A list of highly influential biomedical researchers, 1996–2011

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ABSTRACT

We have generated a list of highly influential biomedical researchers based on Scopus citation data from the period 1996-2011. Of the 15,153,100 author identifiers in Scopus, approximately 1% (n=149,655) have an h-index >=20. Of those, we selected 532 authors who belonged to the 400 with highest total citation count (>=25,142 citations) and/or the 400 with highest h-index (>=76). Of those, we selected the top-400 living core biomedical researchers based on a normalized score combining total citations and h-index. Another 62 authors whose focus is outside biomedicine had a normalized score that was at least as high as the score of the 400th core biomedical researcher. We provide information on the profile of these most influential authors, including the most common Medical Subject Heading terms in their articles that are also specific to their work, most common journals where they publish, number of papers with over 100 citations that they have published as first/single, last, or middle authors, and impact score adjusted for authorship positions, given that crude citation indices and authorship positions are almost totally orthogonal. We also show for each researcher the distribution of their papers across 4 main levels (basic-to-applied) of research. We discuss technical issues, limitations and caveats, comparisons against other lists of highly-cited researchers, and potential uses of this resource.

Keywords Bibliometrics, biomedical researchers, citation counts, h-index, scientific impact, scientometrics.

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Introduction

The world of modern science has become increasingly competitive in recent years. Literature-based metrics are playing a greater role in decision-making than in the past [1]. Many researchers are highly aware of their so-called status, and check diverse metrics related to the impact of their work on a regular basis. The differing dimensions of impact and reasons for citing are receiving renewed discussion and analysis [2–6]. Although citation counts and related metrics (e.g. journal impact factor, h-index for individual researchers) are typically considered as proxy for impact [7], the nature of that impact is rarely, if ever, specified.

It is within this context of creating a better understanding of impact(s) that we have created a list of highly influential biomedical researchers. Ranking of scientists is explicitly not the main purpose of this list. Rather, we wanted to identify a pool of researchers who have had sustained success in highly influential work and who would thus presumably have substantial insight into differing features that could be associated with high impact. This list is being used in an ongoing survey where highly cited researchers are asked about the features of

their most-cited articles. However, the list may be of use for many other purposes, as we discuss below.

Method and construction of database

We created a list of 400 highly influential biomedical scientists using an XML copy of the entire Scopus database obtained from Elsevier in June 2012. Scopus data contain author identifiers for each individual researcher (http://www.info.sciverse.com/scopus/scopus-in-detail/tools/authoridentifier). We used these Scopus author identifiers rather than attempting to solve the author identity or disambiguation problem [8] independently. Scopus author identifiers do suffer to some extent from the two main problems associated with the author identity problem – polysemy (multiple authors merged in a single identifier) and synonymy (multiple identifiers for a single author). Based on our experience, as many as 10% of prolific authors have more than one Scopus author identifier (unpublished observation). However, in the majority of these cases, the papers are split between one very large profile that is weighted

towards older publications and one that is much smaller containing a few newer publications. Thus, few cases of synonymy have a large or deleterious effect on metrics. Polysemy occurs far less often, but is much more problematic from a metrics point of view because the works of multiple authors are counted together. Polysemy is most often associated with common names. Many of the cases are easy to identify due to an unnaturally large number of papers associated with an author identifier.

The method we used to identify highly influential researchers assumes that the Scopus author identifiers have been correctly assigned to individual papers, and that each Scopus author profile contains only papers authored by that researcher. The method used was as follows. For each of the 15 153 100 Scopus author identifiers:

1 The number of articles published between 1996–2011, along with all citations to those articles as of the end of 2011, was counted.
2 These articles and citations to them were used to calculate an h-index [9] as of the end of 2011.
3 Using a local copy of the PubMed database covering the same time period, and for which we had previously linked Scopus records with PubMed records [10], we determined the fraction of publications from (1) that also appear in PubMed.

Of the over 15 million author identifiers, 149 655 (corresponding to 1% of the total) had an h-index of at least 20. These authors were ranked by total citation counts and by h-index. The number of authors with an h-index of at least 30, 40, 50, 60, 70 and 80, was 45 752; 15 385; 5185; 1773; 717, and 281, respectively. We focused on those authors who were ranked in the top 400 by either h-index or by total citation count, that is, those that had either h-index of at least 76 or total citation count of at least 25 142. This resulted in a list of 532 authors. 268 authors were ranked in the top 400 using both metrics, while 264 were ranked in the top 400 using one metric or the other.

Sorting of the 532 researchers was accomplished by first normalizing their total citation counts and h-index values to the top such values (100 939 citations for Shizuo Akira; h-index of 156 for Walter Willett), and then averaging these two normalized values. There are many ways of measuring impact. Rather than choosing a single value upon which to sort, we chose to include both total citation counts and h-index in our process.

There are obviously highly influential researchers across all scientific fields. We chose to generate a focused list of 400 researchers who publish primarily in biomedicine. Upon inspection, we found that all highly cited researchers with at least 80% of their publications linked to PubMed could be clearly classified as core biomedical researchers. In addition, for those

with PubMed linked fractions between 60–80%, roughly half could be considered as core biomedical researchers while the rest have a focus outside biomedicine. The proportion of PubMed linkage of the articles of these authors was apparently lower than the true values, because of potential inaccuracies in the linkage process or uneven coverage in one source or the other. For these cases, biomedical researchers were definitively separated from nonbiomedical researchers by inspection of Medical Subject Heading (MeSH) terms associated with their work and the journals in which they mainly publish. Those with PubMed fractions below 60% were clearly nonbiomedical researchers.

The disposition of the 532 authors was as follows. The top 407 core biomedical researchers (seven deceased, 400 living) form our list of highly influential biomedical researchers. These are listed in Table 1 along with numbers of articles, total citation counts, h-index and the normalized score. Institutions in Table 1 are best estimates of the authors' primary affiliations, but may not be completely accurate due to mobility or joint appointments. Table 2 lists the 62 nonbiomedical researchers whose normalized score is higher than the lowest normalized score of the researchers listed in Table 1. These authors would have appeared on the list if we were making no distinction between biomedical and nonbiomedical subject areas.

The remaining 63 authors are not included in either list for the following reasons: 12 were removed from the list because the numbers of articles associated with those author names, combined with them having common names, made us suspicious that these were cases of polysemy; seven had fewer than three papers cited at least 100 times for which they were first, single or last authors, likely indicating that others were principal investigators on the vast majority of the work associated with their publications; and 44 had normalized scores less than those of the biomedical authors in Table 1.

Tables 1 and 2 also list the dominant specialty journal (excluding the multidisciplinary journals *Science, Nature, PNAS* and *PLoS One*) for the articles of each highly cited scientist. This information may offer insight for the main field(s) where each scientist is working. To offer some further information, we have also selected differentiating MeSH terms from their publications. To do this, we first remove a list of the most common terms (e.g. human, male, female, etc.), check terms and geographical terms; after this step, the top remaining terms for each scientists may still be too generic (a common issue with any thesaurus); therefore, we use the following formula to rank MeSH terms: $\log(1 + n/nptot)*n/nkwd$ where n = #times the MeSH term occurs (for an author), nptot=number of papers by the author, nkwd = #times the MeSH term occurs across all of PubMed. The formula thus rewards a MeSH term that is dominant for the author, but penalizes that term if it is common. To avoid selecting MeSH terms that are highly specific to the author but represent only a tiny proportion of his/her

Table 1 Highly influential biomedical researchers (Scopus 1996–2011)

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Abecasis, Gonçalo R.	University of Michigan	Nature Genetics	184	26 910	69	0.354	7	12	39	0.116
Aebersold, Ruedi	ETH Zurich	Molecular and Cellular Proteomics	443	40 713	92	0.497	2	49	37	0.288
Aggarwal, Bharat B.	MD Anderson Cancer Center	Journal of Biological Chemistry	433	27 004	93	0.432	16	61	10	0.382
Akira, Shizuo	Osaka University	Journal of Immunology	915	10 0939	153	0.990	15	92	119	0.469
Alitalo, Kari	University of Helsinki	Blood	358	34 461	104	0.504	2	51	53	0.252
Allis, C. David	Rockefeller University	Cell	221	39 449	98	0.510	1	46	49	0.249
Alnemri, Emad S.	Thomas Jefferson University	Journal of Biological Chemistry	137	24 523	77	0.368	2	22	36	0.147
Alt, Frederick W.	Harvard University	Journal of Experimental Medicine	276	23 173	91	0.406	0	44	40	0.213
Altman, Douglas G.	University of Oxford	British Medical Journal	474	33 049	86	0.439	11	31	33	0.246
Altshuler, David	Harvard University	Nature Genetics	204	35 366	84	0.444	5	21	51	0.150
Amann, Rudolf	Max Planck Institute for Marine Microbiology	Applied and Environmental Microbiology	240	19 173	78	0.345	5	30	28	0.192
Anderson, David J.	Abbott Laboratories	Neuron	332	21 743	78	0.358	3	36	26	0.215
Anderson, Kenneth C.	Harvard University	Blood	773	37 405	96	0.493	0	69	24	0.366
Antman, Elliott M.	Harvard University	Circulation	416	46 810	103	0.562	16	9	81	0.133
Appelbaum, Frederick R.	University of Washington	Blood	368	22 428	79	0.364	3	15	40	0.113
Aravind, L.	US NIH	Nucleic Acids Research	263	30 970	84	0.423	25	14	29	0.242
Auwerx, Johan	Ecole Polytechnique Federale de Lausanne	Journal of Biological Chemistry	292	25 278	83	0.391	5	40	28	0.241
Baker, David	Marquette University	Journal of Molecular Biology	392	23 191	83	0.381	4	44	16	0.286
Banchereau, Jacques	Baylor Institute for Immunology Research	Journal of Experimental Medicine	261	32 867	82	0.426	8	22	37	0.191
Barnes, Peter J.	Imperial College London	American Journal of Respiratory and Critical Care Medicine	829	52 532	115	0.629	39	60	40	0.448
Barrett-Connor, Elizabeth	University of California at San Diego	Journal of Clinical Endocrinology and Metabolism	507	29 924	79	0.401	13	14	32	0.184
Bartel, David P.	Massachusetts Institute of Technology	Cell	128	35 572	70	0.401	3	35	26	0.238
Baselga, José	Memorial Sloan-Kettering Cancer Center	Journal of Clinical Oncology	259	31 813	79	0.411	20	22	28	0.246

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Bates, David W.	Harvard University	Journal of the American Medical Informatics Association	565	26 741	79	0·386	12	28	20	0·257
Bax, Jeroen J.	Leiden University	American Journal of Cardiology	1200	31 253	78	0·405	12	15	42	0·158
Baylin, Stephen B.	Johns Hopkins University	Cancer Research	234	40 100	93	0·497	7	25	56	0·181
Beal, M. Flint	Cornell University	Journal of Neurochemistry	345	25 140	87	0·403	13	28	30	0·233
Biederman, Joseph	Harvard University	Journal of the American Academy of Child and Adolescent Psychiatry	611	31 702	92	0·452	26	8	50	0·183
Birney, Ewan	Wellcome Trust Sanger Institute	Nucleic Acids Research	161	32 627	61	0·357	7	8	36	0·105
Bluestone, Jeffrey A.	University of California at San Francisco	Journal of Immunology	262	21 905	78	0·359	5	38	21	0·241
Bork, Peer	European Molecular Biology Laboratory	Nucleic Acids Research	353	50 431	100	0·570	9	39	54	0·268
Botstein, David	Princeton University	Molecular Biology of the Cell	201	61 941	88	0·589	2	19	62	0·149
Bousquet, Jean	Hopital Arnaud de Villeneuve	Allergy: European Journal of Allergy and Clinical Immunology	632	25 175	77	0·371	12	11	30	0·161
Bouter, Lex M.	Vrije Universiteit	Spine	467	26 533	88	0·413	0	26	45	0·151
Braunwald, Eugene	Harvard University	Journal of the American College of Cardiology	515	56 306	109	0·628	9	82	26	0·489
Breedveld, Ferdinand C.	Leiden University	Annals of the Rheumatic Diseases	423	25 391	76	0·369	4	1	48	0·035
Brennan, Murray F.	Memorial Sloan-Kettering Cancer Center	Annals of Surgical Oncology	471	25 388	84	0·395	2	33	34	0·200
Breteler, Monique M. B.	Erasmus University Rotterdam	Neurology	410	26 011	89	0·414	2	41	34	0·231
Brooks, David J.	Imperial College London	Brain	338	20 502	78	0·352	0	24	36	0·141
Brown, Patrick O.	Stanford University	Genome Biology	224	64 210	100	0·639	1	33	66	0·217
Buchler, Markus W.	University of Heidelberg	Digestive Surgery	1329	28 091	76	0·383	4	25	16	0·247
Bullmore, Edward T.	University of Cambridge	NeuroImage	358	21 691	80	0·364	6	15	37	0·132
Buring, Julie E.	Harvard University	Circulation	469	32 896	83	0·429	0	18	52	0·110

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Califf, Robert M.	Duke University	American Heart Journal	893	53 030	114	0·628	4	31	103	0·159
Cameron, John L.	Johns Hopkins University	Annals of Surgery	264	17 393	76	0·330	1	12	50	0·068
Cannon, Christopher P.	Harvard University	American Journal of Cardiology	609	30 710	81	0·412	14	4	50	0·109
Cantley, Lewis C.	Harvard University	Journal of Biological Chemistry	278	38 075	101	0·512	2	42	57	0·223
Cardon, Lon R.	GlaxoSmithKline	American Journal of Human Genetics	178	29 968	71	0·376	3	9	40	0·087
Carmeliet, Peter	Katholieke Universiteit Leuven	Journal of Clinical Investigation	464	38 240	88	0·471	23	23	33	0·275
Caron, Marc G.	Duke University	Journal of Biological Chemistry	272	24 052	82	0·382	0	44	22	0·255
Chambon, Pierre	Universite de Strasbourg	Development	410	31 519	99	0·473	1	26	72	0·129
Charney, Dennis S.	Mount Sinai School of Medicine	Biological Psychiatry	376	25 079	88	0·406	5	35	36	0·214
Chrousos, George P.	University of Athens	Journal of Clinical Endocrinology and Metabolism	637	28 746	86	0·418	5	42	26	0·269
Clarke, Mike*	Queen's University Belfast	Lancet	325	29 503	65	0·354	4	12	30	0·123
Clevers, Hans	Utrecht University	Cell	273	31 626	82	0·419	3	55	21	0·308
Cohen, Philip*	University of Dundee	Biochemical Journal	231	29 040	83	0·410	12	32	32	0·237
Colditz, Graham A.	Washington University St. Louis	Cancer Epidemiology Biomarkers and Prevention	725	60 962	132	0·725	8	44	117	0·223
Collen, Désiré	Katholieke Universiteit Leuven	Thrombosis and Haemostasis	375	25 706	80	0·384	1	15	45	0·101
Collins, Francis S.	US NIH	Nature Genetics	504	63 972	107	0·660	12	31	73	0·245
Collins, Rory	University of Oxford	Lancet	201	41 715	63	0·409	6	6	39	0·096
Colombo, Antonio	Universita Vita-Salute San Raffaele	Catheterization and Cardiovascular Interventions	632	29 351	84	0·415	5	33	35	0·216
Cook, Deborah J.	McMaster University	Critical Care Medicine	481	29 612	86	0·422	9	10	54	0·110
Cooper, Cyrus	University of Southampton	Osteoporosis International	630	24 663	82	0·385	7	18	34	0·163
Copeland, Neal G.	Houston Methodist	Genomics	430	29 695	92	0·442	1	13	70	0·074

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Cordon-Cardo, Carlos	Mount Sinai School of Medicine	Clinical Cancer Research	339	27 297	84	0·404	2	12	57	0·080
Corey, Lawrence	University of Washington	Journal of Infectious Diseases	429	23 236	87	0·394	3	34	33	0·208
Cortes, Jorge	University of California at San Diego	Cancer	683	25 045	81	0·384	7	6	48	0·082
Cox, Nancy J.	US CDC	American Journal of Human Genetics	371	30 723	84	0·421	4	17	57	0·113
Croce, Carlo M.	Ohio State University	Cancer Research	533	42 304	104	0·543	4	44	61	0·239
Cummings, Jeffrey L.	Cleveland Clinic Foundation	Neurology	416	27 099	83	0·400	12	18	45	0·160
Cummings, Steven R.	California Pacific Medical Center	Journal of Bone and Mineral Research	404	30 805	83	0·419	10	38	23	0·283
D'Agostino, Ralph B.	Boston University	Circulation	405	38 148	97	0·500	4	13	76	0·091
Dahlof, Björn	Goteborg University	Journal of Hypertension	280	27 647	61	0·332	4	6	32	0·079
Daly, Mark J.	Harvard University	Nature Genetics	285	54 112	96	0·576	1	8	83	0·056
Davis, Roger J.	University of Massachusetts	Journal of Biological Chemistry	275	33 725	93	0·465	2	32	54	0·180
Davis, Ronald W.	Stanford University	Nature Genetics	284	39 327	69	0·416	0	15	41	0·111
Dawson, Ted M.	Johns Hopkins University	Journal of Neuroscience	256	22 141	80	0·366	3	27	39	0·159
Dawson, Valina L.	Johns Hopkins University	Journal of Neuroscience	216	20 136	77	0·347	5	22	38	0·144
De Clercq, Erik	Katholieke Universiteit Leuven	Journal of Medicinal Chemistry	1215	34 184	86	0·445	22	16	30	0·249
Delmas, Pierre D.	DECEASED (Universite Claude Bernard Lyon 1)	Journal of Bone and Mineral Research	469	31 469	89	0·441	11	29	41	0·218
Deloukas, Panos	Wellcome Trust Sanger Institute	Nature Genetics	213	34 323	64	0·375	2	7	46	0·061
DePinho, Ronald A.	MD Anderson Cancer Center	Genes and Development	287	31 217	93	0·453	1	52	39	0·261
Devereux, Richard B.	Cornell University	Hypertension	506	26 782	73	0·367	7	15	31	0·152
Di Marzo, Vincenzo	CNR, Italy	British Journal of Pharmacology	410	24 185	82	0·383	16	31	18	0·277
Dickson, Dennis W.	Mayo Clinic	Neurology	481	29 615	86	0·422	6	8	54	0·087
Dietz, William H.	US CDC	Pediatrics	160	28 958	61	0·339	8	22	13	0·236

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Dimmeler, Stefanie	University of Frankfurt	Circulation Research	308	30 558	94	0.453	18	50	20	0.350
Dinarello, Charles A.	University of Colorado Health Sciences Center	Journal of Immunology	373	23 324	78	0.366	21	17	26	0.217
Dixit, Vishva M.	Genentech Incorporated	Journal of Biological Chemistry	178	34 069	82	0.432	1	51	24	0.295
Dobson, Christopher M.	University of Cambridge	Journal of Molecular Biology	398	27 923	82	0.401	8	34	26	0.248
Dolan, Raymond J.	University College London	NeuroImage	395	33 800	102	0.494	6	85	17	0.417
Dougados, Maxime	Universite Paris 5	Annals of the Rheumatic Diseases	545	21 471	76	0.350	5	12	37	0.110
Druker, Brian J.	Oregon Health and Science University	Blood	274	34 451	76	0.414	9	17	32	0.186
Durbin, Richard	Wellcome Trust Sanger Institute	Nucleic Acids Research	118	29 940	59	0.337	0	10	36	0.073
Easton, Douglas F.	University of Cambridge	Nature Genetics	417	31 935	82	0.421	5	20	46	0.148
Egger, Matthias	University of Bern	British Medical Journal	444	28 142	75	0.380	14	14	33	0.174
Eisen, Michael B.	University of California at Berkeley	Genome Biology	107	32 960	50	0.324	2	3	25	0.054
Elledge, Stephen J.	Harvard University	Genes and Development	195	30 511	86	0.427	1	47	30	0.263
Ellis, Lee M.	MD Anderson Cancer Center	Cancer Research	305	18 544	76	0.335	6	24	25	0.183
Emery, Paul	University of Leeds	Annals of the Rheumatic Diseases	657	30 096	82	0.412	6	16	46	0.133
Eng, Charis	Cleveland Clinic Foundation	Journal of Clinical Endocrinology and Metabolism	380	20 202	80	0.356	9	33	17	0.254
Esteller, Manel	L'Hospitalet de Llobregat	Cancer Research	311	24 473	79	0.374	26	13	24	0.232
Evans, Alan C.	McGill University	NeuroImage	415	26 005	89	0.414	0	45	34	0.236
Evans, Ronald M.	Salk Institute for Biological Studies	Genes and Development	237	34 544	96	0.479	1	55	37	0.288
Faraone, Stephen V.	SUNY Upstate Medical University	American Journal of Medical Genetics, Part B: Neuropsychiatric Genetics	739	32 388	93	0.459	17	14	53	0.169
Ferrara, Napoleone	Genentech Incorporated	Journal of Biological Chemistry	201	40 117	88	0.481	23	27	29	0.304

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Fischer, Alain	INSERM	Blood	464	25 265	79	0·378	1	10	47	0·072
Flavell, Richard A.	Yale University	Journal of Immunology	716	63 686	133	0·742	0	83	87	0·362
Flegal, Katherine M.	US CDC	American Journal of Clinical Nutrition	119	39 164	49	0·351	9	9	23	0·154
Flier, Jeffrey S.	Harvard University	Endocrinology	147	28 939	83	0·409	5	39	33	0·234
Folkman, Judah	DECEASED (Harvard University)	Cancer Research	234	31 292	78	0·405	18	23	26	0·248
Folsom, Aaron R.	University of Minnesota	American Journal of Epidemiology	573	32 240	88	0·442	14	17	50	0·169
Ford, Earl S.	US CDC	Diabetes Care	287	25 979	70	0·353	28	3	25	0·195
Frackowiak, Richard S. J.	University of Lausanne	NeuroImage	273	25 379	92	0·421	0	23	67	0·107
Franceschi, Silvia	International Agency for Research on Cancer	International Journal of Cancer	768	24 825	76	0·367	9	13	26	0·168
Fraser, Claire M.	University of Maryland School of Medicine	Trends in Microbiology	145	30 637	71	0·379	2	28	34	0·178
Friston, Karl J.	University College London	NeuroImage	474	40 991	100	0·524	22	39	39	0·319
Frith, Christopher D.	University of Aarhus	NeuroImage	371	32 266	103	0·490	7	43	56	0·231
Froguel, Philippe	Imperial College London	Diabetes	422	26 602	75	0·372	0	23	30	0·162
Fruchart, Jean-Charles	Fondation Coeur et Arteres	Journal of Biological Chemistry	393	26 891	82	0·396	5	6	60	0·061
Furberg, Curt D.	Wake Forest University	Circulation	307	25 824	75	0·368	4	18	33	0·147
Fuster, Valentin	Mount Sinai Hospital	Circulation	580	36 142	97	0·490	12	14	68	0·136
Gage, Fred H.	Salk Institute for Biological Studies	Journal of Neuroscience	341	49 283	105	0·581	5	72	32	0·410
Gazdar, Adi F.	University of Texas Southwestern	Cancer Research	398	25 640	83	0·393	3	28	37	0·179
Genant, Harry K.	University of California at San Francisco	Osteoporosis International	387	28 788	79	0·396	5	15	41	0·130
Gerstein, Mark	Yale University	Genome Research	396	26 961	79	0·387	5	25	32	0·187
Gibbons, Raymond J.	Mayo Clinic	Journal of the American College of Cardiology	292	25 405	72	0·357	10	0	51	0·058
Gibbs, Richard A.	Baylor College of Medicine	Genome Research	283	39 431	61	0·391	2	5	36	0·064

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Gilliland, D. Gary	Merck	Blood	229	20 764	80	0.359	3	25	39	0.150
Giovannucci, Edward	Harvard University	Cancer Epidemiology Biomarkers and Prevention	634	36 696	102	0.509	23	20	60	0.212
Glass, Christopher K.	University of California at San Diego	Cell	208	31 227	82	0.418	5	25	43	0.172
Goldberg, Alfred L.	Harvard University	Journal of Biological Chemistry	155	19 049	77	0.341	3	37	17	0.239
Golub, Todd R.	Broad Institute	Cancer Cell	172	40 526	77	0.448	2	18	45	0.138
Gonzalez, Frank J.	US NIH (NCI)	Journal of Biological Chemistry	579	31 844	90	0.446	3	21	59	0.129
Gores, Gregory J.	Mayo Clinic	Hepatology	386	18 979	78	0.344	1	40	17	0.243
Green, Douglas R.	St. Jude Children Research Hospital	Cell Death and Differentiation	294	43 806	97	0.528	13	44	40	0.310
Greenberg, Michael E.	Harvard University	Neuron	135	33 402	76	0.409	4	48	13	0.327
Greengard, Paul	Rockefeller University	Journal of Neuroscience	345	23 405	83	0.382	2	26	38	0.162
Grobbee, Diederick E.	Utrecht University	Nederlands Tijdschrift voor Geneeskunde	922	38 653	95	0.496	0	22	65	0.125
Grundy, Scott M.	University of Texas Southwestern	Circulation	341	41 893	93	0.506	32	12	46	0.247
Guralnik, Jack M.	University of Maryland School of Medicine	Journal of the American Geriatrics Society	543	23 254	78	0.365	4	15	46	0.107
Gustafsson, Jan-Åke	University of Houston	Journal of Biological Chemistry	672	44 613	95	0.525	2	41	45	0.257
Guyatt, Gordon H.	McMaster University	Journal of Clinical Epidemiology	736	31 472	96	0.464	12	31	50	0.214
Gygi, Steven P.	Harvard University	Journal of Biological Chemistry	272	29 429	82	0.409	6	23	44	0.162
Haffner, Steven M.	Baylor College of Medicine	Diabetes Care	413	34 609	89	0.457	21	25	38	0.250
Hallett, Mark	US NIH (NINDS)	Neurology	550	27 250	92	0.430	4	54	29	0.287
Halliwell, Barry	National University of Singapore	Free Radical Biology and Medicine	314	21 787	76	0.352	26	16	15	0.259
Hannon, Gregory J.	Cold Spring Harbor Laboratory	Genes and Development	217	33 783	89	0.453	2	37	42	0.218
Hardy, John	University College London	Movement Disorders	472	34 308	80	0.426	8	5	51	0.087
Harris, Adrian L.	University of Oxford	British Journal of Cancer	643	38 604	98	0.505	2	43	48	0.245
Harris, Curtis C.	US NIH (NCI)	Cancer Research	280	19 940	77	0.346	2	39	14	0.258

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Harris, Tamara B.	US NIH (NIA)	Journal of the American Geriatrics Society	513	24 011	82	0.382	1	17	46	0.107
Haussler, David	University of California at Santa Cruz	Genome Research	157	30 846	62	0.352	0	17	30	0.127
Hayashizaki, Yoshihide	Riken	Genome Research	489	30 611	61	0.347	0	13	28	0.110
Hayden, Michael R.	University of British Columbia	Human Molecular Genetics	410	21 649	78	0.357	0	30	31	0.176
Hennekens, Charles H.	Florida Atlantic University	Circulation	375	48 100	102	0.565	6	32	65	0.209
Herman, James G.	Johns Hopkins University	Cancer Research	256	35 757	92	0.472	6	33	46	0.217
Hicklin, Daniel J.	Merck	Cancer Research	179	22 134	77	0.356	2	6	48	0.051
Hodges, John R.	University of New South Wales	Brain	368	19 081	80	0.351	7	29	16	0.243
Hofman, Albert	Erasmus University Rotterdam	Stroke	1146	53 285	118	0.642	3	13	135	0.068
Holgate, Stephen T.	University of Southampton	Journal of Allergy and Clinical Immunology	641	27 448	84	0.405	15	12	38	0.168
Holman, Rury R.	University of Oxford	Diabetologia	180	26 788	59	0.322	6	20	23	0.171
Holmes, David R.	Mayo Clinic	Journal of the American College of Cardiology	745	28 049	86	0.415	5	15	40	0.138
Holsboer, Florian	Max Planck Institute of Psychiatry	Journal of Psychiatric Research	529	23 660	79	0.370	5	21	34	0.161
Holst, Jens J.	University of Copenhagen	Journal of Clinical Endocrinology and Metabolism	604	25 502	85	0.399	6	23	41	0.165
Honjo, Tasuku	Kyoto University	Journal of Experimental Medicine	275	22 127	77	0.356	3	38	21	0.236
Hood, Leroy	Institute for Systems Biology	Genome Research	272	29 070	71	0.372	4	17	35	0.139
Hori, Masatsugu	Osaka Medical Center	Circulation	760	27 584	74	0.374	0	23	27	0.172
Hortobagyi, Gabriel N.	MD Anderson Cancer Center	Journal of Clinical Oncology	715	28 642	88	0.424	7	23	43	0.174
Howard, Barbara V.	MedStar Health Research Institute	Circulation	347	27 249	68	0.353	5	9	32	0.107
Hruban, Ralph H.	Johns Hopkins University	Cancer Research	484	32 988	94	0.465	6	19	67	0.126

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Hu, Frank B.	Harvard University	American Journal of Clinical Nutrition	617	38 625	104	0·525	29	41	38	0·340
Huber, Robert	Max Planck Institute for Biochemistry	Journal of Molecular Biology	447	22 470	77	0·358	1	9	38	0·075
Hunter, David J.	Harvard University	Cancer Epidemiology Biomarkers and Prevention	786	39 716	97	0·508	10	25	61	0·185
Hunter, Tony	Salk Institute for Biological Studies	Journal of Biological Chemistry	209	25 890	83	0·394	5	33	36	0·202
Hyman, Bradley T.	Harvard University	Journal of Neuropathology and Experimental Neurology	416	27 948	92	0·433	2	33	49	0·181
Ioannidis, John P. A.	Stanford University	Journal of Clinical Epidemiology	579	23 639	78	0·367	26	11	27	0·212
Isner, Jeffrey M.	DECEASED (Tufts University)	Circulation	191	30 667	82	0·415	6	44	25	0·276
Jacks, Tyler	Massachusetts Institute of Technology	Genes and Development	207	23 236	80	0·372	2	44	20	0·259
Jacobs, Alice K.	Boston University	Circulation	226	27 109	78	0·384	2	1	62	0·018
Jaenisch, Rudolf	Massachusetts Institute of Technology	Cell	299	36 848	100	0·503	3	70	28	0·364
Jaffe, Elaine S.	US NIH (NCI)	Blood	334	23 680	78	0·367	4	6	51	0·060
Jain, Rakesh K.	Harvard University	Cancer Research	591	36 745	88	0·464	19	49	13	0·390
Jemal, Ahmedin	American Cancer Society	Ca-A Cancer Journal for Clinicians	100	38 198	43	0·327	16	1	12	0·192
Jenkins, Nancy A.	Houston Methodist	Genomics	433	30 078	92	0·444	0	7	78	0·037
Jolesz, Ferenc A.	Harvard University	Journal of Magnetic Resonance Imaging	376	19 415	78	0·346	1	20	37	0·125
Jones, Ronald N.	JMI Laboratories	Diagnostic Microbiology and Infectious Disease	750	24 785	77	0·370	9	12	31	0·149
Kadowaki, Takashi	University of Tokyo	Nippon rinsho. Japanese journal of clinical medicine	590	28 468	80	0·397	4	31	30	0·214
Kahn, C. Ronald	Harvard University	Journal of Clinical Investigation	311	24 531	85	0·394	1	37	31	0·217
Kaibuchi, Kozo	Nagoya University	Journal of Biological Chemistry	297	22 245	78	0·360	2	37	28	0·210
Kandel, Eric R.	Columbia University	Neuron	236	22 374	83	0·377	4	41	29	0·229

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Kangawa, Kenji	Japan National Cardiovascular Center Res Inst	Biochemical and Biophysical Research Communications	638	36 336	87	0·459	0	23	50	0·145
Kantarjian, Hagop	MD Anderson Cancer Center	Cancer	1086	51 458	103	0·585	23	27	57	0·273
Karin, Michael	University of California at San Diego	Cell	335	64 619	125	0·721	20	89	31	0·561
Kastelein, John J. P.	University of Amsterdam	Atherosclerosis	591	25 792	76	0·371	4	17	39	0·130
Keating, Michael J.	MD Anderson Cancer Center	Blood	492	24 218	77	0·367	5	11	37	0·111
Kendler, Kenneth S.	Virginia Commonwealth University	Psychological Medicine	538	23 992	84	0·388	36	21	11	0·325
Kessler, Ronald C.	Harvard University	Psychological Medicine	463	49 095	110	0·596	52	35	37	0·418
Kinzler, Kenneth W.	Johns Hopkins University	Cancer Research	232	58 855	105	0·628	4	23	82	0·156
Kishimoto, Tadamitsu	Osaka University	Blood	329	24 156	88	0·402	2	30	44	0·169
Klein, Ronald	University of Wisconsin	Ophthalmology	645	23 759	84	0·387	14	7	43	0·127
Koob, George F.	Scripps Research Institute	Psychopharmacology	356	22 135	77	0·356	21	20	20	0·240
Koonin, Eugene V.	US NIH	Biology Direct	493	49 287	112	0·603	17	59	43	0·385
Korsmeyer, Stanley J.	DECEASED (Dana-Farber Cancer Institute)	Journal of Biological Chemistry	197	41 891	97	0·518	2	56	34	0·327
Krammer, Peter H.	German Cancer Research Center	Cell Death and Differentiation	301	27 243	77	0·382	3	20	38	0·144
Kroemer, Guido	Universite Paris 5	Cell Death and Differentiation	576	55 431	119	0·656	13	105	25	0·541
Krumholz, Harlan M.	Yale University	Circulation	673	34 174	98	0·483	12	44	38	0·288
Kucherlapati, Raju	Harvard University	Cancer Research	206	27 100	62	0·333	0	7	35	0·055
Kuller, Lewis H.	University of Pittsburgh	American Journal of Epidemiology	636	32 615	91	0·453	6	19	59	0·135
Kupfer, David J.	University of Pittsburgh	American Journal of Psychiatry	395	20 221	76	0·344	3	29	22	0·204
Laakso, Markku	University of Eastern Finland	Diabetes Care	483	28 397	77	0·387	6	17	33	0·159
Lander, Eric S.	Massachusetts Institute of Technology	Nature Genetics	332	94 950	127	0·877	3	44	102	0·277
Lang, Anthony E.	University of Toronto	Movement Disorders	486	24 327	78	0·371	5	14	40	0·119
Langer, Robert	Massachusetts Institute of Technology	Biomaterials	771	46 095	112	0·587	6	75	55	0·350

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Lanier, Lewis L.	University of California at San Francisco	Journal of Immunology	235	22 035	81	0.369	14	23	31	0.201
Lanzavecchia, Antonio	Institute for Research in Biomedicine	European Journal of Immunology	168	31 279	74	0.392	9	29	27	0.229
Lee, Virginia M.-Y.	University of Pennsylvania	Journal of Neuroscience	485	38 793	103	0.522	2	38	68	0.193
Lefkowitz, Robert J.	Duke University	Journal of Biological Chemistry	287	31 621	100	0.477	7	56	37	0.301
Lehrach, Hans	Max Planck Institute for Molecular Genetics	Genomics	400	28 235	67	0.355	0	6	36	0.051
Leon, Martin B.	Columbia University	American Journal of Cardiology	561	33 719	89	0.452	3	37	37	0.235
Levey, Andrew S.	Tufts University	American Journal of Kidney Diseases	300	35 188	79	0.428	11	21	31	0.217
Levine, Arnold J.	Institute for Advanced Studies	Cancer Epidemiology Biomarkers and Prevention	206	32 889	70	0.387	4	35	19	0.260
Levy, Daniel	US NIH (NHLBI)	Circulation	415	44 402	104	0.553	4	49	54	0.274
Libby, Peter	Harvard University	Circulation	413	47 206	113	0.596	19	52	55	0.336
Lieberman, Jeffrey A.	Columbia University	American Journal of Psychiatry	448	24 834	81	0.383	12	32	19	0.267
Liotta, Lance A.	George Mason University	Cancer Research	369	25 721	81	0.387	8	16	43	0.139
Lipman, David J.	US NIH	Nucleic Acids Research	54	41 821	38	0.329	0	3	25	0.035
Lipton, Richard B.	Yeshiva University	Headache	489	23 621	81	0.377	15	19	31	0.197
Lisanti, Michael P.	Thomas Jefferson University	Journal of Biological Chemistry	370	25 271	88	0.407	0	57	19	0.305
Littman, Dan R.	New York University	Journal of Experimental Medicine	184	26 533	78	0.381	2	25	41	0.151
Liu, Yong-Jun	Baylor Institute for Immunology Research	Journal of Experimental Medicine	176	25 683	70	0.352	8	27	19	0.228
Mak, Tak W.	University of Toronto	Journal of Immunology	488	43 447	106	0.555	1	50	66	0.242
Mancia, Giuseppe	University of Milan	Journal of Hypertension	730	32 426	77	0.407	14	17	32	0.200
Mann, Matthias	Max Planck Institute for Biochemistry	Molecular and Cellular Proteomics	452	63 527	122	0.706	5	66	68	0.360
Manns, Michael P.	Hannover Medical School	Hepatology	1069	33 022	82	0.426	4	14	37	0.140
Manson, Joann E.	Harvard University	Journal of the American Medical Association	710	64 300	134	0.748	7	37	132	0.187

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Mantovani, Alberto	University of Milan	Journal of Immunology	593	33 040	91	0·455	12	34	33	0·265
Marmot, Michael	University College London	Journal of Epidemiology and Community Health	553	21 251	78	0·355	11	29	12	0·273
Marra, Marco A.	British Columbia Cancer Agency	Genome Research	219	28 156	60	0·332	2	10	24	0·111
Masliah, Eliezer	University of California at San Diego	Journal of Neuroscience	485	23 447	80	0·373	11	18	35	0·169
Massague, Joan	Memorial Sloan-Kettering Cancer Center	Journal of Biological Chemistry	163	35 069	94	0·475	12	56	21	0·363
Matsuzawa, Yuji	Sumitomo Hospital	Biochemical and Biophysical Research Communications	601	46 768	96	0·539	7	42	39	0·300
Mattson, Mark P.	US NIH (NIA)	Journal of Neurochemistry	689	42 354	111	0·566	34	80	15	0·500
McEwen, Bruce S.	Rockefeller University	Brain Research	431	35 597	99	0·494	27	33	39	0·299
McMahon, Andrew P.	University of Southern California	Development	223	26 620	92	0·427	2	42	43	0·216
McMichael, Andrew J.	University of Oxford	European Journal of Immunology	339	25 540	80	0·383	7	20	40	0·154
McMurray, John J. V.	University of Glasgow	European Journal of Heart Failure	585	30 200	81	0·409	6	17	41	0·147
Medzhitov, Ruslan	Yale University	Nature Immunology	155	34 925	74	0·410	13	38	13	0·327
Meijer, Chris J. L. M.	Vrije Universiteit	International Journal of Cancer	606	34 452	83	0·437	0	22	41	0·152
Melton III, L. Joseph	Mayo Clinic	Osteoporosis International	381	26 800	88	0·415	9	34	33	0·235
Miller, David H.	University College London	Neurology	467	26 155	82	0·392	7	27	33	0·199
Miller, Webb	Pennsylvania State University	Genome Research	176	51 184	58	0·439	0	10	25	0·126
Mills, Gordon B.	MD Anderson Cancer Center	Cancer Research	378	21 240	77	0·352	2	13	42	0·093
Minna, John D.	University of Texas Southwestern	Cancer Research	384	22 511	85	0·384	1	19	47	0·115
Moffitt, Terrie E.	Duke University	Archives of General Psychiatry	206	20 339	76	0·344	8	10	35	0·117
Moher, David	Ottawa Hospital	Journal of Clinical Epidemiology	356	25 369	66	0·337	16	14	20	0·202
Murray, Robin M.	King's College London	British Journal of Psychiatry	637	25 490	78	0·376	1	23	34	0·156
Nagai, Ryozo	University of Tokyo	Journal of Biological Chemistry	842	30 172	77	0·396	0	10	43	0·075
Narod, Steven A.	University of Toronto	Breast Cancer Research and Treatment	499	22 549	76	0·355	6	15	33	0·138

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Narumiya, Shuh	Kyoto University	Journal of Biological Chemistry	317	25 077	78	0·374	5	28	30	0·196
Nemeroff, Charles B.	University of Miami	Biological Psychiatry	400	23 507	78	0·366	11	31	23	0·237
Nestler, Eric J.	Mount Sinai School of Medicine	Journal of Neuroscience	315	28 100	89	0·424	15	47	18	0·329
Nicoll, Roger A.	University of California at San Francisco	Neuron	168	18 217	76	0·334	3	31	25	0·192
Norton, Larry	Memorial Sloan-Kettering Cancer Center	Journal of Clinical Oncology	213	27 866	65	0·346	1	14	36	0·102
Nunez, Gabriel	University of Michigan	Journal of Biological Chemistry	228	23 505	79	0·370	1	40	20	0·248
O'Brien, Susan	MD Anderson Cancer Center	Cancer	557	24 533	76	0·365	4	0	52	0·026
Okumura, Ko	Juntendo University	Journal of Immunology	636	23 371	79	0·369	2	22	36	0·148
Olson, Eric N.	University of Texas Southwestern	Developmental Biology	446	36 788	107	0·525	7	78	31	0·385
Oparil, Suzanne	University of Alabama at Birmingham	Blood Pressure	366	30 355	55	0·327	4	3	26	0·069
Orkin, Stuart H.	Harvard University	Blood	238	19 687	84	0·367	3	42	24	0·239
Osterhaus, Albertus D. M. E.	Erasmus University Rotterdam	Vaccine	695	27 303	74	0·372	0	19	33	0·136
Owen, Michael J.	Cardiff University	American Journal of Medical Genetics - Neuropsychiatric Genetics	632	28 067	86	0·415	3	23	46	0·150
Pandolfi, Pier Paolo	Harvard University	Oncogene	294	24 397	85	0·393	1	41	26	0·243
Paulsen, Ian T.	Macquarie University	Journal of Bacteriology	164	25 576	73	0·361	11	1	51	0·069
Pawson, Tony	Mount Sinai Hospital, Toronto	Molecular and Cellular Biology	247	22 486	82	0·374	8	21	34	0·172
Peltonen, Leena	DECEASED (University of Helsinki)	Nature Genetics	582	26 750	85	0·405	3	21	49	0·133
Penninger, Josef M.	Austrian Academy of Sciences	Journal of Immunology	342	29 989	81	0·408	3	32	33	0·210
Petersen, Ronald C.	Mayo Clinic	Neurology	409	28 458	77	0·388	11	17	32	0·181
Peterson, Eric D.	Duke University	American Heart Journal	698	22 896	77	0·360	6	13	34	0·129
Peto, Richard*	University of Oxford	Lancet	221	34 930	61	0·369	6	22	22	0·206
Pfaller, Michael A.	University of Iowa	Journal of Clinical Microbiology	502	27 074	86	0·410	35	12	25	0·267

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Pfeffer, Marc A.	Harvard University	Circulation	341	40 572	89	0.486	6	19	54	0.154
Pols, Huibert A. P.	Erasmus University Rotterdam	Journal of Bone and Mineral Research	360	21 975	80	0.365	1	14	48	0.087
Ponting, Chris P.	University of Oxford	Genome Research	204	29 557	66	0.358	16	8	23	0.183
Popma, Jeffrey J.	Harvard University	American Journal of Cardiology	337	29 601	78	0.397	2	3	60	0.031
Poynard, Thierry	Universite Paris 6	Gastroenterologie Clinique et Biologique	369	26 015	76	0.372	17	21	23	0.232
Priori, Silvia G.	New York University	Circulation	323	24 925	78	0.373	17	3	47	0.111
Prusiner, Stanley B.	University of California at San Francisco	Journal of Molecular Biology	243	22 129	79	0.363	6	22	32	0.169
Rajewsky, Klaus	Harvard University	Journal of Experimental Medicine	234	20 213	80	0.357	3	26	39	0.152
Raoult, Didier	Universite de la Mediterranee	Emerging Infectious Diseases	1252	29 091	78	0.394	11	42	7	0.348
Reed, John C.	Roche Pharma Research	Journal of Biological Chemistry	755	76 185	131	0.797	20	63	92	0.378
Reiser, Maximilian	University of Munich	Radiologe	1237	25 834	72	0.359	0	18	20	0.170
Reiter, Russel J.	University of Texas Health Science Center	Journal of Pineal Research	445	21 703	76	0.351	18	14	20	0.216
Remuzzi, Giuseppe	Laboratori Negri Bergamo	Journal of the American Society of Nephrology	687	31 651	82	0.420	10	37	22	0.286
Richman, Douglas D.	University of California at San Diego	Journal of Virology	283	27 577	80	0.393	4	29	35	0.191
Ridker, Paul M.	Harvard University	Circulation	587	63 099	112	0.672	47	45	34	0.490
Rifai, Nader	Harvard University	Clinical Chemistry	367	41 460	93	0.503	6	10	70	0.094
Rimm, Eric B.	Harvard University	American Journal of Clinical Nutrition	415	33 727	102	0.494	5	15	83	0.096
Robbins, Trevor W.	University of Cambridge	Psychopharmacology	480	35 032	104	0.507	9	56	43	0.305
Rosen, Bruce R.	Harvard University	NeuroImage	245	23 528	82	0.379	1	21	49	0.118
Rosenberg, Steven A.	US NIH (NCI)	Journal of Immunotherapy	485	38 040	104	0.522	18	42	49	0.287
Rosenfeld, Michael G.	University of California at San Diego	Cell	223	30 548	90	0.440	2	49	32	0.270
Rubenstein, John L. R.	University of California at San Francisco	Development	192	17 899	76	0.332	4	34	27	0.194

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Rubin, Gerald M.	Howard Hughes Medical Institute	Genome biology	125	25 548	70	0·351	2	21	29	0·155
Rush, A. John	National University of Singapore	Journal of Clinical Psychiatry	453	23 041	77	0·361	12	11	33	0·148
Rutgeerts, Paul	Katholieke Universiteit Leuven	Inflammatory Bowel Diseases	521	31 303	84	0·424	9	33	31	0·244
Rutter, Michael	King's College London	Journal of Child Psychology and Psychiatry and Allied Disciplines	253	17 016	79	0·337	18	16	24	0·198
Salvesen, Guy S.	Sanford-Burnham Medical Research Institute	Journal of Biological Chemistry	188	26 386	73	0·365	4	24	35	0·162
Salzberg, Steven L.	Johns Hopkins University	Genome Biology	182	33 745	73	0·401	5	14	43	0·123
Sandborn, William J.	University of California at San Diego	Gastroenterology	406	22 848	82	0·376	22	23	23	0·249
Sawyers, Charles L.	Memorial Sloan-Kettering Cancer Center	Cancer Cell	170	29 490	73	0·380	6	27	27	0·209
Scardino, Peter T.	Memorial Sloan-Kettering Cancer Center	Journal of Urology	427	19 543	76	0·340	0	19	30	0·132
Scherer, Stephen W.	Centre for Applied Genomics	Genomics	473	41 573	84	0·475	3	15	53	0·120
Schomig, Albert	Technische Universitat Munchen	Journal of the American College of Cardiology	560	25 121	79	0·378	4	41	18	0·270
Schreiber, Stefan	Christian-Albrechts-Universität	Journal of the American Chemical Society	267	27 729	84	0·407	4	50	20	0·297
Schreiber, Stuart L.	Massachusetts Institute of Technology	Gut	625	24 816	77	0·370	8	14	38	0·136
Schulten, Klaus	University of Illinois at Urbana-Champaign	Biophysical Journal	334	25 505	70	0·351	0	34	6	0·298
Schultz, Peter G.	Scripps Research Institute	Journal of the American Chemical Society	385	23 786	82	0·381	0	28	28	0·190
Schwartz, Joel	Harvard University	Environmental Health Perspectives	409	19 148	76	0·338	12	11	29	0·150
Schwartz, Michael W.*	University of Washington	Diabetes	403	28 236	88	0·422	13	47	18	0·325
Selkoe, Dennis J.	Harvard University	Journal of Biological Chemistry	246	40 915	97	0·514	21	42	30	0·348

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Semenza, Gregg L.	Johns Hopkins University	Journal of Biological Chemistry	257	34 870	96	0·480	30	34	28	0·334
Serruys, Patrick W.	Erasmus University Rotterdam	Circulation	1135	43 076	99	0·531	12	37	49	0·265
Sette, Alessandro	La Jolla Institute for Allergy and Immunology	Journal of Immunology	365	18 219	77	0·337	2	13	36	0·099
Shay, Jerry W.	University of Texas Southwestern	Cancer Research	292	23 550	79	0·370	10	22	28	0·197
Sheng, Morgan	Massachusetts Institute of Technology	Neuron	177	18 860	76	0·337	9	37	18	0·242
Shimizu, Nobuyoshi	Keio University	Biochemical and Biophysical Research Communications	595	30 266	66	0·361	0	9	32	0·079
Shinozaki, Kazuo	Riken	Plant and Cell Physiology	377	24 409	82	0·384	6	31	27	0·222
Shulman, Gerald I.	Yale University	Diabetes	286	29 243	85	0·417	1	48	27	0·269
Sidransky, David	Johns Hopkins University	Cancer Research	392	26 891	84	0·402	3	39	25	0·252
Silman, Alan J.	Arthritis Research UK	Annals of the Rheumatic Diseases	444	21 920	84	0·378	1	24	34	0·160
Smith, Sidney C.	University of North Carolina	Circulation	334	47 306	103	0·564	7	23	73	0·164
Smith, George Davey	University of Bristol	British Medical Journal	725	29 936	77	0·395	8	17	28	0·186
Smith, Mark A.	DECEASED (Case Western)	Journal of Alzheimer's Disease	662	27 956	81	0·398	9	25	28	0·218
Snyder, Solomon H.	Johns Hopkins University	Journal of Biological Chemistry	274	21 992	84	0·378	5	42	21	0·261
Sonenberg, Nahum	McGill University	Molecular and Cellular Biology	310	25 899	87	0·407	3	43	34	0·234
Speizer, Frank E.	Harvard University	Journal of the American Medical Association	229	29 021	94	0·445	0	10	77	0·051
Spiegelman, Bruce M.	Harvard University	Novartis Foundation Symposium	212	37 789	95	0·492	5	62	27	0·350
Spiegelman, Donna	Harvard University	American Journal of Epidemiology	426	24 237	81	0·380	1	2	62	0·018
Springer, Timothy A.	Harvard University	Journal of Biological Chemistry	225	20 539	77	0·349	2	36	19	0·232
Stampfer, Meir J.	Harvard University	Cancer Epidemiology Biomarkers and Prevention	704	73 673	138	0·807	3	33	153	0·154
Steinman, Ralph M.	DECEASED (Rockefeller University)	Journal of Experimental Medicine	242	39 233	91	0·486	15	32	38	0·269
Stone, Gregg W.	Columbia University	American Journal of Cardiology	593	26 736	80	0·389	28	5	29	0·207

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Storb, Rainer	University of Washington	Blood	461	21 912	78	0.359	3	15	44	0.104
Strieter, Robert M.	University of Virginia	Journal of Immunology	389	22 624	84	0.381	4	26	40	0.163
Sudhof, Thomas C.	Stanford University	Journal of Biological Chemistry	310	26 766	90	0.421	6	46	29	0.270
Szabo, Csaba	University of Texas Medical Branch	Shock	552	23 800	78	0.368	16	29	15	0.276
Takeda, Kiyoshi	Osaka University	Journal of Immunology	292	43 547	89	0.501	12	2	67	0.087
Takeuchi, Osamu	Osaka University	Journal of Immunology	231	30 690	73	0.386	12	1	48	0.082
Talley, Nicholas J.	University of Newcastle	American Journal of Gastroenterology	718	24 704	83	0.388	16	18	23	0.232
Tempst, Paul	Memorial Sloan-Kettering Cancer Center	Journal of Biological Chemistry	242	28 635	95	0.446	0	5	82	0.026
Tessier-Lavigne, Marc	Rockefeller University	Neuron	195	22 475	82	0.374	1	30	42	0.159
Thase, Michael E.	University of Pennsylvania	Journal of Clinical Psychiatry	505	23 264	78	0.365	10	7	43	0.103
Thompson, Alan J.	University College London	Multiple Sclerosis	451	25 142	79	0.378	2	16	36	0.126
Thompson, Craig B.	Memorial Sloan-Kettering Cancer Center	Journal of Immunology	286	36 350	108	0.526	1	74	40	0.343
Thun, Michael J.	American Cancer Society	Cancer Epidemiology Biomarkers and Prevention	392	59 460	79	0.548	5	30	29	0.300
Tibshirani, Robert	Stanford University	Biostatistics	178	31 660	56	0.336	5	12	20	0.155
Topol, Eric J.	Scripps Research Institute	Circulation	814	55 903	116	0.649	15	77	51	0.417
Tracy, Russell P.	University of Vermont	Circulation	341	32 637	85	0.434	4	17	56	0.118
Trojanowski, John Q.	University of Pennsylvania	Acta Neuropathologica	580	43 793	107	0.560	3	34	83	0.173
Tschopp, Jürg	DECEASED (University of Lausanne)	Journal of Immunology	278	36 035	102	0.505	3	61	39	0.314
Tsien, Roger Y.	University of California at San Diego	Journal of Biological Chemistry	159	28 335	79	0.394	4	37	30	0.227
Tuomilehto, Jaakko	University of Helsinki	Diabetes Care	752	51 658	103	0.586	8	24	79	0.169
Tuschl, Thomas	Rockefeller University	RNA	105	29 271	61	0.341	4	26	24	0.189
Van De Werf, Frans	Katholieke Universiteit Leuven	European Heart Journal	468	25 765	76	0.371	7	12	39	0.122
Verkman, Alan S.	University of California at San Francisco	Journal of Biological Chemistry	370	19 883	76	0.342	6	38	7	0.295
Verweij, Jaap	Erasmus University Rotterdam	European Journal of Cancer	471	26 107	67	0.344	2	11	30	0.104

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Vincent, Jean-Louis	Universite Libre de Bruxelles	Critical Care Medicine	728	31 536	77	0.403	16	25	23	0.258
Virmani, Renu	CVPath Institute, Inc.	Circulation	448	25 557	77	0.373	11	33	24	0.242
Vogelstein, Bert	Johns Hopkins University	Cancer Research	256	62 808	108	0.657	3	46	65	0.283
Volkow, Nora D.	US NIH (NIDA)	Synapse	448	21 038	78	0.354	36	5	15	0.259
Walker, Bruce D.	Howard Hughes Medical Institute	Journal of Virology	421	27 250	84	0.404	2	29	38	0.182
Walsh, Thomas J.	Cornell University	Antimicrobial Agents and Chemotherapy	527	28 878	81	0.403	18	23	23	0.258
Watkins, Simon C.	University of Pittsburgh	Journal of Immunology	439	20 579	82	0.365	1	2	51	0.020
Webster, Robert G.	St. Jude Children Research Hospital	Journal of Virology	365	21 306	79	0.359	6	25	30	0.182
Wedel, Hans	Nordic School of Public Health	European Heart Journal	169	30 025	55	0.325	0	12	29	0.095
Weinberg, Robert A.	Massachusetts Institute of Technology	Cell	166	35 681	83	0.443	3	58	14	0.360
Weinberger, Daniel R.	US NIH (NIMH)	Biological Psychiatry	508	34 086	94	0.470	5	58	25	0.337
Weiss, Scott T.	Harvard University	American Journal of Respiratory and Critical Care Medicine	457	20 295	80	0.357	1	17	36	0.119
Weissenbach, Jean	Genoscope	Human Molecular Genetics	260	37 989	72	0.419	0	5	47	0.040
Weissleder, Ralph	Harvard University	Bioconjugate Chemistry	583	33 113	89	0.449	12	38	31	0.277
Weissman, Irving L.	Stanford University	Blood	340	34 864	89	0.458	3	47	32	0.279
Wells, George A.	University of Ottawa	Journal of Rheumatology	485	20 883	79	0.357	2	10	47	0.073
Werb, Zena	University of California at San Francisco	Development	232	30 962	83	0.419	4	37	30	0.242
White, Harvey D.	Auckland City Hospital	European Heart Journal	596	30 472	78	0.401	9	16	42	0.150
White, Nicholas J.	University of Oxford	Transactions of the Royal Society of Tropical Medicine and Hygiene	668	25 253	78	0.375	13	19	24	0.214
White, Owen	University of Maryland School of Medicine	Nucleic Acids Research	120	30 328	69	0.371	1	5	51	0.039
Wichmann, H.-Erich	Helmholtz Zentrum München	Nature Genetics	618	22 715	77	0.359	1	7	47	0.052
Willett, Walter C.	Harvard University	American Journal of Clinical Nutrition	1142	88 386	156	0.938	8	79	161	0.329

Table 1 *Continued*

Researcher	Institution	Main Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Willson, Timothy M.	GlaxoSmithKline	Journal of Medicinal Chemistry	164	29 140	80	0·401	5	14	49	0·112
Wilson, James M.	University of Pennsylvania	Human Gene Therapy	435	23 611	86	0·393	2	47	21	0·275
Wilson, Peter W. F.	Emory University	Circulation	504	39 736	104	0·530	9	22	79	0·149
Wilson, Richard K.	Washington University St. Louis	Genome Research	137	33 836	58	0·354	0	6	31	0·057
Winblad, Bengt	Karolinska Institutet	International Journal of Geriatric Psychiatry	634	24 911	78	0·373	5	10	37	0·108
Wittchen, Hans-Ulrich	Technische Universitat Dresden	International Journal of Methods in Psychiatric Research	429	18 381	76	0·335	12	12	27	0·157
Witteman, Jacqueline C. M.	Erasmus University Rotterdam	Stroke	472	21 973	79	0·362	0	21	40	0·125
Wolmark, Norman	Allegheny General Hospital	Journal of Clinical Oncology	170	28 612	65	0·350	3	29	19	0·220
Yagita, Hideo	Juntendo University	Journal of Immunology	473	23 341	84	0·385	1	8	56	0·053
Yamamoto, Masayuki	Tohoku University	Journal of Biological Chemistry	717	28 311	83	0·406	0	26	37	0·168
Yancopoulos, George D.	Regeneron Pharmaceuticals, Inc.	Cell	247	34 335	94	0·471	2	25	65	0·138
Yates III, John R.	Scripps Research Institute	Analytical Chemistry	667	41 576	102	0·533	7	38	61	0·226
Yazaki, Yoshio	International Medical Center of Japan	Journal of Biological Chemistry	415	20 847	83	0·369	0	16	44	0·098
Yeo, Charles J.	Thomas Jefferson University	Journal of Gastrointestinal Surgery	358	24 549	84	0·391	6	6	64	0·062
Yusuf, Salim	McMaster University	Circulation	630	60 475	110	0·652	22	54	41	0·424
Zanchetti, Alberto	University of Milan	Journal of Hypertension	378	26 130	63	0·331	5	19	12	0·221
Zeiher, Andreas M.	University of Frankfurt	Circulation	318	32 801	92	0·457	0	34	52	0·181
Zimmet, Paul Z.	Baker Heart Research Institute	Diabetes Care	443	26 640	64	0·337	12	5	21	0·151

#papers: number of papers in 1996–2011; #cites: number of total citations of papers published in 1996–2011 as of end-2011; H: Hirsch h-index; Score: normalized score; #FS100: number of papers with at least 100 citations authored as single or first author; #L100: number of papers with at least 100 citations authored as last author; #M100: number of papers with at least 100 citations authored as middle author; AAS: authorship-adjusted score.
*Some errors noted for the respective Scopus author identifier, based on communication from the author.

Table 2 Highly influential researchers with a focus outside biomedicine (Scopus 1996-2011)

Researcher	Institution	Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Alivisatos, A. Paul	University of California at Berkeley	Nano Letters	225	45 610	87	0.505	6	57	17	0.398
Antonietti, Markus	Max Planck Institute of Colloids and Interfaces	Chemistry of Materials	453	22 468	83	0.377	8	38	18	0.271
Barabasi, Albert-László	Northeastern University	Physical Review Letters	173	37 064	67	0.398	10	31	13	0.302
Bawendi, Moungi G.	Massachusetts Institute of Technology	Physical Review B	223	25 008	78	0.374	0	40	20	0.249
Brinkmann, Jonathan V.	Apache Point Observatory	Astronomical Journal	319	37 540	104	0.519	0	14	92	0.069
Buchwald, Stephen L.	Massachusetts Institute of Technology	Journal of the American Chemical Society	280	27 886	96	0.446	2	91	1	0.441
Caruso, Frank	University of Melbourne	Langmuir	337	22 775	78	0.363	22	34	6	0.328
Cirac, Juan Ignacio	Max Planck Institute of Quantum Optics	Physical Review Letters	345	23 034	77	0.361	6	16	38	0.132
Corma, Avelino	Universidad Politecnica de Valencia	Journal of Catalysis	697	27 360	76	0.379	27	7	17	0.253
Dai, Hongjie	Stanford University	Journal of the American Chemical Society	232	47 567	97	0.547	7	69	17	0.447
Dresselhaus, Mildred S.	Massachusetts Institute of Technology	Physical Review B	621	31 045	84	0.423	12	33	22	0.284
Ellis, Richard S.	California Institute of Technology	Astrophysical Journal Letters	292	29 354	83	0.411	4	5	65	0.050
El-Sayed, Mostafa A.	Georgia Institute of Technology	Journal of Physical Chemistry B	270	25 850	68	0.346	2	50	2	0.333
Fabian, Andrew C.	Institute of Astronomy	Monthly Notices of the Royal Astronomical Society	566	20 316	78	0.351	10	14	28	0.162
Filippenko, Alexei V.	University of California at Berkeley	Astrophysical Journal Letters	410	33 824	70	0.392	2	1	41	0.027
Forrest, Stephen R.	University of Michigan	Applied Physics Letters	421	36 148	90	0.468	7	55	22	0.345
Frechet, Jean M. J.	University of California at Berkeley	Journal of the American Chemical Society	499	30 320	93	0.448	3	59	23	0.327
Frenk, Carlos S.	University of Durham	Monthly Notices of the Royal Astronomical Society	237	27 510	74	0.373	1	7	51	0.051
Friend, Richard H.	University of Cambridge	Synthetic Metals	512	36 277	87	0.459	1	40	38	0.238
Fukugita, Masataka	University of Tokyo	Nuclear Physics B	326	38 807	80	0.449	4	1	69	0.030

Table 2 *Continued*

Researcher	Institution	Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Geim, Andre K.	University of Manchester	Physical Review B	170	33 560	50	0·326	7	17	14	0·206
Gratzel, Michael	Ecole Polytechnique Federale de Lausanne	Journal of the American Chemical Society	516	46 641	109	0·580	11	77	31	0·429
Grubbs, Robert H.	California Institute of Technology	Journal of the American Chemical Society	314	30 947	82	0·416	3	56	8	0·366
Gunn, James E.	Princeton University	Astronomical Journal	191	28 182	83	0·406	1	1	72	0·011
Hartwig, John F.	University of Illinois at Urbana-Champaign	Journal of the American Chemical Society	255	20 003	81	0·359	10	47	7	0·319
Hawker, Craig J.	University of California at Santa Barbara	Macromolecules	360	22 013	80	0·365	11	27	30	0·204
Heeger, Alan J.	University of California at Santa Barbara	Synthetic Metals	432	26 444	79	0·384	5	41	16	0·285
Ivezic, Željko	University of Washington	Astronomical Journal	245	27 959	87	0·417	6	2	70	0·043
Jain, Anil K.	Michigan State University	Lecture Notes in Computer Science	616	25 607	73	0·361	22	20	12	0·281
Knapp, Gillian R.	Princeton University	Astronomical Journal	185	22 254	76	0·354	1	2	62	0·016
Kresse, Georg	University of Vienna	Physical Review B	247	38 561	62	0·390	7	7	15	0·188
Lieber, Charles M.	Harvard University	Nano Letters	242	55 770	106	0·616	2	99	9	0·566
Lupton, Robert H.	Princeton University	Astronomical Journal	191	26 451	83	0·397	1	2	73	0·016
Marks, Tobin J.	Northwestern University	Journal of the American Chemical Society	535	22 803	82	0·376	0	55	10	0·318
Matyjaszewski, Krzysztof	Carnegie Mellon University	Macromolecules	728	41 357	106	0·545	30	68	10	0·494
Meijer, E. W. (Bert)	Eindhoven University of Technology	Journal of the American Chemical Society	485	25 229	77	0·372	0	37	14	0·270
Mirkin, Chad A.	Northwestern University	Journal of the American Chemical Society	437	41 590	90	0·494	3	57	21	0·366
Mohwald, Helmuth	Max Planck Institute of Colloids and Interfaces	Langmuir	602	23 077	77	0·361	0	40	14	0·267
Mullen, Klaus	Max Planck Institute for Polymer Research	Journal of the American Chemical Society	1082	33 757	82	0·430	0	35	27	0·243
Schlegel, David J.	Lawrence Berkeley National Laboratory	Astronomical Journal	153	29 112	73	0·378	1	2	62	0·017
Schneider, Donald P.	Pennsylvania State University	Astronomical Journal	543	39 877	104	0·531	4	7	99	0·053

Table 2 *Continued*

Researcher	Institution	Journal	#papers	#cites	h	score	#FS100	#L100	#M100	AAS
Schwartz, Stephen M.	Yeshiva University	Journal of Agricultural and Food Chemistry	754	22 126	76	0·353	11	10	26	0·158
Smalley, Richard E.	DECEASED (Rice University)	Chemical Physics Letters	198	42 029	86	0·484	0	52	31	0·303
Spek, Anthony L.	Utrecht University	Organometallics	821	29 539	58	0·332	2	4	13	0·105
Stanley, H. Eugene	Boston University	Physical Review E	538	24 989	77	0·371	2	43	10	0·303
Stoddart, J. Fraser	Northwestern University	Journal of the American Chemical Society	532	32 499	90	0·449	3	37	38	0·230
Strauss, Michael A.	Princeton University	Astronomical Journal	248	26 376	81	0·390	2	4	63	0·034
Stucky, Galen D.	University of California at Santa Barbara	Chemistry of Materials	405	36 208	88	0·461	0	46	30	0·279
Tanaka, Keiji	Hokkaido University	Polymer Preprints	839	25 320	75	0·366	4	11	36	0·108
Tokura, Yoshinori	University of Tokyo	Physical Review B	726	35 352	89	0·460	6	57	16	0·367
Tour, James M.	Rice University	Journal of the American Chemical Society	368	25 654	71	0·355	4	30	15	0·246
Truhlar, Donald G.	University of Minnesota	Journal of Chemical Physics	482	24 567	78	0·372	3	52	1	0·365
Wang, Joseph	Arizona State University	Electroanalysis	305	19 374	79	0·349	40	2	4	0·319
Wang, Zhong Lin	Georgia Institute of Technology	Nano Letters	482	35 057	97	0·485	20	57	17	0·397
White, Simon D. M.	Max Planck Institute for Astrophysics	Monthly Notices of the Royal Astronomical Society	263	30 300	76	0·394	0	25	36	0·161
Whitesides, George M.	Harvard University	Journal of the American Chemical Society	668	64 091	123	0·712	8	123	23	0·605
Willner, Itamar	Hebrew University of Jerusalem	Journal of the American Chemical Society	426	23 424	81	0·376	14	40	6	0·338
Xia, Younan	Washington University St. Louis	Advanced Materials	493	48 473	115	0·609	17	96	17	0·529
Yaghi, Omar M.	University of California at Los Angeles	Journal of the American Chemical Society	168	36 705	79	0·435	6	54	5	0·402
Yang, Peidong	University of California at Berkeley	Nano Letters	258	44 363	96	0·527	11	58	25	0·387
York, Donald G.	University of Chicago	Astrophysical Journal Letters	321	29 079	85	0·416	0	55	22	0·297
Zhao, Dongyuan	Fudan University	Chemistry of Materials	435	27 229	74	0·372	8	31	16	0·264

Abbreviations as per Table 1.

work, we limit this exercise to MeSH terms that appear in at least 10% of the author's articles. MeSH terms for the researchers of Table 1 appear in the longer online version of Table 1 (http://www.mapofscience.com/?page_id=761) for the whole period 1996–2011 and also limited to 2005–2011. MeSH terms are not provided for the researchers in Table 2, because MeSH coverage of nonbiomedical sciences is relatively sparse and most researchers would not be adequately represented by the minority of their papers indexed also in PubMed.

Limitations and caveats

Due to the above-mentioned issues associated with the author identity problem, we are well aware that not all of the author records for those listed in Tables 1 and 2 are completely accurate. Scopus author profiles are also subject to change over time

Table 3 Comparative data on h-index for a sample of highly influential researchers calculated with different databases

Name	h-index per Table 1	h-index per Scopus (all years)	h-index per Google Scholar
Braunwald, Eugene	109	142	214
Croce, Carlo M.	104	130	168
Grundy, Scott M.	93	123	154
Ferrara, Napoleone	88	120	139
Mantovani, Alberto	91	119	144
Miller, Webb	58	67	81
Schwartz, Michael W.	88*	84*	95
Bouter, Lex M.	88	104	130
Holgate, Stephen T.	84	107	127
Kadowaki, Takashi	80	96	120
Gibbs, Richard A.	61	78	86
Buchler, Markus W.	76	83	102
Schomig, Albert	79	89	105
Hood, Leroy	71	96	146
Ioannidis, John P. A.	78	90	105
Paulsen, Ian T.	73	84	90
Hicklin, Daniel J.	77	83	85
Wolmark, Norman	65	88	107
Durbin, Richard	59	77	88
Holman, Rury R.	59	60	73

*Some problems noted with attribution of papers in the Scopus author identifier (communication with author).

as Elsevier improves assignment algorithms and responds to author requests for changes. Despite the lack of total accuracy, the methodology used is sufficient for our purposes of identifying a set of highly influential biomedical authors. By choosing researchers with the highest total citation counts and/or h-indexes, even if some of those researcher profiles contain a few papers from other researchers with the same name, this does not diminish the fact that these are highly influential researchers.

We are also well aware that many researchers have published highly significant works prior to 1996. This is an inherent limitation to Scopus data. However, using this common time window of 1996–2011 reduces the effect of age and offers a more level ground for comparing productivity and impact over a similar period of time. Scientists whose key work was published exclusively or predominantly before 1996 are not captured in our list. Relatively, young scientists may also be at a disadvantage because they may not have reached full productivity by 1996 and very young scientists who started publishing late in the 1996–2011 window are at a major disadvantage. Nevertheless, the selected window captures highly influential scientists with a wide range of ages, most of whom are still highly active and relevant for the current evolution of science. The total citation counts and h-indexes listed in Tables 1 and 2 are of course lower than those that can be calculated from sources that include materials from before 1996, such as Google Scholar or the Web of Science. Table 3 shows comparatively data on the h-index of a sample of highly cited authors from Scopus including papers published before 1996 and Google Scholar – the h-indices have been updated to August 2013. As shown, when all years are considered Scopus h-indices increase modestly, while Google Scholar h-indices can be substantially higher. However, the relative ranking of scientists is not affected substantially (rank correlation coefficients 0·89 for Scopus 1996–2011 vs. Scopus all years, 0·80 for Scopus 1996–2011 vs. Google Scholar, and 0·96 for Scopus all years vs. Google Scholar, $P < 0.001$ for all).

We also note that while both total citation counts and h-index were used in the normalized score, total citation counts are more highly skewed than h-index values. Thus, the h-index typically accounted for greater than 50% of the normalized score for a researcher.

Finally, the normalized scores that we used did not account for multiple authorship of papers and for author position and relative contributions in each paper. The final columns in Tables 1 and 2 provide some additional insight into authorship aspects. Three columns show the numbers of papers with at least 100 citations split by author position. First and single authored papers are counted together (#FS100), while last and middle authored papers are considered separately (#L100 and #M100, respectively). Exact contributions are not listed in many

papers and are difficult to quantify with a single simple metric. To attempt to account for authorship patterns and to show how different metrics can change relative rankings, the final column in Tables 1 and 2 shows an authorship-adjusted score (AAS) calculated as the normalized score times the proportion of papers cited 100 times or more that are first, single or last authored papers (pFSL). The rank correlation coefficient is 0·106 ($P = 0.033$) between total citations and pFSL, 0·012 ($P = 0.81$) between h-index and pFLS, suggesting that citation indices and authorship positions are almost totally orthogonal. Eventually, the rank correlation coefficient is 0·42 ($P < 0.001$) between the normalized score and AAS.

The sortable online version of Table 1 (http://www.mapof-science.com/?page_id=761) also contains information on the proportion of papers of each author that is categorized in each of 4 levels of research (applied to basic), as well as the dominant type for each scientist. Research levels were first used in 1976 by Narin *et al.* [11] when they classified biomedical journals into four types: (i) clinical observation, (ii) clinical mix, (iii) clinical observation and (iv) basic research. Machine learning was recently used to train a classifier on title and abstract words using journal research level data. This classifier was then used to assign research levels to individual articles [12]. It is those research level assignments that are used to populate Table 1. All metrics and descriptors in Tables 1 and 2 are based on the time period 1996–2011.

Comparison with other lists of highly cited scientists

Thomson Reuters generates lists of the top 1% highly cited scientists for 21 different fields based on total citation counts for articles belonging to each field (in the module Essential Science Indicators) and it also used to generate lists of the 300 most-cited scientists in each of these fields, but the latter option is no longer updated. Other focused lists have been published from time-to-time in various fields [13,14]. While division per field causes more granularity and adjusts for potential differences in citation density per field, scientists who work in several of these more granular fields are at a major disadvantage vs. scientists concentrated in a more narrow focus. Moreover, the Thomson Reuters classification uses only total citations, while our score incorporates also the h-index that may be more appropriate.

Microsoft Academic Search also allows generating of lists of scientists in distinct fields and also in even more narrow sub-fields based on total citations or h-index, but not on a combined score. Moreover, the inclusion of papers and the respective citation data for biomedical sciences are still more limited in Microsoft Academic Search than in Scopus.

None of the previously developed lists has accounted for multiple authorship and author contributions. Moreover, they have not provided information on dominant/specific MeSH terms that may provide more accurate information on the focus of each scientist's work.

Potential uses

The list of highly influential researchers was developed so as to identify a reproducible set of researchers with high citation metrics. We are currently using this list in an ongoing survey of these scientists regarding what features of scientific papers define major impact. The list may be used in additional surveys pertaining to issues where these scientists are likely to offer a highly knowledgeable viewpoint, for example issues of funding, conduct and reporting of scientific research. Lists of influential researchers may also be a resource for identifying suitable scientists for leadership, advisory and reviewer positions. Finally, impact metrics may be used for funding decisions based on appraisal of investigator excellence instead of or in addition to specific grant proposals [15]. We see the generated list as a resource that can be used creatively by other interested investigators for very diverse purposes and we welcome suggestions for improvements.

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