; it ranked 13th with 31 HCRs. Harvard University published not only the most HCRs, but also the most single-institution, interinstitutionally collaborative, first-author, corresponding-author, single-author HCRs. In addition, Harvard University had the lowest percentage of single-institution HCRs to their total HCRs (*S*%) with 30%, while Cornell University had 44% single-institution HCRs.

Of 1,773 HCRs with author addresses, 1,478 (83%) were single-country HCRs and 295 (17%) were internationally collaborative HCRs. The characteristics of these 19 countries publishing at least 15 HCRs are illustrated in Table 5. The leading country was the United States (1,218 HCRs), accounting for 69%, followed distantly by the UK (243 HCRs) and Germany (152 HCRs). The United States ranked in top in six indicators with the highest percentage of single-country HCRs in total HCRs. The G7 countries (The United States, the UK, Germany, Canada, France, Japan, and Italy) published 1,621 HCRs (91% of 1,773 HCRs with author-affiliation information). Domination in publication was not surprising from mainstream countries because this pattern has occurred in many medical-related topics, for example, patent ductus arteriosus (Hsieh et al., 2004), asthma in children (Chen et al., 2005), stem cells (Li et al., 2009), *Helicobacter pylori* (Suk et al., 2011), and human papillomavirus (Lin et al., 2011).

Conclusions

This study identified 1,857 HCRs in the *SCI Ex* from 1906 to 2010 that had at least 1,000 citations since publication to 2011. The largest number of HCRs was published in the 1990s, while the highest *CPP* was found in the 1940s. One third of HCRs was published by a single author and 36% HCRs were published by two authors. English was the dominant language.

TABLE 4. The top 15 institutions with $TP \geq 30$.

Institution	TP	TPR (%)	IPR (%)	CPR (%)	FPR (%)	RPR (%)	SPR (%)	S%
Harvard University, US	97	1 (5.5)	1 (2.7)	1 (9.8)	1 (2.8)	1 (2.8)	1 (2.5)	30
University of Texas, US	58	2 (3.3)	2 (2.2)	4 (4.9)	3 (1.8)	3 (1.8)	2 (1.6)	41
Washington University, US	53	3 (3.0)	8 (1.4)	2 (5.5)	4 (1.5)	4 (1.5)	4 (1.4)	43
Stanford University, US	52	4 (2.9)	8 (1.4)	3 (5.3)	6 (1.4)	6 (1.4)	4 (1.4)	38
University of California, Berkeley, US	47	5 (2.7)	7 (1.5)	6 (4.5)	8 (1.3)	8 (1.3)	12 (1.1)	40
University of Michigan, US	46	6 (2.6)	10 (1.3)	5 (4.6)	8 (1.3)	8 (1.3)	12 (1.1)	37
Massachusetts Institute of Technology (MIT), US	46	6 (2.6)	4 (1.9)	7 (3.8)	5 (1.5)	5 (1.5)	9 (1.3)	35
University of California, San Francisco, US	45	8 (2.5)	3 (2.1)	10 (3.2)	2 (1.9)	2 (1.9)	4 (1.4)	33
Yale University, US	40	9 (2.3)	10 (1.3)	7 (3.8)	6 (1.4)	6 (1.4)	12 (1.1)	38
Washington University, US	38	10 (2.1)	5 (1.8)	14 (2.7)	10 (1.2)	10 (1.2)	9 (1.3)	37
University of California, San Diego, US	36	11 (2.0)	18 (0.93)	7 (3.8)	19 (0.79)	19 (0.79)	9 (1.3)	39
Cornell University, US	32	12 (1.8)	10 (1.3)	16 (2.6)	19 (0.79)	19 (0.79)	2 (1.6)	44
University of Cambridge, UK	31	13 (1.7)	18 (0.93)	11 (3)	14 (1.0)	14 (1.0)	4 (1.4)	42
University of Illinois, US	31	13 (1.7)	15 (1.0)	12 (2.9)	12 (1.1)	12 (1.1)	12 (1.1)	42
Johns Hopkins University, US	30	15 (1.7)	15 (1.0)	14 (2.7)	19 (0.79)	19 (0.79)	30 (0.54)	37

Note. TP = total number of highly cited reviews (HCRs); TPR (%) = the rank and percentage of total HCRs; IPR (%) = the rank and percentage of single-institution HCRs; CPR (%) = the rank and percentage of interinstitutionally collaborative HCRs; FPR (%) = the rank and percentage of first-author HCRs; RPR (%) = the rank and percentage of corresponding author HCRs; SPR (%) = the rank and percentage of single-author HCRs in their total HCRs; S% = the percentage of single-institution HCRs in total HCRs for each institution; US = United States; UK = United Kingdom.

TABLE 5. The top 19 countries with highly cited reviews ($TP \geq 15$).

Country	TP	TPR (%)	IPR (%)	CPR (%)	FPR (%)	RPR (%)	SPR (%)	S%
US	1,218	1 (69)	1 (68)	1 (74)	1 (63)	1 (63)	1 (62)	82
UK	243	2 (14)	2 (10)	2 (34)	2 (10)	2 (10)	2 (11)	58
Germany	152	3 (8.6)	3 (5.5)	3 (24)	3 (5.9)	3 (5.9)	3 (7.5)	53
Canada	88	4 (5.0)	5 (2.4)	5 (18)	4 (2.8)	4 (2.8)	6 (2.3)	43
France	82	5 (4.6)	6 (1.8)	4 (19)	5 (2.4)	5 (2.4)	5 (2.7)	43
Japan	70	6 (3.9)	4 (2.6)	8 (11)	5 (2.4)	5 (2.4)	4 (3.2)	39
Switzerland	63	7 (3.6)	7 (1.8)	6 (13)	7 (2.0)	7 (2.0)	8 (1.8)	41
Italy	50	8 (2.8)	10 (1.0)	7 (12)	9 (1.4)	9 (1.4)	11 (0.72)	46
Australia	48	9 (2.7)	9 (1.1)	8 (11)	10 (1.2)	10 (1.2)	9 (0.89)	33
Sweden	48	9 (2.7)	8 (1.6)	11 (8.5)	8 (1.8)	8 (1.8)	7 (2.0)	31
Netherlands	37	11 (2.1)	12 (0.74)	10 (8.8)	11 (1.1)	11 (1.1)	9 (0.89)	32
Spain	30	12 (1.7)	14 (0.41)	12 (8.1)	14 (0.56)	14 (0.56)	13 (0.54)	37
Israel	30	12 (1.7)	11 (0.81)	13 (6.1)	11 (1.1)	11 (1.1)	13 (0.54)	23
Belgium	21	14 (1.2)	18 (0.34)	14 (5.4)	15 (0.51)	15 (0.51)	13 (0.54)	29
Austria	20	15 (1.1)	14 (0.41)	15 (4.7)	13 (0.62)	13 (0.62)	11 (0.72)	30
Russia	18	16 (1.0)	14 (0.41)	16 (4.1)	17 (0.39)	17 (0.39)	19 (0.36)	33
India	17	17 (1.0)	13 (0.47)	19 (3.4)	17 (0.39)	17 (0.39)	13 (0.54)	35
Denmark	16	18 (0.9)	18 (0.34)	17 (3.7)	16 (0.45)	16 (0.45)	19 (0.36)	31
Finland	15	19 (0.85)	20 (0.27)	17 (3.7)	20 (0.28)	20 (0.28)	13 (0.54)	33

Note. TP = total number of highly cited reviews (HCRs); TPR (%) = the rank and percentage of total HCRs; IPR (%) = the rank and percentage of single-institution HCRs; CPR (%) = the rank and percentage of interinstitutionally collaborative HCRs; FPR (%) = the rank and percentage of first-author HCRs; RPR (%) = the rank and percentage of corresponding author HCRs; SPR (%) = the rank and percentage of single-author HCRs in their total HCRs; S% = the percentage of single-institution HCRs in total HCRs for each institution; US = United States; UK = United Kingdom.

The number of HCR coauthors and average-cited-reference counts per HCR increased from the 1900s to 2000s.

The HCRs were published in 376 journals across 113 WoS categories. *Chemical Reviews* was the most productive journal, followed by *Nature* and *Annual Review of Biochemistry*. The most common category was biochemistry and molecular biology. Sixty-five HCRs were published in journals with IF > 10. The most-cited HCRs did not always appear in the highest impact journals. The top 10 most highly cited HCRs in publication year, early years, and later years were not the same. The impact of HCRs changed over time.

One percent of authors who published HCRs were Nobel Prize winners in Physiology or Medicine, Chemistry, and Physics. M. J. Berridge published the most HCRs.

The interinstitutional collaboration rate was lower for HCRs. Harvard University was the most productive and independent research institution. The numbers of first-author HCR was the same as the number of corresponding-author HCR for most authors, institutions, and countries. The United States published the most HCRs, while the G7 countries published 91% of HCRs.

References

Adams, M.D., Celniker, S.E., Holt, R.A., Evans, C.A., Gocayne, J.D., Amanatides, P.G., . . . Venter, J.C. (2000). The genome sequence of *Drosophila melanogaster*. Science, 287(5461), 2185–2195.

Aksnes, D.W. (2003). Characteristics of highly cited papers. Research Evaluation, 12(3), 159–170.

Aversa, E.S. (1985). Citation patterns of highly cited papers and their relationship to literature aging: A study of the working literature. Scientometrics, 7(3–6), 383–389.

Avramescu, A. (1979). Actuality and obsolescence of scientific literature. Journal of the American Society for Information Science, 30(5), 296–303.

Baltussen, A., & Kindler, C.H. (2004). Citation classics in anesthetic journals. Anesthesia and Analgesia, 98(2), 443–451.

Banchereau, J., & Steinman, R.M. (1998). Dendritic cells and the control of immunity. Nature, 392(6673), 245–252.

Bartel, D.P. (2004). MicroRNAs: Genomics, biogenesis, mechanism, and function. Cell, 116(2), 281–297.

Bartel, D.P. (2009). MicroRNAs: Target recognition and regulatory functions. Cell, 136(2), 215–233.

Berghmans, T., Meert, A.P., Mascaux, C., Paesmans, M., Lafitte, J.J., & Sculier, J.P. (2003). Citation indexes do not reflect methodological quality in lung cancer randomised trials. Annals of Oncology, 14(5), 715–721.

Berridge, M.J. (1993). Inositol trisphosphate and calcium signaling. Nature, 361(6410), 315–325.

Brandt, J.S., Downing, A.C., Howard, D.L., Kofinas, J.D., & Chasen, S.T. (2010). Citation classics in obstetrics and gynecology: The 100 most frequently cited journal articles in the last 50 years. American Journal of Obstetrics and Gynecology, 203(4), 355.e1–355.e7.

Bridgstock, M. (1991). The quality of single and multiple authored papers—An unresolved problem. Scientometrics, 21(1), 37–48.

Brooke, B.S., Nathan, H., & Pawlik, T.M. (2009). Trends in the quality of highly cited surgical research over the past 20 years. Annals of Surgery, 249(1), 162–167.

Bui-Mansfield, L.T. (2005). Whatever happened to the 50 most frequently cited articles published in *AJR*? American Journal of Roentgenology, 185(3), 597–601.

Burman, K.D. (1982). Hanging from the masthead—Reflections on authorship. Annals of Internal Medicine, 97(2), 602–605.

Castro Neto, A.H., Guinea, F., Peres, N.M.R., Novoselov, K.S., & Geim, A.K. (2009). The electronic properties of graphene. Reviews of Modern Physics, 81(1), 109–162.

DOI: 10.1002/asi

Chen, S.R., Chiu, W.T., & Ho, Y.S. (2005). Asthma in children: Mapping the literature by bibliometric analysis. Revue Française d'Allergologie et d'Immunologie Clinique, 45(6), 442–446.

Chiu, W.T., & Ho, Y.S. (2005). Bibliometric analysis of homeopathy research during the period of 1991 to 2003. Scientometrics, 63(1), 3–23.

Chuang, K.Y., Huang, Y.L., & Ho, Y.S. (2007). A bibliometric and citation analysis of stroke-related research in Taiwan. Scientometrics, 72(2), 201–212.

Chuang, K.Y., Wang, M.H., & Ho, Y.S. (2011). High-impact papers presented in the subject category of water resources in the Essential Science Indicators database of the Institute for Scientific Information. Scientometrics, 87(3), 551–562.

Daniel, M.C., & Astruc, D. (2004). Gold nanoparticles: Assembly, supramolecular chemistry, quantum-size-related properties, and applications toward biology, catalysis, and nanotechnology. Chemical Reviews, 104(1), 293–346.

Diamond, Jr., A.M. (1985). The money value of citations to single-authored and multiple-authored articles. Scientometrics, 8(5–6), 315–320.

Dubin, D., Häfner, A.W., & Arndt, K.A. (1993). Citation classics in clinical dermatological journals: Citation analysis, biomedical journals, and landmark articles, 1945–1990. Archives of Dermatology, 129(9), 1121–1129.

Duncan, A.P., & Johnson, A.R. (2007). A "classic papers" approach to teaching undergraduate organometallic chemistry. Journal of Chemical Education, 84(3), 443–446.

Engers, M., Gans, J.S., Grant, S., & King, S.P. (1999). First-author conditions. Journal of Political Economy, 107(4), 859–883.

Fardi, A., Kodonas, K., Gogos, C., & Economides, N. (2011). Classic reviews in endodontic journals. Journal of Endodontics, 37(9), 1183–1190.

Fearon, E.R., & Vogelstein, B. (1990). A genetic model for colorectal tumorigenesis. Cell, 61(5), 759–767.

Foo, J.Y.A. (2011). A retrospective analysis of the trend of retracted publications in the field of biomedical and life sciences. Science and Engineering Ethics, 17(3), 459–468.

Freundlich, H.M.F. (1906). Concerning adsorption in solutions. Zeitschrift für Physikalische Chemie-Stochiometrie und Verwandtschaftslehre, 57(4), 385–470.

Fu, H.Z., Wang, M.H., & Ho, Y.S. (2012). The most frequently cited adsorption research articles in the Science Citation Index (Expanded). Journal of Colloid and Interface Science, 379(1), 148–156.

Gaeta, T.J. (1999). Authorship: "Law" and order. Academic Emergency Medicine, 6(4), 297–301.

Garfield, E. (1970). Citation indexing for studying science. Nature, 227(5259), 669–671.

Garfield, E. (2002). Highly cited authors. Scientist, 16(7), 10.

Garfield, E., & Welljamsdorof, A. (1992). Of Nobel class: A citation perspective on high-impact research authors. Theoretical Medicine and Bioethics, 13(2), 117–135.

Geary, W.J. (1971). Use of conductivity measurements in organic solvents for characterisation of coordination compounds. Coordination Chemistry Reviews, 7(1), 81–122.

Gething, M.J., & Sambrook, J. (1992). Protein folding in the cell. Nature, 355(6355), 33–45.

Gingras, Y., & Wallace, M.L. (2010). Why it has become more difficult to predict Nobel Prize winners: A bibliometric analysis of nominees and winners of the chemistry and physics prizes (1901–2007). Scientometrics, 82(2), 401–412.

Goldstein, J.L., & Brown, M.S. (1990). Regulation of the mevalonate pathway. Nature, 343(6257), 425–430.

Goodall, A.H. (2009). Highly cited leaders and the performance of research universities. Research Policy, 38(7), 1079–1092.

Guimaraes, J.A., & Carlini, C.R. (2004). Most cited papers in *Toxicon*. Toxicon, 44(4), 345–359.

Han, J.S., & Ho, Y.S. (2011). Global trends and performances of acupuncture research. Neuroscience and Biobehavioral Reviews, 35(3), 680–687.

Hanahan, D., & Weinberg, R.A. (2000). The hallmarks of cancer. Cell, 100(1), 57–70.

Hennessey, K., Afshar, K., & MacNeily, A.E. (2009). The top 100 cited articles in urology. CUAJ, Canadian Urological Association Journal, 3(4), 293–302.

Ho, Y.S. (2004). Comment on "Removal of copper from aqueous solution by aminated and protonated mesoporous aluminas: Kinetics and equilibrium," by S. Rengaraj, Y. Kim, C.K. Joo, and J. Yi. Journal of Colloid and Interface Science, 276(1), 255–258.

Ho, Y.S. (2008). Bibliometric analysis of biosorption technology in water treatment research from 1991 to 2004. International Journal of Environment and Pollution, 34(1–4), 1–13.

Ho, Y.S. (2011). Untitled. Adsorption Science & Technology, 28(5), 465.

Ho, Y.S. (2012). Top-cited articles in chemical engineering in Science Citation Index Expanded: A bibliometric analysis. Chinese Journal of Chemical Engineering, 20(3), 478–488.

Ho, Y.S., Satoh, H., & Lin, S.Y. (2010). Japanese lung cancer research trends and performance in Science Citation Index. Internal Medicine, 49(20), 2219–2228.

Hoffmann, M.R., Martin, S.T., Choi, W.Y., & Bahnemann, D.W. (1995). Environmental applications of semiconductor photocatalysis. Chemical Reviews, 95(1), 69–96.

Hsieh, W.H., Chiu, W.T., Lee, Y.S., & Ho, Y.S. (2004). Bibliometric analysis of patent ductus arteriosus treatments. Scientometrics, 60(2), 205–215.

Huth, E.J. (1986). Guidelines on authorship of medical papers. Annals of Internal Medicine, 104(2), 269–274.

Hynes, R.O. (1992). Integrins: Versatility, modulation, and signaling in cell-adhesion. Cell, 69(1), 11–25.

Ioannidis, J.P.A. (2010). Is there a glass ceiling for highly cited scientists at the top of research universities? FASEB Journal, 24(12), 4635–4638.

Kelly, J.C., Glynn, R.W., O'Briain, D.E., Felle, P., & McCabe, J.P. (2010). The 100 classic papers of orthopaedic surgery: A bibliometric analysis. Journal of Bone and Joint Surgery–British Volume, 92B(10), 1338–1343.

Khan, M.A., & Ho, Y.S. (2012). Top-cited articles in environmental sciences: Merits and demerits of citation analysis. Science of the Total Environment, 431, 122–127.

Komatsu, E., Dunkley, J., Nolta, M.R., Bennett, C.L., Gold, B., Hinshaw, G., . . . Wright, E.L. (2009). Five-year Wilkinson microwave anisotropy probe observations: Cosmological interpretation. Astrophysical Journal Supplement Series, 180(2), 330–376.

Kulkarni, A.V., Aziz, B., Shams, I., & Busse, J.W. (2009). Comparisons of citations in Web of Science, Scopus, and Google Scholar for articles published in general medical journals. JAMA, Journal of the American Medical Association, 302(10), 1092–1096.

Kulkarni, A.V., Busse, J.W., & Shams, I. (2007). Characteristics associated with citation rate of the medical literature. PLoS One, 2(5), e403.

Lander, E.S., Linton, L.M., Birren, B., Nusbaum, C., Zody, M.C., & Baldwin, J. (2001). Initial sequencing and analysis of the human genome. Nature, 409(6822), 860–921.

Lauer, H.H. and McManigall, D. (1986). Capillary zone electrophoresis of proteins in untreated fused silica tubing. Analytical Chemistry, 58(1), 166–170.

Lefaivre, K.A., Shadgan, B., & O'Brien, P.J. (2011). 100 most cited articles in orthopaedic surgery. Clinical Orthopaedics and Related Research, 469(5), 1487–1497.

Li, J.F., Wang, M.H., & Ho, Y.S. (2011). Trends in research on global climate change: A Science Citation Index Expanded-based analysis. Global and Planetary Change, 77(1–2), 13–20.

Li, L.L., Ding, G.H., Feng, N., Wang, M.H., & Ho, Y.S. (2009). Global stem cell research trend: Bibliometric analysis as a tool for mapping of trends from 1991 to 2006. Scientometrics, 80(1), 39–58.

Li, Z., & Ho, Y.S. (2008). Use of citation per publication as an indicator to evaluate contingent valuation research. Scientometrics, 75(1), 97–110.

Lin, H.W., Yu, T.C., & Ho, Y.S. (2011). A systemic review of the human papillomavirus studies: Global publication comparison and research trend analyses from 1993 to 2008. European Journal of Gynaecological Oncology, 32(2), 133–140.

Lipsman, N., & Lozano, A.M. (2011). The most cited works in major depression: The ‘citation classics.’ Journal of Affective Disorders, 134(1–3), 39–44.

Mattsson, P., Sundberg, C.J., & Laget, P. (2011). Is correspondence reflected in the author position? A bibliometric study of the relation between corresponding author and byline position. Scientometrics, 87(1), 99–105.

McGeown, J.G. (2006). Passing on the legacy: Teaching capillary filtration and developing presentation skills using classic papers. Advances in Physiology Education, 30(3), 108–112.

Moncada, S., Palmer, R.M.J., & Higgs, E.A. (1991). Nitric oxide: Physiology, pathophysiology, and pharmacology. Pharmacological Reviews, 43(2), 109–142.

Montori, V.M., Wilczynski, N.L., Morgan, D., Haynes, R.B., & the Hedges Team (2003). Systematic reviews: A cross-sectional study of location and citation counts. BMC Medicine, 1, article number 2.

Nakamura, K., Hagiwara, K., Hikasa, K., Murayama, H., Tanabashi, M., Watari, T., . . . Zyla, P.A. (2010). Review of particle physics. Journal of Physics G-Nuclear and Particle Physics, 37(7A), 1–1422.

Nishizuka, Y. (1984). The role of protein kinase-C in cell-surface signal transduction and tumor promotion. Nature, 308(5961), 693–698.

O’Leary, D.E. (2009). The most cited *IEEE Software* articles. IEEE Software, 26(1), 12–14.

Ohba, N., Nakao, K., Isashiki, Y., & Ohba, A. (2007). The 100 most frequently cited articles in ophthalmology journals. Archives of Ophthalmology, 125(7), 952–960.

Otwinowski, Z., & Minor, W. (1997). Processing of x-ray diffraction data collected in oscillation mode. Macromolecular Crystallography A, 276, 307–326.

Paladugu, R., Schein, M., Gardezi, S., & Wise, L. (2002). One hundred citation classics in general surgical journals. World Journal of Surgery, 26(9), 1099–1105.

Patterson, M.S., & Harris, S. (2009). Are higher quality papers cited more often? Physics in Medicine and Biology, 54(17). doi:10.1088/0031-9155/54/17/E01.

Perdew, J.P., & Zunger, A. (1981). Self-interaction correction to density functional approximations for many electron systems. Physical Review B, 23(10), 5048–5079.

Perdew, J.P., Chevary, J.A., Vosko, S.H., Jackson, K.A., Pederson, M.R., & Singh, D.J. (1992). Atoms, molecules, solids, and surfaces: Applications of the generalized gradient approximation for exchange and correlation. Physical Review B, 46(11), 6671–6687.

Picknett, T., & Davis, K. (1999). The 100 most-cited articles from *JMB*. Journal of Molecular Biology, 293(2), 173–176.

Piel, G. (1986). The social process of science. Science, 231(4735), 201.

Ponce, F.A., & Lozano, A.M. (2011). The most cited works in Parkinson’s disease. Movement Disorders, 26(3), 380–390.

Raff, H. (2005). Using classic papers to teach physiology. Advances in Physiology Education, 29(3), 138.

Reed, A.E., Curtiss, L.A., & Weinhold, F. (1988). Intermolecular interactions from a natural bond orbital, donor-acceptor viewpoint. Chemical Reviews, 88(6), 899–926.

Riordon, J., Zubritsky, E., & Newman, A. (2000). Top 10 articles—*Analytical Chemistry* looks at 10 seminal papers. Analytical Chemistry, 72(9), 324A–329A.

Rodríguez-Navarro, A. (2011). Measuring research excellence: Number of Nobel Prize achievements versus conventional bibliometric indicators. Journal of Documentation, 67(4), 582–600.

Ross, R. (1993). The pathogenesis of atherosclerosis: A perspective for the 1990s. Nature, 362(6423), 801–809.

Ross, R. (1999). Mechanisms of disease—atherosclerosis—an inflammatory disease. New England Journal of Medicine, 340(2), 115–126.

Schein, M., Paladugu, R., & Sutija, V.G. (2000). What American surgeons read: A survey of a thousand Fellows of the American College of Surgeons. Current Surgery, 57(3), 252–258.

Schmidt, M.W., Baldridge, K.K., Boatz, J.A., Elbert, S.T., Gordon, M.S., Jensen, J.H., . . . Montgomery Jr., J.A. (1993). General atomic and molecular electronic structure system. Journal of Computational Chemistry, 14(11), 1347–1363.

Schmidt, M.W., Baldridge, K.K., Boatz, J.A., Elbert, S.T., Gordon, M.S., & Jensen, J.H. (1993). General atomic and molecular electronic structure system. Journal of Computational Chemistry, 14(11), 1347–1363.

Shelton, R.D., & Holdridge G.M. (2004). The US–EU race for leadership of science and technology: Qualitative and quantitative indicators. Scientometrics, 60(3), 353–363.

Smith, D.R. (2008). Citation indexing and highly cited articles in the *Australian Veterinary Journal*. Australian Veterinary Journal, 86(9), 337–339.

Spergel, D.N., Bean, R., Dore, O., Nolta, M.R., Bennett, C.L., Dunkley, J., . . . Wright, E.L. (2007). Three-year Wilkinson microwave anisotropy probe (WMAP) observations: Implications for cosmology. Astrophysical Journal Supplement Series, 170(2), 377–408.

Spergel, D.N., Verde, L., Peiris, H.V., Komatsu, E., Nolta, M.R., Bennett, C.L., . . . Wright, E.L (2003). First-year Wilkinson microwave anisotropy probe (WMAP) observations: Determination of cosmological parameters. Astrophysical Journal Supplement Series, 148(1), 175–194.

Springer, T.A. (1990). Adhesion receptors of the immune-system. Nature, 346(6283), 425–434.

Stern, R.S., & Arndt, K.A. (1999). Top cited authors in dermatology—a citation study from 24 journals: 1982–1996. Archives of Dermatology, 135(3), 299–302.

Suk, F.M., Lien, G.S., Yu, T.C., & Ho, Y.S. (2011). Global trends in *Helicobacter pylori* research from 1991 to 2008 analyzed with the Science Citation Index Expanded. European Journal of Gastroenterology & Hepatology, 23(4), 295–301.

Sundell, J., & Nazaroff, W.W. (2009). The most cited articles in *Indoor Air*, through 18 years. Indoor Air, 19(2), 91–92.

Thomson Reuters (2012). Journal Citations Reports 2011. http://admin-apps.webofknowledge.com/JCR/static_html/notices/notices.htm

Venter, J.C., Adams, M.D., Myers, E.W., Li, P.W., Mural, R.J., & Sutton, G.G. (2001). The sequence of the human genome. Science, 291(5507), 1304–1351.

Wang, M.H., Yu, T.C., & Ho, Y.S. (2010). A bibliometric analysis of the performance of *Water Research*. Scientometrics, 84(3), 813–820.

Wohlin, C. (2005). Most cited journal reviews in software engineering. Information and Software Technology, 47(15), 955.

Wren, J.D., Kozak, K.Z., Johnson, K.R., Deakyne, S.J., Schilling, L.M., & Dellavalle, R.P. (2007). The write position—a survey of perceived contributions to papers based on byline position and number of authors. EMBO Reports, 8(11), 988–991.

Zhang, W.W., Qian, W.H., & Ho, Y.S. (2009). A bibliometric analysis of research related to ocean circulation. Scientometrics, 80(2), 305–316.

Zubarev, D.N. (1960). Double-time green functions in statistical physics. Uspekhi Fizicheskikh Nauk, 71(1), 71–116.