TIAFT ALAN CURRY AWARD WINNERS A Scientometric Evaluation

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Making a critical evaluation of a person's contributions to science is never easy and there is always an element of subjectivity involved. Counting the number of papers listed in a CV is not very helpful, because conference abstracts, book chapters, original articles and letters-to-the-editor are often combined in the same list. Furthermore, quantity is not the same as quality and publishing hundreds of articles in diverse scientific journals, including predatory journals, is not especially meritorious. Neither are journal impact factors (JIF) a reliable indicator of quality, although journals with the highest JIF also tend to have high rejection rates for unsolicited manuscripts. Moreover, acceptance by a high-impact journal does not necessarily mean that your article will become highly cited. The most objective indicator of quality and usefulness of a published paper is the number of times the work becomes cited in original articles and reviews penned by other scientists. An attempt to improve and standardize citation metrics was described in an article published in PLoS Biology. This contained supplementary EXCEL files listing 100,000 of the most cited authors from all scientific disciplines. These were selected from ~8 million scientists, who had written or co-written at least five papers that were abstracted in Elsevier's database SCOPUS. I searched these EXCEL files to find winners of TIAFT's Alan Curry award. There were nine individuals included among the 100,000 most highly cited scientists worldwide. In decreasing rank order of their composite citation score these TIAFT members were Ed Cone (US), Pascal Kintz (France), Hans Maurer (Germany), Marilyn Huestis (US), Olaf Drummer (Australia), Wayne Jones (Sweden), Robert Flanagan (UK), Fritz Pragst (Germany) and Alain Verstraete (Belgium).

Introduction

During the plenary lecture at the TIAFT meeting in Birmingham in 2019, Tony Moffat posed the question of "who is the greatest forensic toxicologist of all time?" He followed this up with an article published in the TIAFT bulletin identifying several people, who in his opinion were pioneers in the field and/or had made significant contributions (1). However, there did not appear to be any scientific basis for Moffat's selections, apart from "gut feelings" and "personal relationships."

I am sure that most members of TIAFT would agree that Tony Moffat's question is impossible to answer in any definite way. For instance, how can you realistically compare scientists engaged with forensic toxicology investigations over three centuries, spanning from the days of Mathieu Orfila (1787-1853) to the present time? The status of analytical chemistry then and now is like night and day; the analytical techniques and procedures used to identify drugs and poisons in body fluids are beyond comparison.

The field of Forensic Toxicology and the ability to identify drugs and toxins in biological specimens has changed remarkably since the 1940s, when instrumental techniques began to emerge. There was a revolution in the 1960s when the first gas- and liquid-chromatography (GC and LC) methods were used to determine a wide range of drugs and poisons in biological materials. By the 1970s, the chromatography separation technique was coupled to a mass spectrometric (MS) detector, which gave much higher sensitivity and specificity of analysis. The availability of synthetic drugs and pharmaceuticals has expanded greatly over the past 50 years and the many psychoactive substances now prescribed as medication are also being misused for recreational purposes.

Today, the analysis of drugs and toxic substances may appear relatively easy with the aid of high resolution LC-MS-MS techniques, but there are pitfalls for the unwary. Challenges remain about how best to interpret the analytical results, such as whether the concentrations reflect intake and abuse or simply passive exposure. Things like environmental contamination, instability of drugs and metabolites after sampling and before analysis etc., need careful consideration. In postmortem toxicology, diffusion and redistribution of drugs between different body compartments after death is a confounding factor, especially when the corpse is decomposed or exhumed.

From my interests in the history of Forensic Toxicology, as exemplified by essays appearing in the TIAFT bulletin "Profiles in Forensic Toxicology", I have reviewed the work of many famous 20th century practitioners, some of whom were personal heroes. In a recent article in TOXTALK, the newsletter of the Society of Forensic Toxicology, I identified Alexander Oscar Gettler (1883-1968) as a driving force in establishing the discipline of postmortem toxicology in the US (2).

Because of the multi-disciplinary nature of analytical and forensic toxicology, identifying the "greatest forensic toxicologist of all time" is virtually impossible, because people are intimately linked to their own special field of expertise. For example, the names of Erik Widmark (1889-1945) in Sweden (3) and Kurt Dubowski (1921-2017) in the US (4) are well-known for their research and publications on forensic aspects of ethanol. Other people are closely associated with analytical methodology, such as Hans Maurer (Germany), who has made major contributions to clinical toxicology, especially the application of GC-MS and LC-MS methods of analysis.

Edward Cone (US) deserves mention for his comprehensive and well-designed pharmacokinetic studies with many recreational drugs of abuse, including cocaine, THC etc., in all sorts of biological media. Pascal Kintz (France) is appreciated for his work and publications on drug analysis in hair strands (5). However, results need to be interpreted cautiously, owing to various artifacts, such as the method of decontamination and

extraction used, the clean-up procedure, cosmetic treatment (bleaching agents and conditioner) and environmental contamination (6). Standardization of analytical procedures and establishing a conservative analytical cut-off concentrations are important to differentiate actual drug use from passive exposure (7).

I could go on and on mentioning TIAFT members, who in one way or another, have made important contributions to various aspects of forensic toxicology, such as human behavior testing, research on alcohol, drugs and driving, the analysis of doping agents, drugs in alternative specimens and urine drug testing. But that would entail making selections from the entire literature of analytical and forensic toxicology and more objective ways to identify the *crème-de-la-crème* among TIAFT members are needed (8).

Bibliometrics

The word bibliometrics was coined in 1934 and is defined as "the measurement of all aspects related to the publication and reading of books and documents," and in 1969 as "the application of mathematics and statistical methods to books and other media of communication." The word scientometric, which appears in the title of this article, can be considered a branch of information science involving quantitative evaluation of certain characteristic of articles, authors and the journals where the results of research and scientific investigations are published. The guru of citation analysis was Eugene Garfield (1925-2017); a US pioneer in information science about whom I wrote a tribute in the TIAFT bulletin (9).

Citation analysis entails counting how often a published article is subsequently referenced in other articles from thousands of scientific journals worldwide. The number of citations is an objective indication of the usefulness or utility of the

FIGURE 1. THE NINE TIAFT MEMBERS AND WINNERS OF THE ALAN CURRY AWARD, WHO WERE LISTED AMONG THE TOP 100,000 MOST HIGHLY CITED SCIENTISTS IN ALL DISCIPLINES (10).

information contained in the article concerned, because other scientists have drawn attention to the work with a literature citation. Several databases and websites tally the annual number of citations received by articles published in thousands of scientific journals worldwide. Notable among these are Web of Knowledge, SCOPUS and ResearchGate. Information gleaned from these databases can be used to track developments in science and assess the impact of specific articles, authors, and the journals where their work was published. Citation metrics are widely used (and sometimes misused) in connection with evaluation of scientists for promotion, tenure, membership in learned societies, research grants and award of prizes and other accolades.

PLoS Biology

PLoS stands for Public Library of Science, which is an open-access, science, technology and medicine publisher of several highly successful scientific journals. There are roughly ten PLoS journals and the oldest of these is PLoS Biology (from 2003). An article appeared in a 2019 issue of PLoS Biology entitled "A standardized citation metrics author database annotated for scientific fields," with John P.A. Ioannidis (Stanford University) as first and corresponding author (10). In brief, Ioannidis and his colleagues assembled a list of the 100,000 most highly cited scientists' worldwide using information about their published work gleaned from searching the SCOPUS database. They compared and contrasted the published work of all scientists with at least five items classified by SCOPUS as articles, reviews or conference papers.

The abstract of the article in PLoS Biology reads:

> *Citation metrics are widely used and misused. We have created a publicly available database of 100,000 top scientists that provides standardized information on citations, h-index, coauthorship-adjusted hm-index, citations to papers in different authorship positions, and a composite indicator. Separate data are shown for career-long and single-year impact. Metrics with and without self-citations and ratio of citations to citing papers are given. Scientists are classified into 22 scientific fields and 176 subfields. Field- and subfield-specific percentiles are also provided for all scientists who have published at least five papers. Career-long data are updated to end of 2017 and to end of 2018 for comparison.*

Preparing the PLoS Biology article must have been a mammoth task, because the SCOPUS database contains data for millions of scientists publishing articles in all scientific disciplines. The PLoS Biology article represents a good example of "research on research" and the resulting databases were provided as EXCEL files as supplementary material, via the journal website. I have worked with these EXCEL files and searched for and filtered out the citation records of winners of TIAFT's Alan Curry award. The names of nine winners of this award were included among the 100.000 most highly cited scientists in all scientific disciplines (see figure 1). The photos were chosen by me and were in the public domain available from various websites.

Authorship practices

In my eyes, a unique feature of the PLoS Biology article and the accompanying EXCEL databases was that several different types of citation metrics were used to compare scientists, not just a single indicator, such as the well-known H-index (11). Indeed, particular attention was given to citations to papers if the person was a sole author, first author, last author or some combination thereof. The citation analysis and composite score was reported with and without including self-citations, that is, when an author cites an earlier paper they had written or co-authored. Based on six citation metrics (see later), the PLoS Biology article arrived at a "composite score" ranking the 100.000 scientists accordingly (10).

The days when names on a multi-authored paper are arranged in alphabetical order are long gone. With solo authored papers it is obvious to whom all the credit and responsibility belong, but articles with only one author, unless it is a review article, are not so commonly encountered. The first name on a multi-authored article is usually the person who made the biggest contribution to the completion of the work, including laboratory practical work, statistical analysis of the data collected and drafting the manuscript for publication, etc. Very often the first author is also listed as the corresponding author during submission and peer review process, which reinforces the prime importance of that person's role in the author by-line.

Being listed as the last name on a paper is also considered a prestige position, and is usually reserved for the head of the department, the institute chief, or the person who supervised the work or mentored the graduate student(s) involved. The person listed last on a paper might only have provided laboratory facilities for the experimental work, or helped with acquisition of the funding, which could just as well have been mentioned in an acknowledgement and not as co-authorship. Furthermore, articles and scientific journals abound with examples of honorary and/or ghost authorship (12,13). Most credit and recognition for the final published article belongs to the person named as the first author and a consensus should be reached about name ordering at an early stage in the joint project

The lead author of the PLoS Biology article is probably one of today's most prolific scientists. His current H-index, according to Google scholar, is 203 (Sept 2020), which means that his name appears on 203 articles each of which has been cited >= 203 times. For comparison, my own Google Scholar H-index (Sept 2020) was 62. John Ioannidis' CV was online via the Stanford University website and among other things, there were 1026 original articles listed. He even included a so-called "author position analysis" writing:

> *Among these 1026 publications; first author in 302 articles (single author in 145 articles), last author in 371 articles, author in other positions in 353 articles; single/first/last author position in 66% of articles (673/1026). Among the 353 articles that are not single/first/last-authored; second author in 93, one of several senior authors with equal contributions in many others.*

Maybe TIAFT members and especially candidates for the Alan Curry award should consider including such an authorship declaration when they prepare their CVs for submission and evaluation by the executive board or other award committees.

It is not easy to review and evaluate a person's CV containing scores, sometimes hundreds, of published articles with no explanation as to what the person had contributed to multi-authored papers. When there are 6-12 names on the paper, as is often the case in the medical field, it is virtually impossible to know what exactly each person contributed (14). Being listed as first and last author are the prestige positions and exactly what other names on the paper contributed to genesis of the finished work remains an open question.

These days, many international journals require an "authorship declaration" when a manuscript is submitted for peer review and publication. The individual authors are expected to spell-out exactly what their input was to the genesis and completion of the finished article (15). This author declaration is then

TABLE 1. THE NINE WINNERS OF TIAFT'S ALAN CURRY (AC) AWARD, WHO WERE AMONG THE 100,000 MOST HIGHLY CITED SCIENTISTS IN ALL DISCIPLINES. SHOWN ARE COUNTRY WHERE THEY WORK, NUMBER OF PAPERS IN THE SCOPUS DATABASE AND THEIR COMPOSITE CITATION SCORES WITH AND WITHOUT SELF-CITATIONS AND RESEARCH DISCIPLINE, ACCORDING TO THE S4 EXCEL FILE FROM THE PLOS BIOLOGY ARTICLE (10).

TIAFT member	Year of AC award	Country	Paper count	Composite score, without self-citations	Composite score, with self-citations	Research category or discipline
Cone, E	2006	US	313	3.9944	4.0236	Analytical chemistry
Kintz, P	2015	France	471	3.9765	4.0200	Legal and forensic medicine
Maurer, HH	2003	Germany	330	3.9590	4.0863	Analytical chemistry
Huestis, MA	2010	US	447	3.9237	3.9984	Analytical chemistry
Drummer, OH	2016	Australia	271	3.8161	3.8310	Legal and forensic medicine
Jones, AW	2011	Sweden	272	3.8085	3.8792	Legal and forensic medicine
Flanagan, RJ	2019	UK	193	3.4470	3.4729	Analytical chemistry
Pragst, F	2007	Germany	135	3.4357	3.4526	Legal and forensic medicine
Verstraete, AG	2018	Belgium	163	3.3187	3.3634	Legal and forensic medicine

published at the end of the article, usually before the list of references along with a conflict of interest statement, and acknowledgement for funding sources, etc (16).

When reading these author declarations on published articles, one notices a lot of duplication of the things each person contributed, as exemplified by a recent publication in Forensic Science International. This was a database study with six co-authors and their contributions were summarized as follows:

- Conceptualization, investigation, writing original draft, review and editing.
- Conceptualization, methodology, formal analysis, investigation, writing, review and editing.
- Investigation, writing, review and editing.
- Investigation, writing, review and editing.
- Conceptualization, investigation, data selection, writing, review and editing.
- Supervision, conceptualization, methodology, investigation, funding acquisition, writing, review and editing.

From the above, one notices that several people did more or less the same thing, which does not make it easy to attribute credit to the individual names on the paper. Accordingly, when evaluating and attributing credit, the first name, last name and corresponding author should remain the main focus of attention also in the future.

Alan Curry award

The Alan Curry award is TIAFTs most prestigious honor and is intended to recognize those members of our organization who have made a career long contribution to analytical and/or forensic toxicology. The award is named after Alan Stewart Curry (1925-2017) of the United Kingdom (UK) and was established in 1992. The publication track record and other merits of those nominated for the award is evaluated by the TIAFT executive board. The name of the winner is announced in conjunction with the annual meetings in an award ceremony. The first recipient of the Alan Curry award was Neville Dunnett (UK) in 1993 and the most recent recipient was Robert Flanagan (UK) in 2019. In the intervening years (1993-2019) there have been 22 other winners of this award.

To prepare the present article, I used the PLoS Biology supplementary EXCEL databases and searched for the names of people honored with TIAFT's Alan Curry award. There were nine award winners listed among the top 100,000 most highly cited scientists in all disciplines. Six citation metrics were used to calculate a composite score; total citations, Hirsch h-index, h-index adjusted for multiple-authors, citations to single author papers, citations to single or first author papers and citations to single, first or last authored papers combined. These six metrics were weighted using a rather complex looking formulae and the 100,000 scientists were then ranked after their composite score. This ranking was done with and without including self-citations.

Table 1 lists the names of the nine TIAFT award winners, who were among the top 100,000 scientists in all scientific disciplines included in the database. The year of their Alan Curry award, the country where they work, a publication count (according to SCOPUS) and a composite score with and without including self-citations are presented. The primary journal subject category in which their articles are published is also shown.

Because forensic science and toxicology are intimately linked with law enforcement, besides counting citations in scientific journal articles, one should perhaps also consider the number of times a person's work is cited in legal judgments and decisions in criminal and civil cases, but this information is not so easy to obtain and evaluate.

When evaluating the EXCEL databases, there are several caveats to remember, as explained in the PLoS Biology article. People publish in many different scientific journals and my own papers were listed under several categories, such as "Legal and Forensic Medicine, "Substance Abuse" and "General Medicine,"

TABLE 2. VALUES OF THE SIX CITATION METRICS USED TO CALCULATE THE COMPOSITE SCORES OF THE NINE WINNERS OF TIAFT'S ALAN CURRY AWARD

TIAFT member	Rank in database[1]	Total cites	H-index	H-adjusted[2]	Single author papers (cites)	Single and first author papers (cites)	Single, first or last author papers (cites)
Cone, E	9797	10252	56	31.71	18 (704)	118 (3255)	220 (6844)
Kintz, P	10519	8243	47	31.85	63 (907)	251 (4218)	319 (5732)
Maurer, HH	11226	7252	45	30.88	29 (1370)	78 (2583)	272 (6567)
Huestis, MA	12850	12762	52	30.06	8 (429)	38 (2020)	314 (8367)
Drummer, OH	19197	6793	44	26.17	30 (747)	78 (1969)	187 (4470)
Jones, AW	19678	4180	34	27.73	85 (1243)	201 (2980)	244 (3778)
Flanagan, RJ	63195	2989	33	18.25	17 (197)	74 (1285)	147 (2561)
Pragst, F	65360	3600	35	15.88	9 (168)	46 (1390)	90 (2460)
Verstraete, AG	90021	2934	30	13.24	8 (386)	26 (537)	80 (1574)

[1] RANKING AMONG THE TOP 100,000 MOST HIGHLY CITED SCIENTISTS IN ALL SCIENTIFIC DISCIPLINES.
[2] MODIFIED TO ADJUST CITATIONS FOR MULTIPLE AUTHORSHIP.

in that order. As already mentioned, SCOPUS was the source of the bibliometric data used to prepare the standardized citation metrics and the authors wrote:

"For papers published from 1960 until 1995, the citations received in 1996–2017 are also included in the calculations, but the citations received up to 1995 are not."

This means, of course, that some of the elder generation of forensic toxicologist, who might have produced many highly cited articles prior to 1995, are not credited with these citations, unless the articles were referenced in journal articles published between 1996 and 2017. Furthermore, to allow a direct comparison between people with shorter or longer careers, the Stanford University group included citation data for just one calendar year (2017). They wrote:

"It provides a measure of performance in that single recent year. Therefore, it removes the bias that may exist in comparing scientists with long accrual of citations over many years of active work versus younger ones with shorter time frame during which they may accumulate citations because it focuses on citation accrual only during a single year."

Accordingly, the citation data and other metrics in the EXCEL files were labelled (S1), which covered a 22 year time span from January 1, 1996 until December 31, 2017. The second EXCEL file (S2) included citation data for a single calendar year 2017. This is probably more relevant when comparing people of different ages and who were publishing papers for different periods of time. The third EXCEL file (S4) looked at citations accumulated to the end of 2018. Regardless of the database used, there was a high correlation and good overall agreement and ranking of the nine TIAFT members did not change much.

Table 2 contains values for the six citation metrics used to derive the composite scores shown in table 1. The ranking among the 100.000 most cited scientists in all disciplines is listed first, then the total number of citations, the H-index in 2018 according to SCOPUS and number of papers as single author, single or first author and single, first or last author. Also shown in parenthesis are the number of citations to single, first and last authored papers.

There are bound to be small errors and inconsistencies when such a large bibliometric project is undertaken and much depends on the reliability and completeness of information in the SCOPUS database. I noticed a few things myself, for example the last publication year of my own articles was given as 2015, although I also authored or co-authored several articles 2016-2019 and these should also be included in the SCOPUS database.

Concluding remarks

Scientific impact is a sensitive and contentious subject and this always involves some degree of subjectivity. However, it is generally agreed that an objective measure of a person's contributions to a research field or discipline is gleaned from the number of times the articles they write and publish are referenced in articles penned by other scientists (19). Furthermore, the number of publications as single author, first-author and last-author are also important considerations when judging a person's contributions to a particular scientific field. Some people also pay attention to the prestige of the journals where the articles were published, such as by the Journal Impact Factor (JIF) and the higher the better (20).

Love them or hate them, the JIF and other citation metrics are here to stay. They are often utilized by universities when people apply for promotion or tenure and by funding agencies when people apply for research grants (20). A person's publication and citation track record is also considered when they are nominated for membership in learned societies or are proposed to receive various awards and other accolades, such as the Alan Curry Award.

The discipline of citation analysis and bibliometrics has interested me for many years and I have written several articles about authorship practices (18), most cited articles and journals (19) as well as the pros and cons of the JIF (20). The present article has focused on winners of TIAFT's Alan Curry award and whether they were among the top 100,000 most highly cited scientists worldwide in all scientific disciplines.

The PLoS Biology article (10) and the associated EXCEL databases can be filtered in various ways to find highly cited scientists from certain countries or universities and those active

in different subject categories. Each of the highly cited authors was allocated a primary and secondary subject category, such as “Analytical Chemistry” or “Pharmacology and Pharmacy” or “Legal and Forensic Medicine”, etc.

A more recent article in PLoS Biology (published online 6th October 2020) by the same research group from Stanford University contained an update of their database to cover all publications up to the end of 2019 (21). The latest version of the citation database therefore included eight million scientists each of whom had at least five papers in the SCOPUS database. A new feature of the updated database was that the names of those within the top-cited 2% of their scientific discipline, e.g. “legal and forensic medicine”, were included. There were 215 people considered to be within the top 2% from a total of 10,159 individuals with “legal and forensics medicine” as their primary scientific discipline. However, only 30 of the 10,159 (0.3%) forensic practitioners were among the top 100,000 most highly cited scientists in all disciplines. This constitutes an elite group of forensic scientists and topping the list of the most highly cited was Dr. Pascal Kintz (France).

The article by Tony Moffat (1) correctly identified two contemporary forensic toxicologists, namely Hans Maurer and Pascal Kintz, as being among the greatest of all time. The present bibliometric analysis verifies that the publications by Kintz and Maurer have been highly cited in papers published by other scientists (10). Other winners of TIAFT’s Alan Curry Award (figure 1) were also listed among the 100,000 most highly cited scientists in all disciplines.

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TIAFT PRIZE: BEST BULLETIN PAPER

TIAFT will again be sponsoring the best paper published in the TIAFT Bulletin since the Birmingham meeting.

The Best Bulletin Paper will be decided by the TIAFT Executive Board and the award will be presented at the annual TIAFT meeting. The award winner will be acknowledged with a certificate and $500USD. We hope that this encourages our members to contribute to the Bulletin.

The following restrictions apply:

1. The author, or one of his/her co-authors, must be a TIAFT member;

2. The paper must not have been published elsewhere;

3. The paper must not infringe copyright of already published material.

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