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The 2009 Race for Impact by Journals in Sport and Exercise Science and Medicine, and Tom Reilly's H Index

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Sportscience 12, 24-27, 2009 (sportsci.org/2009/wghif.htm)
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Amongst journals specializing in sport and exercise, the gold medal for the highest impact factor this year went for the first time to American Journal of Sports Medicine (3.6). Making a substantial improvement since last year, Medicine and Science in Sports and Exercise was second equal with Exercise and Immunology Reviews (3.4). A substantial decline in form resulted in fourth place for Sports Medicine (3.0). Sharing the prize for most noteworthy improvement (70-80%) were Journal of Science and Medicine in Sport (1.9) and Journal of Sport Management (1.1). Other journals making substantial gains (30-70%) were Journal of Electromyography and Kinesiology (1.8), Human Movement Science (1.7), Journal of Aging and Physical Activity (1.7), Psychology of Sport and Exercise (1.6), and Research Quarterly for Exercise and Sport (1.2). This year's new competitors were European Journal of Sport Science (0.8) and Sports Biomechanics (0.5). International Journal of Sports Physiology and Performance failed to qualify but had an estimated factor of ~1.0. Journals showing substantial impairments in performance (10-40%) included Exercise and Sport Sciences Reviews (2.6), British Journal of Sports Medicine (2.1), Clinics in Sports Medicine (1.3), Journal of Applied Sport Psychology (1.1), and Journal of Strength and Conditioning Research (0.8). Journals with small or negligible change since last year included Journal of Biomechanics (2.8), Scandinavian Journal of Medicine and Science in Sports (2.3), Journal of Sport and Exercise Psychology (2.1), Journal of Athletic Training (1.7), Journal of Sports Sciences (1.7), Clinical Journal of Sport Medicine (1.6), International Journal of Sports Medicine (1.6), International Journal of Sport Nutrition and Exercise Metabolism (1.4), Journal of Applied Biomechanics (1.2) and Pediatric Exercise Science (1.0). A new citation statistic, the H or Hirsch index, is gaining attention as a measure of lifetime impact of an individual researcher. The renowned and recently deceased Tom Reilly has an H index of 38, which means he is an author of 38 publications that have each been cited at least 38 times, or 1.06 for each of his 36 publishing years–a high benchmark for sport scientists. KEYWORDS: academic, citation, publication, research.

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Updates July 2009: Hirsch (2005) demonstrated that his index is approximately proportional to a researcher's number of productive years. Researchers in the same discipline can therefore compare their H indices by dividing them by their years of publishing. Tom Reilly authored his first paper in 1973, giving him an H "rate" of 38/36 = 1.06 per publishing year. Several minor errors in the section on the H index have also been corrected.

This article represents my annual update of the impact factors of journals in the disciplines of exercise and sport science and medicine, cribbed from the latest edition of Journal Citation Reports. If you are new to the notion of a journal's impact factor, it is the average number of times the average article in the journal has been cited recently. As such, it is an objective measure of the credibility or usefulness of articles in the journal. The impact factor probably adds little to what experienced researchers already know about the relative importance of journals. Nevertheless, these updates are justifiable if only for their entertainment value, which is not dissimilar to that of competitive

sport. See last year's update and the links therefrom for more information about the impact factor, its limitations, and related statistics.

The abstract of this article provides an overview of this year's impact factors of the main journals in our disciplines, along with some new entrants. I was disappointed not to find the International Journal of Sports Physiology and Performance amongst them. This journal is now in its fourth year of publication and could have qualified for inclusion. I have therefore calculated its impact factor by putting its name and the years 2006-2007 into the advanced search form of Google Scholar. I retrieved 88 articles, and the total cites to these articles was 166. If we assume half the cites were made in journals published last year, the impact factor is approximately 1.0, which is a very good entry level. The value next year is likely to be lower, because 70 of the cites were to the article on magnitude-based inferences by Alan Batterham and me in the first issue, which will not be included in next year's calculation.

As in previous updates I will finish this article by introducing you to another citation statistic. Earlier this year a colleague brought my attention to the H index or number, named after the physicist Jorge Hirsch, who suggested it as a measure of an individual's lifetime publishing impact. Rather than attempting to define the H index, I will explain how I got it for a particular individual. I chose Tom Reilly, a founding father not only of British and European sport science but also of chronobiology and ergonomics, who died on June 11. I started by putting *t-reilly* into the author field of the Google Scholar advanced search form. The resulting reference list comes up pre-sorted in approximate descending order of the number of cites to each reference. I counted down this list from the top until I reached the last reference where the number of cites exceeded or equaled the number of the reference. The number of that reference is Tom Reilly's H index, 38, which means that he had 38 publications each cited at least 38 times. We can now regard this number as a benchmark for outstanding lifetime impact by a sport scientist. Reilly and Thomas (1976) was his publication with the most cites (186). His total number of publications is difficult to determine precisely because of the other T Reillys, but it appears to be ~500.

The procedure to get the H index was actually a little more difficult than I described above. To cut down on other T Reillys, I limited the search to references with at least one of the words *exercise, sport, physical activity, ergonomic,* and *circadian*. The list was still heavily contaminated with other T Reillys, most of which I eliminated by inserting *tm-reilly wt-reilly dt-reilly tj-reilly te-reilly jt-reilly* in the search field labeled ***without*** *the words*. The sorting was also far from perfect, so I copied the first 50 references into a Word doc to manually complete the editing and sorting, and I also skimmed the next 100 references for any highly cited publications that were out of sequence.

There are several conceptual problems with the H index: it discriminates against individuals who have been influential by publishing only a few very highly cited articles; its value will be lower when estimated with a conservative database such as Web of Science; and by being essentially non-parametric it does not adequately take an individual's total productivity (publications) or total influence (cites) into account. On the other hand, the H index is easy to calculate and verify, if your name isn't too ordinary or you aren't too productive. With these limitations, the H index is good for some fun of the mine's-bigger-than-yours variety, but there will be a need for serious validation and benchmarking if it is used to award grants and promotions. Find out more about the index in a Wikipedia article and in Hirsch (2005).

Hirsch JE (2005). An index to quantify an individual's scientific research output. Proceedings of the National Academy of Sciences USA 102, 16569–16572

Reilly T, Thomas V (1976). A motion analysis of work-rate in different positional roles in professional football match-play. Journal of Human Movement Studies 2, 87-97

Table 1: Impact factors (citations per paper) for sport and exercise science journals based on papers published in 2006 and 2007 that were cited in 2008. Some impact factors are shown as inequalities, to comply with terms of use set by Thomson Scientific. "<1.0" implies a value between 0.1 and 1.0. ??? indicates a likely accidental omission. A journal without an impact factor is not in Thomson Scientific's science or social sciences databases, either because the journal is too new or the factor is too low. Colors indicate changes in impact factor since last year.

	↑ ≥70%		↑ 30-69%		↑ 10-29%		↑↓ 0-9%		↓ 10-60%

<1.0	ACSM's Health and Fitness Journal	0.6	International Journal of Sport Psychology
???	Acta Physiologica Scandinavica	1.6	International Journal of Sports Medicine
<1.0	Adapted Physical Activity Quarterly		International J of Sports Physiology & Performance
	American Journal of Medicine and Sports		International Review for the Sociology of Sport
1.7	American Journal of Physical Medicine & Rehabilitation	<1.0	International Sportmed Journal
3.9	American Journal of Physiology - Endo & Metab		International Sports Journal
3.6	American Journal of Physiology - Heart & Circ	0.2	Isokinetics and Exercise Science
3.6	American Journal of Sports Medicine	<0.1	Japanese Journal of Physical Fitness and Sport
1.3	Applied Ergonomics	1.7	Journal of Aging and Physical Activity
1.6	Applied Physiology Nutrition & Metabolism		Journal of Applied Behavioral Science
<1.0	Applied Psychological Measurement	1.2	Journal of Applied Biomechanics
1.2	Applied Psychology-International Review	3.7	Journal of Applied Physiology
2.2	Archives of Physical Medicine and Rehabilitation	3.8	Journal of Applied Psychology
<1.0	Athletic Therapy Today	1.1	Journal of Applied Sport Psychology
1.9	Australian Journal of Physiotherapy	1.7	Journal of Athletic Training
0.8	Aviation Space and Environmental Medicine	2.8	Journal of Biomechanics
1.7	Behavior Research Methods		Journal of Bodywork and Movement Therapies
<1.0	Biology of Sport	1.5	Journal of Clinical Psychology
2.1	British Journal of Sports Medicine		Journal of Comparative Physical Education & Sport
2.0	Clinical Biomechanics	1.8	Journal of Electromyography and Kinesiology
1.6	Clinical Journal of Sport Medicine	3.2	Journal of Epidemiology and Community Health
3.2	Clinical Nutrition		Journal of Exercise Physiology Online
1.3	Clinics in Sports Medicine	???	Journal of Human Movement Studies
	Current Sports Medicine Reports		Journal of Human Performance in Extreme Environments
<1.0	Deutsche Zeitschrift fur Sportmedizin	<1.0	Journal of Leisure Research
	Electromyography and Motor Control	1.0	Journal of Motor Behaviour
1.6	Ergonomics	3.6	Journal of Nutrition
1.9	European Journal of Applied Physiology	2.1	Journal of Occupational & Environmental Medicine
2.7	European Journal of Clinical Nutrition	1.9	Journal of Orthopaedic & Sports Physical Therapy
0.8	European Journal of Sport Science	<1.0	Journal of the Philosophy of Sport
	European Review of Aging and Physical Activity		Journal of Physical Education, Recreation, & Dance
	European Sports History Review	4.6	Journal of Physiology
3.4	Exercise and Immunology Reviews	1.9	Journal of Science and Medicine in Sport
2.6	Exercise and Sport Sciences Reviews	1.3	Journal of Social and Clinical Psychology
2.7	Gait and Posture	2.1	Journal of Sport and Exercise Psychology
1.7	High Altitude Medicine and Biology	<1.0	Journal of Sport and Social Issues
1.7	Human Movement Science		Journal of Sport Behavior
5.8	International Journal of Epidemiology		Journal of Sport History
	International Journal of History of Sport	1.1	Journal of Sport Management
	International Journal of Performance Analysis in Sport	<1.0	Journal of Sport Rehabilitation
1.4	International J of Sport Nutrition & Exercise Metabolism		Journal of Sports Chiropractic and Rehabilitation

<1.0	Journal of Sports Medicine and Physical Fitness
0.6	Journal of Sports Science and Medicine
1.7	Journal of Sports Sciences
	Journal of Sports Traumatology
0.8	Journal of Strength and Conditioning Research
	Journal of Swimming Research
<1.0	Journal of Teaching in Physical Education
<1.0	Leisure Sciences
	Leisure Studies
	Measurement in Physical Education & Exercise Science
<1.0	Medicina dello Sport
3.4	Medicine and Science in Sports and Exercise
	Medicine and Sport Science
1.6	Motor Control
1.0	Pediatric Exercise Science
	Pediatric Physical Therapy
<1.0	Perceptual and Motor Skills
	Physical Educator
2.2	Physical Therapy
0.6	Physical Therapy in Sport

???	Physician and Sportsmedicine
1.6	Psychology of Sport and Exercise
<1.0	Quest
	Research in Sports Medicine
1.2	Research Quarterly for Exercise and Sport
2.3	Scandinavian Journal of Medicine & Science in Sports
<1.0	Science and Sports
0.7	Sociology of Sport Journal
	Sport History Review
0.5	Sport, Education, and Society
0.9	(The) Sport Psychologist
0.5	Sports Biomechanics
	Sports Exercise and Injury
3.0	Sports Medicine
1.0	Sports Medicine and Arthroscopy Review
	Sports Medicine Standards & Malpractice Reporter
<1.0	Sportverletzung-Sportschaden
	Strength and Conditioning
<1.0	Strength and Conditioning Journal
	Women in Sport & Physical Activity Journal

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Published June 2009
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