

The 250 Most-Cited Primary
Authors, 1961-1975. Part I.
How the Names Were Selected.

Number 49, December 5, 1977

Last year I promised to publish a list of the 250 most-cited primary authors based on data from the *Science Citation Index*[®] (*SCI*[®]).¹ I knew when I made the promise that someone would protest our failure to include author number 251. The situation would be similar to that in the French Academy, which limits membership to 40. New members can be elected only upon the death of an old member. Thus who sits waiting in the "41st chair" is a lively topic of discussion.

I certainly do *not* want to offend thousands of distinguished scientists whose names do not appear on this list. Therefore as a symbolic gesture I have omitted the final name. This list of the 250 most-cited primary authors contains only 249 names.

Since the amount of data involved is quite large, I will discuss this topic in three consecutive parts. This week's essay includes a general introduction to the list, which appears on pages 9-13. It also discusses how the list was assembled. Next week I will discuss the correlation of citedness with other forms of scientific recognition such as awards, prizes, and memberships in national academies of science. The

following week I will list and discuss the most-cited publication written by each of the 250 authors.

Those unfamiliar with citation analysis may need some explanation of the mechanics of preparing a list of this type. Authors of scientific papers acknowledge prior work by citing it in their own papers. These acknowledgements, or citations, are regularly compiled in the *Science Citation Index*, enabling them to be counted and analyzed in other ways, either manually or by computer. Of course, there are many reasons why one author may cite another,² but in general we assume that the number of citations is positively correlated with the scientific value of the cited work. Papers which receive a large number of citations are usually found to have reported significant new scientific knowledge. And the most-cited authors are likely to be scientists who have had significant impact on the development of science.

It would have been easy to rank these authors according to their total citation counts over the 15-year period from 1961 to 1975. But we resisted the temptation to do this. Citation counts are significantly affected by many factors which

we did not and could not take into consideration in the time available. These factors include the author's age, the size of the author's field, the citation practices in that field, and the extent to which the field has been covered by the *SCI* since its inception in 1961. We can safely assert, however, that each of these 250 scientists has—for one reason or another—had substantial impact on the world's scientific community.

It is important to remember that this list is based only on primary-author data. A citation to a paper with three authors, for example, would be credited only to the first author. We are now working to remedy this bias by assembling a whole new data set based on citations to *all* authors. All-author data will produce a new list of highly cited authors, which can then be compared with the primary-author data. Such comparisons will tell us much about the effects of multiple authorship on citation counts. In a sense, this series of essays marks the end of the exclusive use of first-author data in compiling lists of highly cited scientists. I will elaborate on the implications of this change in Part Three.

Every author listed in Figure 1 has been cited more than 4,000 times, a yearly average of at least 266. Since the average yearly citation rate for cited authors in the *SCI* is only 7.48,³ each of these 250 authors is clearly a citation superstar. But I hasten to add that a list of the next 1,000 most cited authors would *still* be composed exclusively of citation superstars. The difference between the group in Figure 1

and the next 250 most-cited authors is only 1,000 fewer citations over the same time period. Thus, there are 500 primary authors who were cited 3,000 or more times. And over 1,000 authors were cited 2,000 or more times in this period.

By listing authors alphabetically, rather than by citation rank, we have in effect adopted a kind of percentile ranking system. This method is similar to that used in Scholastic Aptitude Test (SAT) scores and other test results. In fact, if we assume that over one million scientists worldwide have worked over the same time period as these 250, the list in Figure 1 can be viewed as the 0.025 percentile, or the top quarter of one hundredth of one percent. The *thousand* most-cited authors would comprise the top one-tenth of one percent.

The list in Figure 1 is multi-disciplinary. But similar listings based on citation counts could be developed for specific disciplines or specialties. Organic and inorganic chemistry predominate, with 81 authors (32.5% of the total). Biochemistry is represented by 42 authors (16.8%), physics including spectroscopy and mathematical physics by 40 authors (16.0%), and medicine including hematology, immunology, and pathology by 29 (11.6%). Eighteen authors are in life sciences, which include bacteriology, cytology, ichthyology, microbiology, and zoology. Together, all of the disciplines mentioned above account for 84% of the 250 authors.

Of the remaining 16%, eleven authors are in physiology or histophysiology: NE Anden, DR Curtis,

JC Eccles, W Feldberg, RA Granit, B Katz, SS Kety, S Levine, H Selye, and US Von Euler. Ten authors are in mathematics or statistics: M Abramowitz, RE Bellman, N Bourbaki, S Chapman, CA Coulson, R Courant, ME Fisher, RA Fisher, A Erdelyi, and T Kato.

The list includes relatively few authors in other disciplines. However, pharmacology is represented by six authors: BB Brodie, JH Burn, A Carlsson, LS Goodman, OH Lowry, and EW Sutherland. Astrophysics and astronomy are represented by S Chandrasekhar, HL Johnson, and L Spitzer; statistics by GW Snedecor, RGD Steel, and BJ Winer; and psychology by RB Cattell, HJ Eysenck, and S Freud. Biophysics is represented by AL Hodgkin and HM McConnell. The list contains the name of only one metallurgist, M Hansen. Some fields, such as earth science, space science and botany, are not represented.

The representation on this list of given authors and disciplines is related not only to the stature of the authors but also to the amount of activity and the citation practices in their fields. For example, we know that the average number of cited references per paper differs significantly from one field to another. This can affect the average citation impact for authors in a given field. In recent years papers in biochemistry and molecular biology have contained an average of about 30 references each. Francis Narin of Computer Horizons has reported that biomedical research papers average 20 references, astronomy

and astrophysics 14, and physics 12.5.⁴ But papers in general psychology average only 10 references, engineering and technology 6, and probability and statistics 5.6. Thus, the number of authors in each field who are on this list is at least roughly correlated with the average number of references per publication in the field. I would expect more authors in fields with few references to turn up in a listing of the 1,000 most cited authors.

The absence of botanists was particularly noteworthy, since the average number of references per publication in botany is about 12, which is higher than that for probability and statistics (5.6) or for engineering and technology (6), both of which *are* represented on the list. According to Dr. L. Andrew Staehelin of the Department of Molecular, Cellular and Developmental Biology at the University of Colorado, Boulder, whose education and experience are in botany, the absence of botanists from this list has two causes. "First, the lack of funding in the field has forced many of the leading botanists to leave, or to call themselves molecular biologists or cell biologists, and to center their research in these areas. This has left very few qualified scientists in the field, and in turn there are few educators to prepare future botanists. Secondly, the diversification of the field may be responsible. There are many highly specific areas in the botanical sciences; they may not be citing each other."⁵

Additional reasons for the absence of botanists from the list were advanced by Dr. Robert S. Platt,

Jr., of the Department of Botany at Ohio State University. He felt that the primary author bias was particularly significant in botany. Thus, if he is correct, the list discriminates against botanists. Whether professors of botany list their student co-authors first more often than other scientists remains to be seen. Dr. Platt also agreed with Dr. Staehelin about the narrow specialization of botanists, commenting, "Maybe there is some kind of citation barrier in botany, so that specific research in the field is only used and quoted by a limited number of other researchers in a very specific field." He went on, "There isn't a lot of cross-discipline referencing in botany. Maybe this could be turned into a real slam against botanists, that they get too narrow and don't understand anything that's going on outside their narrow field."⁶ The lack of representation of agricultural disciplines might also indicate a lack of basic research in fields financed by departments of agriculture throughout the world.

In any case, it is certain that the lack of representation on this list of some scientific disciplines and specialities is an artifact of the activity and citation practices in the missing fields as well as of the limits on the length of the list we could publish. In the future we will reduce the bias of similar lists by using all-author data. We will also expand the most-cited author list to 1,000 or more names, and may list the most-cited authors in each speciality—even botany.

In Figure 1 the year of birth of

each author appears in parentheses after the name. Some, of course, are now deceased. The average age overall is 63. This makes sense, since older scientists have been publishing—and therefore accumulating citations—longer than younger ones.

The list is composed mostly of those who have made their mark by continuous, usually quite prolific, contribution over the entire period from 1961 to 1975. That is why it contains the names of many scientists who are now in their 50s and 60s. Thirty-three of these 250 authors are (or would be) in their 40s, 82 in their 50s, 75 in their 60s, 34 in their 70s, 15 in their 80s and 8 in their 90s. The earliest-born scientist whose name appears on this list is Sigmund Freud, who was born in 1856 and died in 1939. The youngest is JD Bjorken, born in 1934.

For the most part, the citation rates of these 250 authors have remained static over the last two to three years. However, some have been changing, for better or worse. Although it can only be a rough indication at best, a pattern of ascending citations might help us identify those whose impact is increasing. A pattern of descending citations might help to identify those whose work was important, but is now being superseded by newer contributions.

We defined an ascending citation record as one which meets three conditions: (1) the number of cites (citations received) in 1974 is at least 10 greater than the average yearly number of cites from 1961-1975; (2) the number of cites in 1975

Figure 1. The 250 most-cited primary authors, based on *Science Citation Index*[®] data from 1961 to 1975. Birth date appears in parentheses after name. Ascending and descending arrows based partly on 1976 data (not shown).

	Total Citations 1961-75	Average Yearly Citations 1961-75	1974 Citations	1975 Citations	Ascending = ↑ Descending = ↓
Abraham A (1914)	6,769	451	628	608	
Abramowitz M (1915-1958)	5,108	340	720	667	
Abrikosov AA (1928)	5,429	362	407	305	
Albert A (1911)	8,664	578	586	521	
Allinger NL (1928)	4,140	276	375	323	
Allison AC (1928)	6,105	407	611	580	
Anden NE (1937)	5,147	343	884	762	
Anderson PW (1923)	6,787	452	788	600	
Andrews P (1928)	4,485	299	578	521	
Arnon DI (1910)	4,323	288	342	294	
Axelrod J (1912)	6,973	465	559	435	
Baker BR (1915)	5,395	360	230	190	↓
Bardeen J (1908)	4,788	319	365	257	
Barrer RM (1910)	5,230	349	408	279	
Bartlett PD (1907)	5,180	345	427	342	
Barton DHR (1918)	7,763	518	584	510	
Basolo F (1920)	4,083	272	394	285	
Basov NG (1922)	4,320	288	445	392	
Bates DR (1916)	6,925	462	440	340	↓
Bell RP (1907)	4,400	293	306	281	
Bellamy LJ (1916)	10,736	717	455	430	
Bellman RE (1920)	5,678	379	433	363	
Bender ML (1924)	4,924	328	341	300	
Benson SW (1918)	5,319	355	464	431	
Bergstrom S (1916)	4,473	298	348	280	
Berson SA (1918)	4,486	299	430	292	
Bethe HA (1906)	7,718	515	559	498	
Beutler E (1928)	5,636	376	481	449	
Billingham RE (1921)	6,269	418	268	248	↓
Birch AJ (1915)	4,339	289	292	231	
Bjorken JD (1934)	4,264	284	584	428	
Bloembergen N (1920)	5,234	349	318	334	
Born M (1882)	9,206	614	792	721	
Bourbaki N (—)	4,860	324	413	296	
Boyer PD (1918)	6,906	460	270	246	↓
Brachet J (1909)	5,956	397	191	119	
Braunwald E (1929)	4,980	332	390	375	
Bray GA (1931)	8,012	534	750	690	
Bridgman PW (1882-1961)	5,053	337	282	229	↓
Brodie BB (1909)	7,493	500	526	421	
Brown HC (1912)	16,623	1,108	1,257	1,153	
Brown JB (1899)	4,074	272	197	187	
Buckingham AD (1930)	4,332	289	423	372	
Budzikiewicz H (1933)	5,089	339	456	320	
Bunnnett JF (1921)	4,370	291	312	294	
Burn JH (1892)	5,650	377	191	158	↓
Burnet FM (1899)	5,553	370	384	301	
Burton K (1926)	6,913	461	728	674	
Busing WR (1923)	5,066	338	518	448	

Figure 1. The 250 most-cited primary authors (continued)

	Total Citations 1961-75	Average Yearly Citations 1961-75	1974 Citations	1975 Citations	Ascending = ↑ Descending = ↓
Carlson LA (1928)	4,282	285	400	338	
Carlsson A (1923)	7,697	515	675	554	
Cattell RB (1905)	4,190	279	337	249	
Chance B (1913)	16,306	1,087	952	824	↓
Chandrasekhar S (1910)	8,179	545	724	594	
Chapman S (1888-1970)	5,235	349	326	285	↓
Chatt J (1914)	6,692	446	641	521	
Clementi E (1931)	5,684	379	637	579	
Cohen MH (1927)	4,808	321	404	389	
Conney AH (1930)	5,151	343	491	458	
Cope AC (1909)	5,269	351	281	242	↓
Corey EJ (1928)	9,901	660	1,045	1,031	
Cotton FA (1930)	12,901	860	1,416	1,493	↑
Coulson CA (1910)	6,569	438	440	362	
Courant R (1888)	4,154	277	323	255	
Cram DJ (1919)	6,148	410	391	288	↓
Cromer DT (1923)	5,148	361	933	1,029	↑
Cruickshank DWJ (1924)	4,512	301	259	258	
Cuatrecasas P (1903)	4,484	299	1,060	1,064	
Curtis DR (1927)	4,794	320	614	470	
Dacie JV (1912)	4,323	288	317	242	
Dalgarno A (1928)	5,365	358	460	395	
Davis BJ (1932)	7,074	472	1,079	989	
Dawson RMC (1924)	4,125	275	297	269	
DeDuve C (1917)	8,445	563	645	567	
DeRobertis E (1913)	4,801	320	269	205	↓
Dewar MJS (1918)	9,800	653	1,017	955	
Dische Z (1895)	7,874	525	485	367	
Dixon M (1899)	6,331	422	543	508	
Djerassi C (1923)	8,520	568	362	286	↓
Doering WVE (1917)	4,253	284	310	222	
Dole VP (1913)	5,902	393	414	342	
Duncan DB (1925)	4,153	277	311	285	
Eagle H (1905)	6,498	433	435	326	
Eccles JC (1903)	10,104	674	802	545	
Eigen M (1927)	4,980	332	441	379	
Elieel EL (1921)	8,615	574	650	575	
Erdelyi A (1908)	5,978	399	390	377	
Eysenck HJ (1916)	5,241	349	379	307	
Fahey JL (1924)	4,724	315	277	235	
Falck B (1927)	4,275	285	375	290	
Farquhar MG (1928)	4,525	302	337	268	
Fawcett DW (1917)	6,236	416	505	378	
Feigl F (1891)	4,074	272	154	165	
Feldberg W (1900)	4,762	317	394	281	
Feynman RP (1918)	6,031	402	708	567	
Fieser LF (1899)	9,392	626	634	527	
Fischer EO (1918)	4,788	319	443	413	
Fisher ME (1931)	4,289	286	565	510	
Fisher RA (1890-1962)	8,336	556	672	617	

Figure 1. The 250 most-cited primary authors (continued)

	Total Citations 1961-75	Average Yearly Citations 1961-75	1974 Citations	1975 Citations	Ascending = ↑ Descending = ↓
Fiske CH (1890)	8,249	550	572	505	
Flory PJ (1910)	10,247	683	928	795	
Folch J (1917)	9,693	646	899	820	
Fraenkel-Conrat H (1910)	4,376	292	197	187	↓
Fredrickson DS (1924)	6,897	460	783	740	
Freud S (1856-1939)	8,490	566	633	530	
Friedel J (1921)	4,325	288	356	277	
Gell-Mann M (1929)	9,669	645	585	404	↓
Gilman H (1893)	7,849	523	503	435	↓
Ginzburg VL (1916)	6,834	456	530	445	
Glasstone S (1897)	5,080	339	295	289	
Gomori G (1904)	7,136	476	445	327	
Good RA (1922)	4,607	307	296	232	↓
Goodman LS (1906)	5,627	375	399	413	↑
Goodwin TW (1919)	4,727	315	243	224	↓
Gornall AG (1914)	5,921	395	532	470	
Grabar P (1898)	4,717	314	176	166	↓
Granit RA (1900)	4,629	309	245	210	↓
Green DE (1926)	4,708	314	271	163	
Gutowksy HS (1919)	4,286	286	254	223	↓
Hansen M (1921)	4,262	350	398	377	
Harned HS (1921)	4,960	331	306	276	↓
Herbert V (1927)	4,106	274	333	316	
Herzberg G (1904)	13,110	874	1,095	972	
Hirs CHW (1923)	4,578	305	322	320	
Hirschfelder JO (1911)	7,033	469	496	414	
Hodgkin AL (1914)	7,500	500	513	505	
Horner L (1911)	4,469	298	299	303	
House HO (1929)	4,393	293	484	504	↑
Hubel DH (1926)	4,640	309	562	532	
Huisgen R (1920)	9,309	621	801	772	
Huxley HE (1924)	4,073	272	300	318	
Ingold CK (1893)	4,198	280	244	171	
Jackman LM (1926)	4,927	328	325	326	
Jacob F (1920)	7,101	473	301	219	
Jaffé HH (1919)	5,106	340	344	229	
Johnson HL (1933)	4,117	274	367	337	
Jorgensen CK (1931)	6,049	403	545	472	
Kabat EA (1914)	7,529	502	450	419	↓
Karnovsky MJ (1926)	5,616	374	660	635	
Karplus M (1930)	5,770	385	415	292	
Kato T (1917)	4,138	276	597	522	
Katritzky AR (1928)	4,704	314	355	292	
Katz B (1911)	4,690	313	486	512	↑
Keilin D (1887)	4,121	275	163	131	
Kety SS (1915)	4,594	306	297	281	↓
King RB (1903)	5,109	340	569	550	
Kirkwood JG (1907-1959)	4,084	272	339	291	
Kittel C (1916)	5,591	373	451	407	
Klein G (1925)	4,430	295	519	409	

Figure 1. The 250 most-cited primary authors (continued)

	Total Citations 1961-75	Average Yearly Citations 1961-75	1974 Citations	1975 Citations	Ascending = ↑ Descending = ↓
Klotz IM (1916)	4,151	277	328	292	
Kolthoff IM (1894)	9,697	646	642	511	
Kornberg A (1918)	4,548	303	240	238	
Krebs HA (1900)	7,657	510	578	539	
Kubo R (1920)	4,232	282	436	395	
Kuhn R (1900-1967)	7,488	499	401	333	
Landau LD (1908-1968)	18,888	1,259	1,767	1,533	
Lee TD (1926)	4,879	325	317	289	↓
Lehninger AL (1917)	5,507	367	410	369	
Lemieux RU (1920)	4,619	308	360	308	
Levine S (1921)	4,035	269	351	349	
Lineweaver H (1907)	5,202	347	386	325	
Löwdin PO (1916)	5,060	337	413	325	
Lowry OH (1910)	58,304	3,887	7,904	7,565	
Luft JH (1927)	8,926	595	795	671	
Marmur J (1926)	6,475	432	519	407	
McConnell HM (1927)	5,490	366	381	366	
McKusick VA (1921)	4,181	279	371	284	
Miller JFA (1931)	6,371	425	494	446	
Millonig G (1925)	4,106	274	238	209	
Mitchell P (1883)	4,086	272	455	447	
Monod J (1910)	4,791	319	383	328	
Moore S (1913)	8,167	544	560	554	
Morse PM (1903)	5,089	339	416	349	
Mott NF (1905)	10,473	698	901	885	
Muller A (1931)	4,500	300	464	344	
Müller E (1912)	4,664	311	322	249	
Mulliken RS (1896)	10,508	701	804	725	
Nakamoto K (1922)	5,132	342	492	472	
Natta G (1903)	5,735	382	246	251	
Nesmeyanov AN (1899)	6,783	452	620	457	
Newman MS (1908)	4,730	315	266	235	↓
Novikoff AB (1913)	7,662	511	500	371	↓
Olah GA (1927)	8,311	554	1,083	896	
Ouchterlony O (1914)	5,986	399	501	476	
Palade GE (1912)	5,969	398	218	216	
Pauling L (1901)	15,662	1,044	1,271	1,095	
Pearse AGE (1916)	10,522	701	879	775	
Perutz MF (1914)	4,263	284	579	533	
Pople JA (1925)	15,135	1,009	1,572	1,263	
Prigogine I (1917)	4,681	312	373	290	
Racker E (1913)	4,567	304	356	384	↑
Reed LJ (1926)	4,290	286	300	316	↑
Reynolds ES (1928)	10,115	674	1,084	903	
Roberts JD (1918)	4,501	300	251	226	
Robinson RA (1914)	5,543	370	411	419	
Rose ME (1911)	4,127	275	224	173	
Rossini FD (1899)	4,105	274	136	132	
Russell GA (1925)	5,933	396	364	275	↓
Sabatini DD (1931)	6,205	414	226	197	

Figure 1. The 250 most-cited primary authors (continued)

	Total Citations 1961-75	Average Yearly Citations 1961-75	1974 Citations	1975 Citations	Ascending = ↑ Descending = ↓
Scatchard G (1892)	4,191	279	544	511	
Scheidegger JJ (1900)	4,159	277	283	218	
Schneider WC (1919)	7,029	469	419	376	
Schwarzenbach G (1904)	4,618	308	309	312	↓
Schwinger J (1918)	4,855	324	437	367	
Seeger A (1914)	4,757	317	375	335	
Seitz F (1911)	5,396	360	130	129	
Selye H (1907)	8,928	595	480	339	
Seyferth D (1929)	4,462	297	447	368	
Sillen LG (1916)	4,375	292	583	436	
Skou JC (1918)	4,127	275	345	297	
Slater JC (1926)	7,587	506	761	650	
Smith HW (1895-1962)	5,392	359	259	387	
Smithies O (1925)	6,192	413	266	256	↓
Snedecor GW(1881-1974)	14,762	984	1,502	1,395	
Somogyi M (1883-1971)	4,465	298	262	208	
Spackman DH (1924)	6,889	459	528	495	
Spitzer L (1914)	4,238	283	410	417	
Stahl E (1924)	6,252	417	375	294	
Steel RGD (1917)	5,100	340	665	617	
Streitwieser A (1927)	7,511	501	557	396	
Sutherland EW (1915-1974)	5,150	343	432	384	
Taft RW (1922)	5,083	339	332	322	
Tanford C (1921)	5,934	396	534	589	↑
Udenfriend S (1918)	5,039	336	346	313	
Umbreit WW (1913)	5,229	349	297	224	
Van Slyke DD (1883)	4,282	285	147	130	
Van Vleck JH (1899)	5,449	363	321	298	
von Euler US (1905)	8,728	582	483	375	↓
Walling C (1916)	5,590	373	349	315	↓
Warburg O (1883)	7,463	498	425	332	
Warren L (1924)	4,303	287	478	448	
Watson ML (1912)	4,176	278	282	217	
Weber G (1922)	8,319	555	534	507	↓
Weber K (1916)	5,823	388	1,409	1,481	↑
Weinberg S (1933)	6,306	420	959	734	
Weiss P (1911)	4,048	269	243	239	
Wiberg KB (1927)	5,461	364	445	387	
Wieland T (1913)	4,423	295	253	179	↓
Wigglesworth VB (1899)	4,489	299	343	319	
Wigner EP (1902)	4,948	330	366	297	
Wilson EB (1908)	5,139	342	385	357	
Winer BJ (1917)	5,145	343	667	622	
Winstein S (1912)	7,884	526	489	433	
Wittig G (1928)	6,079	405	358	304	↓
Woodward RB (1917)	7,069	471	661	497	
Zachariasen WH (1906)	4,050	270	310	310	
Zeldovich YB (1914)	4,794	320	477	473	
Ziman JM (1925)	4,499	300	379	299	
Zimmerman HE (1926)	4,217	281	457	325	

is at least 10 greater than the number in 1974; and (3) the number of cites in 1976 is at least ten greater than the number in 1975. According to this definition, only 9 of the 250 scientists have ascending citation rates. They are FA Cotton, C Tanford, K Weber, LS Goodman, DT Cromer, B Katz, E Racker, HO House, and LJ Reed.

The definition for ascending rates was inverted to define descending rates. In contrast to the relatively small number of authors with ascending citations, we identified 35 authors with descending citation rates. Although one might expect to find a difference in the ages of ascending and descending authors, we found no significant difference in the average ages of each group.

Some of the names which appeared on the original computer printout from which this list was derived proved to be homographs (the same name representing two or more individuals). While these were not difficult to detect, it was not easy to separate the publications of each person involved. For example, at first we assumed the name K Alder represented the Nobel Prize winning German chemist. However, many of the citations to K Alder were to papers published after 1958, the year the Nobel Prize winner died. Finally, we found that K Alder represented both the German chemist and a highly cited Swiss physicist.

In some cases we have retained names we know to be homographs. For instance, Henry Clay Brown III of the University of Florida has published 20 articles in organic chem-

istry. But the HC Brown on our list is Herbert Charles Brown of Purdue University, who has published 697 articles in inorganic chemistry.

Our most complex homograph problem concerned the name "E Fischer." There are seven Fischers with the first initial "E" listed in *World Who's Who in Science*.⁷ Eric Horst Fischer, Ernst Georg Fischer, Ernst Otto Fischer, Ernst Sigismund Fischer, and two scientists by the name of Emil Fischer. We also found that the name "E Fischer" combined Emil Fischer, the German chemist and Nobel Prize winner born in 1852, with Emil Fischer, the Swiss physiologist born in 1868. Both were deleted from Figure 1. It is possible, although very difficult, to separate the citations received by the two Emils by carefully examining the dates of publication, journals, and titles cited. If this were done, one or both of the E Fischers might have remained on the list.

Others were eliminated from the list because they were editors, compilers, or authors of textbooks rather than reports of original research. These included SP Colowick, who was the editor of a monographic series;⁸ AI Vogel, whose two textbooks account for about two thirds of his total citations;^{9,10} CE Moore, who compiled a monograph on atomic energy levels;¹¹ RD Lillie, author of a textbook on histochemistry;¹² HU Bergmeyer, editor of a book on methods of enzymatic analysis;¹³ and GEW Wolstenholme, the director of the CIBA Foundation and an editor of many CIBA studies.

However, we have decided to retain another "corporate" name on the list. Nicolas Bourbaki is the collective pseudonym for a group of French mathematicians who have written a 36-volume survey of mathematics. Although the group's membership has changed since its formation in the late 1930's, the identities of the mathematicians who have contributed to the Bourbaki books have been kept a secret.

Some readers might believe that this listing of most-cited individual scientists is simply an extension of our society's fascination with celebrities. This phenomenon is evident from the growing popularity of newspaper columns and whole magazines devoted solely to gossip. But it is absurd to compare our list of 250 most-cited scientists to a list of the most popular pop singers.

Whether the personalities behind the scientific names are charismatic or not, the publication evidence is clear that their work has been empirically important in the advance of science. These names represent, among other things, pockets of scientific creativity and activity, past and present. They may sometimes be indicators of the future.

In the next chapter of this study you can observe the high correlation between citation counts and other forms of scientific recognition. Those scientists who have been well recognized by society or their peers will not object to these listings. And if our studies call attention to the work of other individuals who, by other criteria, have not been adequately recognized, then I feel our efforts will have been well rewarded.

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