

# Current Comments

## The 300 Most-Cited Authors, 1961-1976, Including Co-Authors. Part 2. The Relationship Between Citedness, Awards, and Academy Memberships

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In our 1977 study of primary authors we provided information on the relationship between citedness and other forms of recognition.<sup>1</sup> In this second part of our "all-author" study, we will document the same relationship.

Our new study is based on citation counts for both primary and secondary authorships. To obtain these data, we had to make certain compromises which I discussed in the first part of this "all-author" study.<sup>2</sup> In brief the 300 authors on this list are those who published—from 1961 to 1976—journal articles which were indexed by the *Science Citation Index*<sup>®</sup>. The chronological bias and the restriction to the journal literature should be kept in mind. Authors who published important research in books or in conference proceedings may have been missed.

The list of the 300 most-cited authors, the number of citations they received, and their memberships, honors, and awards appear in Figure 1 which begins on page 9. Authors are listed alphabetically under their disciplines.

To obtain data on the awards and memberships in honorific academies, we consulted several biographical directories. Our chief sources were Marquis' *World Who's Who in Science* and *American Men & Women of Science*. Unfortunately, the most recent editions of these directories are out of date. For example, *World Who's Who in Science* was last published in 1968. As a result, some of the scientists on our list did not appear in either directory. And entries for many others were incomplete. So we wrote to the 300 authors involved for an up-to-date list of their prizes and/or memberships. Most responded and gave us a complete list of their awards. Some listed only a few, but added that they had "many others," without naming them.

Since we were interested in listing only honors received for scientific research, we deleted all those given for nonscientific achievement, e.g., public service awards. We also omitted awards given by local organizations. Of course, there are some awards for

scientific research which do not appear here, but we feel that the 57 which are shown in the figure are an *indication* of the recognition the authors have received.

Naturally, the Nobel Prize was included on our list because it is still the single most visible and prestigious award in science.<sup>3</sup> The relationship between citedness and winning a Nobel has already been demonstrated.<sup>4-5</sup>

It was not surprising that twenty-six of the 300 authors are Nobel laureates: two in physics, six in chemistry, and 18 in physiology or medicine.

However, eleven Nobelists, who did not make our earlier most-cited *primary* author list, appear in this "all-author" study. Winners in chemistry who make their first appearance here are C.B. Anfinsen and W.N. Lipscomb. Winners in physiology or medicine are F.A. Lipmann, S. Ochoa, H.G. Khorana, G.M. Edelman, D. Baltimore, B.S. Blumberg, R. Guillemin, A. Schally, and R. Yalow.

What about the Nobel prize winners who are not on this list? Many won the prize for work done prior to 1961. Although their research may still be highly cited, it was excluded from this study. Others, like A. Hewish and M. Ryle, the first astronomers to win the Nobel in physics, are from small fields. Thus, it would be very difficult for them to amass enough citations to appear on this list. Of course, many other Nobel laureates would show up if we extended our list to include the 1,000 most-cited authors. You must remember that the top 300 is an in-

finitesimally small percentage of the scientists who published between 1961-1976. That is why we want to expand these lists in the future.

The other prizes included on the list cover most of the honors mentioned by the authors themselves. One hundred seventy-seven (about 59%) of the authors won at least one of these prizes, awards, or honors. Many of the authors have won several. (A note at the end of the figure gives the full name of each award, the organization which presents it, and its purpose.)

In each discipline except one, over half of the authors have won at least one award. In pharmacology only about one-third have won. An informal survey of pharmacologists resulted in one possible reason for this phenomenon: there are fewer awards specifically for scientists in this field than in other disciplines like chemistry and physics.

We also included membership in national academies because such memberships are strictly limited, and are indeed comparable in prestige to awards.

For example, the US National Academy of Sciences (NAS) had only 1,182 members in 1976. It has been estimated that there were approximately 150,000 publishing scientists in the US that year.<sup>6</sup> The NAS admits as many as 75 new members per year; still Academy members make up less than 0.7% of all American publishing scientists.

One hundred fifteen of the authors on our list, or 39%, are members of the US National Academy of Science. They account for

nearly 10% of the total NAS membership. This is another indication why it would be desirable to extend this analysis to at least the 1,000 most-cited scientists.

Twenty-one authors are members of the United Kingdom's equivalent to the NAS, the Royal Society of London. Twenty-five belong to the Deutsche Akademie Naturforscher Leopoldina, the 300-year-old organization which functions as the national academy of science for the Federal Republic of Germany, the German Democratic Republic, and other German-speaking nations. The national academies of Denmark and Sweden each have seven members on the list.

Australia's national academy of science is represented by six authors; India's and Canada's by four each. The Netherlands, USSR, France, and Israel each have three members of their academies of science on the list. The academies of Brazil, Italy, and Poland are represented by two members each. Other academies which have one each on the list are: Chile, Mexico, Yugoslavia, Republic of China (Taiwan), Hungary, Rumania, Japan, Ireland, Belgium, Czechoslovakia, Spain, and Austria.

Twenty-nine authors on the list are members of national academies of medicine. Thirteen belong to the US Institute of Medicine, nine to the UK's Royal Society of Medicine. Belgium's academy of medicine is represented by three authors; Argentina's by two. The academies of medicine of Mexico, France, and Brazil each have one member on the list.

The list also includes 112 members of the American Academy of Arts & Sciences. Founded in 1780, the Academy honors men and women (both US and non-US citizens) for their attainments in the mathematical and physical sciences, biological sciences, social arts and sciences, and the humanities. There are currently more than 3,000 members. Approximately 1,800 are from the sciences.

One hundred sixty of the authors on this list are members of at least one academy. Sixty-seven of them are also members of a second academy, 26 of three, 12 of four. H.A. Krebs and C.R. deDuve are members of 5 academies; S. Ochoa is a member of six. C.D. Djerassi, and M.F. Perutz hold seven memberships; R.B. Woodward and J.C. Eccles eight, and F. Sorm, nine. Incidentally, all Nobelists on the list are also members of national academies. This is not always true. Nobel prize winners are often elected to national academies after they get the prize, which seems to say something about the politics of local science bodies.

The American Philosophical Society is also on our list, although it is not, strictly speaking, an academy. Founded in 1767 by Benjamin Franklin, the Society now elects to its membership outstanding contributors to the mathematical and physical sciences, geological and biological sciences, social sciences, and humanities. Membership is limited to 500 US citizens and 100 non-US citizens. Twenty authors on our list are members of the American Philosophical So-

ciety. All of them belong to at least one national academy, and twelve have won Nobel Prizes. Members of the APS tend to be much older than the academy membership.

In all, 220, or 73%, of the authors have received recognition in the form of honors and honorific memberships we have listed. But we may also inquire into the reasons why 80 authors on the list have not been so recognized. One of the authors stated, "Since I am not a joiner of societies, I do not receive any prizes." I doubt that this is a universal factor. There are too many people who are joiners who don't receive recognition either. Knowledgeable persons involved in the politics of science would agree that for every member

of an academy, there is at least one person equally deserving. The interesting question is whether the existing selection procedures are overly subjective. And yet we know from certain studies that subjective peer judgments correlate well with citation analysis.<sup>7,8</sup> If it works for grants, why not for awards and academy elections?

Those of you who serve on awards committees may find some names here worthy of consideration. It should be obvious that we have identified many scientists whose work has had significant impact. But for reasons known best to others, they have not yet received formal recognition commensurate with that impact.

#### REFERENCES

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**Figure 1.** The 300 most-cited authors, including co-authors, 1961-1976, listed with their total citations, 1961-1976, honorific academy memberships, and awards and honors. A key to the full names of academies and awards follows the figure. The honors shown do not represent a complete list of awards won by each author. They are meant to give some indication of the recognition these authors have received.

Name	Total Citations 1961-1976	National Academy	Awards & Prizes
<b><u>Organic &amp; Inorganic Chemistry</u></b>			
<b>Bender ML</b>	5,131	US	Sloan (Chem)/59-63
<b>Benson SW</b>	4,359		Guggenheim/50-1; Petroleum Chem./77
<b>Brown HC</b>	10,288	Am. Acad. Arts/Sci.; India; US	Howe/53; Nichols/59; Synth. Org. Chem./60; Pauling/68; NMS/69; Adams/71
<b>Clementi E</b>	5,440		
<b>Corey EJ</b>	8,500	Am. Acad. Arts/Sci.; US	Sloan (Chem)/55-9; Guggenheim/56, 68; Pure Chem./59; Guenther/68; Howe/70; Pauling/73; Cope/76
<b>Cotton FA</b>	10,292	Am. Acad. Arts/Sci.; Denmark; US	Guggenheim/56; Sloan (Chem.)/60-4; Inorganic Chem./62; Baekeland/63; Dist. Service/74; Nichols/75; Howe/75; Pauling/76
<b>Cram DJ</b>	3,827	Am. Acad. Arts/Sci.; US	Guggenheim/54-5; Synth. Org. Chem./65; Cope/74
<b>Davidson ER</b>	3,757		Sloan (Chem.)/67-9; Guggenheim/74
<b>Dewar MIS</b>	6,635	Am. Acad. Arts/Sci.; UK	Howe/61
<b>Djerassi C</b>	11,027	Am. Acad. Arts/Sci.; Brazil; Leop.; Mexico; Sweden; US; US/Med.	Pure Chem/58; Baekeland/59; Guenther/60; Creative Invention/73; NMS/73; Wolf/78
<b>Drago RS</b>	4,178		Inorganic Chem./69; Guggenheim/73
<b>Flory PJ</b>	5,538	Am. Acad. Arts/Sci.; APS; US	Guggenheim/54; Nichols/62; NMS/74; Nobel/C/74; Priestley/74; Weizmann/76
<b>Grant DM</b>	3,869		

Figure 1. (cont'd.)

Name	Total Citations 1961-1976	National Academy	Awards & Prizes
<b>Organic &amp; Inorganic Chemistry (cont'd.)</b>			
Gray HB	4,526	Denmark; US	Sloan (Chem.)/64-6; Pure Chem./70; Howe/72; Guggenheim/72; Inorganic Chem./78
Hammond GS	5,129	Am. Acad. Arts/Sci.; US	Guggenheim/55; Petroleum Chem./61; Norris/68; Priestley/76;
Hoffmann R	7,969	Am. Acad. Arts/Sci.; US	Sloan (Chem.)/66-8; Pure Chem./69; Howe/69; Cope/73; Pauling/74
Huisgen R	4,996	Am. Acad. Arts/Sci.; Leop.; Spain	Adams/75
Ibers JA	6,452		
Jortner J	4,821	Israel	Weizmann/73
Karplus M	6,193	Am. Acad. Arts/Sci.; US	Sloan (Chem.)/59-63; Howe/67
Khorana HG	6,620	Am. Acad. Arts/Sci.; APS; India; Leop.; US	Lasker/BR/68; Nobel/M or P/68; Synth. Org. Chem./69
King RB	4,583		Sloan (Chem.)/67-9; Pure Chem./71
Kochi JK	3,919		
Li CH	3,908	Am. Acad. Arts/Sci.; Chile; Republic of China; US	Oppenheimer/47; Guggenheim/48; Lasker/BR/62
Lipscomb WN	6,364	Am. Acad. Arts/Sci.; Netherlands; US	Guggenheim/54-72; Howe/58; Dist. Service/68; Nobel/C/76
Muetterties EL	3,883	Am. Acad. Arts/Sci.; US	Inorganic Chem./65
Nemethy G	3,927		Pius XI/72
Olah GA	7,451	US	Petroleum Chem./56; Baekeland/67; Morley/70; Guggenheim/72

<b>Paquette LA</b>	3,819		<b>Sloan (Chem.)/65-7; Morley/71; Guggenheim/70</b>
<b>Pople JA</b>	10,479	Am. Acad. Arts/Sci.; UK; US	<b>Langmuir/70; Howe/71; Pauling/77</b>
<b>Roberts JD</b>	6,088	Am. Acad. Arts/Sci.; APS; US	<b>Guggenheim/52, 54; Pure Chem./54; Howe/57; Morley/76</b>
<b>Robins RK</b>	4,239		
<b>Samuelsson B</b>	5,849		<b>Lasker/BR/77</b>
<b>Scheraga HA</b>	9,232	Am. Acad. Arts/Sci.; US	<b>Guggenheim/56, 62; Lilly/57; Nichols/74</b>
<b>Schleyer PV</b>	5,860		<b>Sloan (Chem.)/62-6; Guggenheim/64</b>
<b>Sorm F</b>	5,858	Am. Acad. Arts/Sci.; Czechoslovakia; Denmark; Hungary; Leop.; Poland; Rumania; US; USSR	<b>Guenther/59</b>
<b>Stewart RF</b>	3,894		<b>Sloan (Chem.)/70-2</b>
<b>Sweeley CC</b>	4,424		<b>Guggenheim/70</b>
<b>Tanford C</b>	5,888	Am. Acad. Arts/Sci.; US	<b>Guggenheim/56</b>
<b>Winstein S</b>	4,522	Am. Acad. Arts/Sci.; US	<b>Pure Chem./48; Norris/67; NMS/70</b>
<b>Witkop B</b>	4,341	Leop.; US	
<b>Woodward RB</b>	4,044	Am. Acad. Arts/Sci; APS; Australia; Ireland; India; Leop.; UK; US; USSR	<b>Baekeland/55; Nichols/56; Synth. Org. Chem./Pius XI/61; NMS/64; Nobel/C/65; Weizmann/64</b>
<b><u>Biochemistry</u></b>			
<b>Allfrey VG</b>	6,069		
<b>Ames BN</b>	6,689	Am. Acad. Arts/Sci.; US	<b>Lilly/64</b>
<b>Andrews P</b>	4,606		

Figure 1. (cont'd.)

Name	Total Citations 1961-1976	National Academy	Awards & Prizes
<b>Biochemistry (cont'd.)</b>			
Anfinsen CB	4,942	APS; Denmark; US	Guggenheim/57; NIH Lecture/64; Weizmann/69; Nobel/C/72
Brady RO	3,744	Argentina/Med.; US	Gairdner/73; NIH Lecture/70; Modern Med./76
Cleland WW	4,652	Am. Acad. Arts/Sci.	
Cuatrecasas P	6,777		Abel/72; Lilly (Diabetes)/75
deDuve CR	4,178	Am. Acad. Arts/Sci.; Belgium; Belgium/Med.; US	Pfizer/57; Gairdner/67; Nobel/M or P/74
DeLuca HF	8,622	Am. Acad. Arts/Sci.	Lichwitz/69; Gairdner/74
Doty P	7,422	Am. Acad. Arts/Sci.; APS; US	Guggenheim/50; Pure Chem./56
Edelman GM	6,797	Am. Acad. Arts/Sci.; US	Lilly/65; Nobel/M or P/72; NIH Lecture/76
Estabrook RW	4,546	US/Med.	
Fasman GD	4,149		Guggenheim/74
Hales CN	3,936		
Harris H	4,326	UK; US	
Horecker BL	4,529	Am. Acad. Arts/Sci.; Leop.; US	Pfizer/52; NIH Lecture/70
Jencks WP	4,299	Am. Acad. Arts/Sci.; US	Lilly /62; Guggenheim/73
Kaplan NO	7,248	Am. Acad. Arts/Sci.; US	Lilly/53; Guggenheim/64, 74
Kornberg A	6,706	Am. Acad. Arts/Sci.; APS; Leop.; UK; US	Pfizer/51; Nobel/M or P/59; NIH Lecture/59; Weizmann/65; Borden/68; Guggenheim/69
Koshland DE	5,136	Am. Acad. Arts/Sci.; US	Guggenheim/71; Jones/77



<b>Krebs EG</b>	4,043	Am. Acad. Arts/Sci.; US	Guggenheim/59, 66
<b>Krebs HA</b>	5,146	Am. Acad. Arts/Sci.; APS; France/ Med.; Leop.; UK; US	Nobel/M or P/53; Lasker (APHA)/53
<b>Lardy HA</b>	4,954	Am. Acad. Arts/Sci.; APS; UK	Pfizer/49
<b>Lehninger AL</b>	4,651	Am. Acad. Arts/Sci.; APS; Leop.; US; US/Med.	Pfizer/48; Guggenheim/51, 62
<b>Lipmann F</b>	5,019	APS; Denmark; Leop.; UK; US	Nobel/M or P/53; NMS/66
<b>Moore S</b>	5,619	Am. Acad. Arts/Sci.; Belgium/Med.; US	Chromatography/64; Nobel/C/72
<b>Morris HP</b>	4,319		
<b>Ochoa S</b>	4,172	Am. Acad. Arts/Sci.; APS; Leop.; Poland; UK; US; USSR	Borden/58; Nobel/M or P/59; Virchow/63
<b>Passonneau JV</b>	4,034		Borden/66
<b>Piez KA</b>	4,302		Jones/70; NIH Lecture/75
<b>Prockop DJ</b>	5,187		
<b>Randle PJ</b>	6,442		
<b>Reich E</b>	4,996	Am. Acad. Arts/Sci.	Waksman/64; Guggenheim/74
<b>Rodbell M</b>	4,037		
<b>Roseman S</b>	4,068	US	
<b>Rutter WJ</b>	4,147		Guggenheim/62; Pfizer/68
<b>Seegmiller JE</b>	4,690	US	Gairdner/68
<b>Smith EI</b>	3,861	Am. Acad. Arts/Sci.; APS; US	Guggenheim/38-9
<b>Tappel AL</b>	4,665		Guggenheim/65; Borden/73
<b>Udenfriend S</b>	10,507	Am. Acad. Arts/Sci.; US	Gairdner/67; Sollmann/75
<b>Umezawa H</b>	5,781	Am. Acad. Arts/Sci.; Japan; Leop.	
<b>Vallee BL</b>	5,527	Am. Acad. Arts/Sci.; Denmark; US	
<b>Van Deenen LL</b>	6,873	Netherlands	

Figure 1. (cont'd.)

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Name	Total Citations 1961-1976	National Academy	Awards & Prizes
<b><u>Immunology</u></b>			
Austen KF	6,023	Am. Acad. Arts/Sci.; US	Gairdner/77
Benacerraf B	9,197	Am. Acad. Arts/Sci.; US	Jones/76
Cooper MD	3,905		
Fahey JL	6,482		
Finland M	4,082	Am. Acad. Arts/Sci.; US	
Franklin EC	4,358		
Fudenberg HH	7,523	UK/Med.	
Good RA	17,641	Am. Acad. Arts/Sci.; US; US/Med.	Lasker/CR/70; Gairdner/70; Borden/70; Virchow/75
Grey HM	3,788		
Haber E	4,638	Am. Acad. Arts/Sci.; UK/Med.	
Hirschhorn K	4,548		Virchow/74
Ishizaka K	4,947		Gairdner/73
Kunkel HG	9,031	Am. Acad. Arts/Sci.; US	Gairdner/62; Jones/74; Lasker/BR/75
Merrill JP	5,262	Am. Acad. Arts/Sci.	Modern Med./65; Gairdner/69
Moller G	4,383		Jahre/76
Muller-Eberhard HJ	5,924	UK/Med.; US	Jones/71; Modern Med./74; Gairdner/74
Nossal GJV	3,985	Am. Acad. Arts/Sci.; Australia	
Paul WE	4,189		

<b>Pressman D</b>	3,726		Morley/67
<b>Reisfeld RA</b>	4,559		
<b>Roltt IM</b>	3,902		Van Meter/57; Gairdner/64
<b>Rosen FS</b>	4,149		Guggenheim/74
<b>Sela M</b>	4,987	Am. Acad. Arts/Sci.; Israel; US	NIH Lecture/73
<b>Terasaki PI</b>	5,174		Modern Med./71
<b>Waksman BH</b>	4,730		
<b>Wigzell H</b>	4,046		

### Endocrinology

<b>Aurbach GD</b>	3,887		Lichwitz/68
<b>Barter FC</b>	3,736		Modern Med./77
<b>Berson SA</b>	5,474	UK/Med.; US	Lilly (Diabetes)/57; Middleton/60; Gairdner/71
<b>Conn JW</b>	3,938	Argentina/Med.; US; US/Med.	Gairdner/65; CIBA-Stouffer/69
<b>Daughaday WH</b>	3,731		Modern Med./77
<b>Greenwood FC</b>	5,572		
<b>Guillemin R</b>	4,200	Am. Acad. Arts/Sci.; US	NIH Lecture/73; Gairdner/74; Lasker/BR/75; NMS/76; Borden/76; Nobel/M or P/77
<b>Hunter WM</b>	5,214		
<b>Kastin AJ</b>	3,852		Tyler/75
<b>Kipnis DM</b>	4,805	Am. Acad. Arts/Sci.; US/Med.	Lilly (Diabetes)/67; Oppenheimer/67
<b>Laragh JH</b>	4,763		CIBA-Stouffer/69
<b>Lever AF</b>	3,884		
<b>Liddle GW</b>	4,483		
<b>Lipsett MB</b>	3,912		Sloan/55
<b>Midgley AR</b>	5,108		

**Figure 1. (cont'd.)**

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<b>Name</b>	<b>Total Citations 1961-1976</b>	<b>National Academy</b>	<b>Awards &amp; Prizes</b>
<b><u>Endocrinology (cont'd.)</u></b>			
<b>Pastan I</b>	5,997		Van Meter/71; NIH Lecture/73
<b>Potts JT</b>	4,148		Oppenheimer/68; Lichwitz/68
<b>Rasmussen H</b>	4,489		Lichwitz/71
<b>Roth J</b>	5,647		Oppenheimer/74; Lilly (Diabetes)/74
<b>Schally AV</b>	10,386	Am. Acad. Arts/Sci.; Mexico/Med.; US	Van Meter/69; Middleton/70; Gairdner/74; Borden/75; Lasker/BR/75; Tyler/75; Nobel/M or P/77
<b>Unger RH</b>	4,623		Lilly (Diabetes)/64; Middleton/69
<b>Wilson JD</b>	4,140		Oppenheimer/72
<b>Wurtman RJ</b>	6,170		Abel/68; Oppenheimer/73
<b>Yalow RS</b>	5,595	Am. Acad. Arts/Sci.; US	Middleton/60; Lilly (Diabetes)/61; Gairdner/71; Modern Med./76; Lasker/BR/76; Nobel/M or P/77; Virchow/78
<b><u>Molecular Biology</u></b>			
<b>Baltimore D</b>	5,270	Am. Acad. Arts/Sci.; US	Lilly (Microbiology)/71; Gairdner/74; Nobel/M or P/75
<b>Berg P</b>	5,307	Am. Acad. Arts/Sci.; US	Lilly/59; NIH Lecture/76
<b>Bonner J</b>	7,096	Am. Acad. Arts/Sci.; APS; Leop.; US	Waksman/56
<b>Changeaux JP</b>	6,208	Leop.	

<b>Gros F</b>	3,712	Am. Acad. Arts/Sci.; France	Pius XI/64
<b>Hurwitz J</b>	4,873	Am. Acad. Arts/Sci.; US	Lilly/62; Guggenheim/68
<b>Jacob F</b>	10,383	Am. Acad. Arts/Sci.; APS; France; UK; US	Nobel/M or P/65
<b>Leder P</b>	3,892		NIH Lecture/77; CIBA-GEIGY Drew/78
<b>Maizel JV</b>	4,807		
<b>Marmur J</b>	10,254		Waksman/62
<b>Monod J</b>	6,945	APS; Leop.; US	NIH Lecture/64; Nobel/M or P/65
<b>Nomura M</b>	5,100	Am. Acad. Arts/Sci.; Denmark	
<b>Perutz MF</b>	4,734	Am. Acad. Arts/Sci.; APS; Austria; France; Leop.; Netherlands; UK; US	Weizmann/61; Nobel/C/62
<b>Racker E</b>	4,876	Am. Acad. Arts/Sci.; US	NIH Lecture/75; NMS/76
<b>Rich A</b>	6,075	Am. Acad. Arts/Sci.; US	Gairdner/60; Guggenheim/63
<b>Schimke RT</b>	4,816	Am. Acad. Arts/Sci.; US	Pfizer/69
<b>Singer SJ</b>	4,422	Am. Acad. Arts/Sci.; US	Guggenheim/59
<b>Szybalski W</b>	3,753		
<b>Tomkins GM</b>	6,157		
<b>Vinograd J</b>	4,956	Am. Acad. Arts/Sci.; US	Jones/72
<b>Weisbach H</b>	4,112		Pfizer/70
<b><u>Pharmacology</u></b>			
<b>Anden NE</b>	4,475		
<b>Axelrod J</b>	15,769	Am. Acad. Arts/Sci.; US	NIH Lecture/67; Gairdner/67; Nobel/M or P/70; Virchow/71; Sollmann/73

**Figure 1. (cont'd.)**

600	Name	Total Citations 1961-1976	National Academy	Awards & Prizes
	<b>Pharmacology (cont'd.)</b>			
	<b>Brodie BB</b>	6,246	Am. Acad. Arts/Sci.; US; US/Med.	Sollmann/63; Modern Med./64; Lasker/BR/67; NMS/68; Hunter/70
	<b>Carlsson A</b>	4,786	Sweden	Jahre/74
	<b>Conney AH</b>	6,366		
	<b>Corrodi H</b>	4,366		
	<b>Costa E</b>	3,994		
	<b>Curtis DR</b>	3,728	Australia; UK	
	<b>Fuxe K</b>	8,888		
	<b>Gillette JR</b>	3,869		
	<b>Glowinski J</b>	4,502		
	<b>Greengard P</b>	4,916	Am. Acad. Arts/Sci.; US	
	<b>Iversen LL</b>	5,833		
	<b>Kopin IJ</b>	6,694		
	<b>Levy G</b>	3,898		
	<b>Lowry OH</b>	4,867	Am. Acad. Arts/Sci.; US	Borden/66
	<b>Robison GA</b>	4,051		
	<b>Sjoerdsma A</b>	6,479		
	<b>Snyder SH</b>	6,687		Abel/70
	<b>Sutherland EW</b>	11,644	US	Guggenheim/55; Gairdner/69; Sollmann/69;Lasker/BR/70; Nobel/M or P/72; NMS/73
	<b>Vane JR</b>	6,292	UK	Lasker/BR/77

**Cell Biology**

<b>Aaronson SA</b>	3,821		
<b>Allison AC</b>	5,807		
<b>Barnett RJ</b>	5,945		
<b>Brenner S</b>	6,334	Am. Acad. Arts/Sci.; Leop.; US; UK	Lasker/BR/71
<b>Busch H</b>	4,736		
<b>Davis BJ</b>	7,602		
<b>Ernster L</b>	5,884	Sweden	
<b>Farquhar MG</b>	5,149		
<b>Green DE</b>	5,482	Am. Acad. Arts/Sci.; US	Pfizer/46
<b>Green H</b>	4,338	Am. Acad. Arts/Sci.	
<b>Leblond CP</b>	5,165	Am. Acad. Arts/Sci.; Canada; UK	Gairdner/65
<b>McCulloch EA</b>	4,417	Canada	Gairdner/69
<b>Palade GE</b>	11,242	Am. Acad. Arts/Sci.; Belgium/Med.; US; US/Med.	Lasker/BR/66; Gairdner/67; NIH Lecture/67; Nobel/M or P/74
<b>Penman S</b>	7,124	Am. Acad. Arts/Sci.	
<b>Porter KR</b>	4,221	Am. Acad. Arts/Sci.; US	Gairdner/64; Guggenheim/67-8; NMS/76
<b>Sabatini DD</b>	4,649		
<b>Sachs L</b>	5,982	Israel	
<b>Sandberg AA</b>	4,489		
<b>Weissmann G</b>	5,210		Guggenheim/73

**Physiology**

<b>Arimura A</b>	5,278
<b>Brown JJ</b>	3,892

**Figure 1. (cont'd.)**

<b>Name</b>	<b>Total Citations 1961-1976</b>	<b>National Academy</b>	<b>Awards &amp; Prizes</b>
<b><u>Physiology (cont'd.)</u></b>			
<b>Butcher RW</b>	6,875		
<b>Carlson LA</b>	4,002	Sweden	
<b>Eccles JC</b>	4,579	Am. Acad. Arts/Sci.; APS; Australia; Belgium; India; Italy; Leop.; UK; US	Nobel/M or P/63
<b>Fredrickson DS</b>	7,871	Am. Acad. Arts/Sci.; US; US/Med.	McCullum/71; Modern Med./71
<b>Hubel DH</b>	4,474	Am. Acad. Arts/Sci.; Leop.; US	
<b>Lassen NA</b>	4,004		Jahre/77
<b>McCann SM</b>	4,956		Oppenheimer/66
<b>Meltes J</b>	4,665		
<b>Mirsky AE</b>	5,083	APS; US	
<b>Munro HN</b>	4,414	US	Borden/78
<b>Odell WD</b>	3,720		
<b>Page IH</b>	5,161	Am. Acad. Arts/Sci.; Brazil; Sweden; US	Modern Med./56; Lasker/AHA/59; Gairdner/63; Hunter/66; CIBA—Stouffer/70
<b>Park CR</b>	3,763		
<b>Robertson JI</b>	3,705		
<b>Starzl TE</b>	4,901	Am. Acad. Arts/Sci.	Middleton/68; Eppinger/70
<b>Waldmann TA</b>	4,088		
<b>Wiesel TN</b>	4,605	Am. Acad. Arts/Sci.	NIH Lecture/75



**Microbiology & Virology**

<b>Blumberg BS</b>	6,029	US	Eppinger/73; Modern Med./75; Gairdner/75; N
<b>Chanock RM</b>	7,659	US	
<b>Darnell JE</b>	9,091	Am. Acad. Arts/Sci.; US	
<b>Henle G</b>	5,261		
<b>Henle W</b>	4,908	US	
<b>Hilleman MR</b>	4,871	Am. Acad. Arts/Sci.	
<b>Huebner RJ</b>	8,418	US	NIH Lecture/61; NMS/69; Adams/75
<b>Koprowski H</b>	4,419	Am. Acad. Arts/Sci.; US; Yugoslavia	
<b>McCarthy BJ</b>	4,625		Lilly (Microbiology)/68
<b>Melnick JL</b>	7,466		Modern Med./65
<b>Rapp F</b>	3,729		CIBA-GEIGY Drew/77
<b>Rapp HJ</b>	3,762		
<b>Rowe WP</b>	7,183	US	Lilly (Diabetes)/60; NIH Lecture/73
<b>Sever JL</b>	4,599		Borden/57
<b>Spiegelman S</b>	9,712	Am. Acad. Arts/Sci.; Brazil/Med.; Leop.; US	Lasker/BR/74
<b>Strominger JL</b>	5,854	Am. Acad. Arts/Sci.; US; US/Med.	Abel/60; Pfizer/62; Guggenheim/74
<b>Uhr JW</b>	4,567		
<b>Yanofsky C</b>	4,640	Am. Acad. Arts/Sci.; Leop.; US	Lilly (Microbiology)/59; Lasker/BR/71

**Physics & Biophysics**

<b>Anderson PW</b>	3,838	Am. Acad. Arts/Sci.; US	Heineman/75; Nobel/Physics/77; Guthrie/78
<b>Chance B</b>	7,981	Am. Acad. Arts/Sci.; APS; Leop.; Sweden; US	Guggenheim/45, 47; Pfizer/50; Howe/66; Fran Gairdner/72; NMS/74

Figure 1. (cont'd.)

Name	Total Citations 1961-1976	National Academy	Awards & Prizes
<b>Physics &amp; Biophysics (cont'd.)</b>			
<b>Cromer DT</b>	5,587		Lawrence/69
<b>Dalgarno A</b>	3,712	Am. Acad. Arts/Sci.; UK	Hodgkins/78
<b>Fisher ME</b>	5,164	UK	Guggenheim/70; Langmuir/71
<b>Franklin RM</b>	3,917		
<b>Gell-Mann M</b>	4,912	Am. Acad. Arts/Sci.; US; US/Med.	Sloan (Physics)/57-61; Heineman/59; Franklin/67; Nobel/Physics/69; Guggenheim/71
<b>Mandel P</b>	3,881		
<b>McConnell HM</b>	4,309	Am. Acad. Arts/Sci.; US	Pure Chem./62; Howe/68; Langmuir/72
<b>Miledi R</b>	4,111	UK	
<b>Osborn M</b>	6,618		
<b>Rice SA</b>	4,034	Am. Acad. Arts/Sci.; Denmark; US	Sloan (Chem.)/58-62; Guggenheim/59; Pure Chem./63; Baekeland/71
<b>Setlow RB</b>	3,777	Am. Acad. Arts/Sci.; US	
<b>Sinsheimer RL</b>	5,332	Am. Acad. Arts/Sci.; US	NIH Lecture/72
<b>Till JE</b>	5,109	Canada	Gairdner/69
<b>Weber K</b>	8,517		
<b>Weinberg S</b>	7,349	Am. Acad. Arts/Sci.; US	Sloan (Physics)/61-5; Oppenheimer/73; Heineman/77
<b>Wyman J</b>	4,208	Am. Acad. Arts/Sci.; Italy; US	

**Histology & Oncology**

<b>Boyse EA</b>	8,239	Am. Acad. Arts/Sci.; UK	
<b>Carbone PP</b>	4,413		Lasker/CR/72
<b>Falck B</b>	4,088		
<b>Heidelberger C</b>	3,981		National (Am. Cancer Soc.)/74
<b>Hellstrom I</b>	5,219		National (Am. Cancer Soc.)/74
<b>Hellstrom KE</b>	4,985		National (Am. Cancer Soc.)/74
<b>Hokfelt T</b>	4,553		
<b>Klein E</b>	4,650		
<b>Klein G</b>	7,393	Am. Acad. Arts/Sci.; Sweden; US	National (Am. Cancer Soc.)/73; Gairdner/76
<b>Luft JH</b>	8,902		
<b>Moore GE</b>	4,026		Modern Med./62
<b>Old LJ</b>	8,457	Am. Acad. Arts/Sci.; US/Med.	Sloan/62
<b>Pearse AGE</b>	4,415	Leop.	
<b>Todaro GJ</b>	6,936		
<b>Weber G</b>	4,744	UK/Med; US	

**Pathology**

<b>Benditt EP</b>	3,755	US	
<b>Bensch K</b>	3,755		
<b>Dixon FJ</b>	6,590	US	Modern Med./61; Gairdner/69; Lasker/BR/75
<b>Edwards JE</b>	3,828		Modern Med./65

**Figure 1. (cont'd.)**

<b>Name</b>	<b>Total Citations 1961-1976</b>	<b>National Academy</b>	<b>Awards &amp; Prizes</b>
<b><u>Pathology (cont'd.)</u></b>			
<b>Karnovsky MJ</b>	10,114	Am. Acad. Arts/Sci.	
<b>Metcalf D</b>	3,904	Australia	
<b>Miller JFA</b>	4,432	Australia; Belgium/Med.; UK; UK/Med.	Gairdner/66
<b>Novikoff AB</b>	5,101	US	
<b>Popper H</b>	3,795	Am. Acad. Arts/Sci.; Leop.; US	Modern Med./77
<b>Reynolds ES</b>	10,452		
<b>Trump BF</b>	3,973		
<b>Weiss L</b>	4,072		

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**Miscellaneous Medical Disciplines (Cardiology, Hematology, Gastroenterology & Radiology)**

<b>Beutler E</b>	4,537	Am. Acad. Arts/Sci.; US	Gairdner/75
<b>Braunwald E</b>	15,040	Am. Acad. Arts/Sci.; US; US/Med	Able/65; Modern Med./68
<b>Epstein SE</b>	3,948		
<b>Frei E</b>	4,167		Lasker/CR/72
<b>Freireich EJ</b>	3,998		Lasker/CR/72
<b>Gorlin R</b>	5,697	UK/Med.	
<b>Grossman MI</b>	6,096		Modern Med.
<b>Herbert V</b>	5,739	UK/Med.	McCollum/72

<b>Hofmann AF</b>	4,254		<b>Eppinger/76</b>
<b>Isselbacher KJ</b>	5,027	Am. Acad. Arts/Sci.; US	
<b>Kaplan HS</b>	4,187	Am. Acad. Arts/Sci.; US	
<b>Lees RS</b>	5,667		
<b>Levy RI</b>	8,227		
<b>Lieber CS</b>	4,432		<b>McCollum/73; Middleton/77</b>
<b>Mason DT</b>	4,232		
<b>Morrow AG</b>	5,308		
<b>Mustard JF</b>	4,852	Canada	<b>Gardner/67</b>
<b>Ross J</b>	7,207		
<b>Sherlock S</b>	5,421	UK/Med.	
<b>Sonnenblick EH</b>	8,540		
<b>Wagner HN</b>	4,951		
<b>Wallach DFH</b>	3,835		<b>Guggenheim/70</b>

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## Key to Abbreviations in Figure 1

### Academies

Memberships in national academies of sciences are indicated by country abbreviations. Memberships in national academies of medicine are indicated by "country/med."

#### Exceptions:

**Am. Acad. Arts/Sci.** = American Academy of Arts and Sciences

**APS** = American Philosophical Society

**Leop.** = Deutsche Akademie der Naturforscher LEOPOLDINA, which serves as the national academy of sciences for the Federal Republic of Germany, the German Democratic Republic, and the other German-speaking countries.

### Awards and Prizes

<b>Name</b>	<b>Description</b>
<i>Abel</i>	John Jacob Abel Award—given by the American Society for Pharmacology & Experimental Therapeutics—for outstanding research in pharmacology-toxicology.
<i>Adams</i>	Roger Adams Award—in Organic Chemistry—given by the American Chemical Society (ACS) and sponsored by Organic Reactions, Inc. and Organic Synthesis, Inc.—for outstanding contributions to research in organic chemistry.
<i>Baekeland</i>	Baekeland Award—awarded by North Jersey section of ACS and supported by Union Carbide Plastics Company—to recognize accomplishments in pure or industrial chemistry.
<i>Borden</i>	Borden Award in Medical Science—awarded by Association of American Medical Colleges—for faculty members of AAMC schools who have done outstanding research.
<i>Chromatography</i>	Chromatography Award—given by ACS, sponsored by SUPELCO, Inc.—to recognize outstanding contributions to the fields of chromatography.
<i>CIBA-GEIGY Drew</i>	CIBA-GEIGY Drew Award in Biomedical Research—given by CIBA Pharmaceuticals Divisions—to stimulate new concepts for research in the overlapping disciplines of biology, chemistry, and medicine.
<i>CIBA—Stouffer</i>	Stouffer Award—superseded by CIBA Award—given by CIBA Pharmaceuticals Division—for research in high blood pressure and arteriosclerosis.
<i>Cope</i>	Arthur C. Cope Award—given by ACS—for outstanding achievement in the field of organic chemistry, the significance of which has become apparent within the 5 years preceeding the year in which the award will be considered.

## Abbreviations (cont'd.)

<i>Creative Invention</i>	ACS Award for Creative Invention—sponsored by the ACS Committee on Corporation Associates—to recognize individual inventors for successful applications of research in chemistry and/or chemical engineering which contribute to the material prosperity and happiness of people.
<i>Dist. Service</i>	ACS Award for Distinguished Service in the Advancement of Inorganic Chemistry—sponsored by Mallinkrodt, Inc.—for distinguished service in the advancement of inorganic chemistry.
<i>Eppinger</i>	Eppinger Prize—given by Herbert Falck Company—for research in liver pathology.
<i>Franklin</i>	Franklin Medal—given by Franklin Institute—for those workers in physical science or technology, without regard to country, who have done the most to advance a knowledge of physical science or its appreciation.
<i>Gairdner</i>	Gairdner Foundation Award—given by Gairdner Foundation of Toronto—for outstanding medical research.
<i>Guenther</i>	Ernest Guenther Award in the Chemistry of Essential Oils and Related Products—given by ACS and sponsored by Fritzsche, Dodge, and Olcott, Inc.—to recognize and encourage outstanding achievements in analysis, structure elucidation, chemistry synthesis of essential oils, isolates, and related substances.
<i>Guggenheim</i>	Guggenheim Fellowship—given by John Simon Guggenheim Memorial Foundation—grants to foster research and provide for the cause of better international understanding.
<i>Guthrie</i>	Guthrie Medal and Prize—awarded by Institute of Physics, London—for contributions to physics by a physicist of international reputation.
<i>Heineman</i>	Dannie Heineman Prize—awarded jointly by the American Physical Society and the American Institute of Physics—for the outstanding publication in the field of mathematical physics.
<i>Hodgkins</i>	Hodgkins Medal and Prize—given by Smithsonian Institute—for recognition of significant contributions in atmospheric science.
<i>Howe</i>	Harrison Howe Award—given by Rochester section of ACS—to recognize outstanding achievement in chemistry, particularly in opening new areas of knowledge important to the future of chemistry.
<i>Hunter</i>	Oscar B. Hunter Award—given by American Society for Clinical Pharmacology & Therapeutics—for research which advances the science of human pharmacology and therapeutics.

## Abbreviations (cont'd.)

<i>Inorganic Chem.</i>	ACS Award in Inorganic Chemistry—sponsored by Monsanto Company—to recognize and encourage fundamental research in the field of inorganic chemistry.
<i>Jahre</i>	Anders Jahre Endowment for Advancement of Science—to individuals for distinguished work or significant findings in Scandinavian medicine.
<i>Jones</i>	T. Duckett Jones Memorial Award—given by Helen Hay Whitney Foundation—in recognition of outstanding accomplishments in research on connective tissues.
<i>Langmuir</i>	Irving Langmuir Award in Chemical Physics—given by ACS, and American Physical Society. Sponsored by G.E. Foundation—to recognize and encourage outstanding interdisciplinary research in chemistry and physics.
<i>Lasker/BR</i> <i>Lasker/CR</i> <i>Lasker/AHA</i> <i>Lasker/APHA</i>	Albert & Mary Lasker Foundation Awards—sponsored by Lasker Foundation—to recognize those who have made significant contributions to research in the diseases which are the main cause of death and disability. BR = basic research award given by Lasker Foundation. CR = clinical research award given by Lasker Foundation. AHA = basic research award given through American Heart Association. APHA = basic research award given through American Public Health Association.
<i>Lawrence</i>	E.O. Lawrence Memorial Award—given by US Atomic Energy Commission—for recognition of young scientists who have made recent, meritorious contributions to the development, use or control of atomic energy.
<i>Lichwitz</i>	Andre Lichwitz Prize—given by the French National Institute of Health and Medical Research—for research in calcium and phosphorous compounds.
<i>Lilly</i>	Eli Lilly Award—given by Division of Biological Chemistry of ACS—to stimulate fundamental research in biological chemistry.
<i>Lilly (Diabetes)</i>	Eli Lilly Award—given by American Diabetes Association—for outstanding medical research.
<i>Lilly (Microbiology)</i>	Eli Lilly Award—awarded by American Society for Microbiology, American Association of Immunologists and American Society for Experimental Pathology—for outstanding fundamental research in microbiology or immunology research.
<i>McCollum</i>	McCollum Award—established by National Dairy Council, awarded by American Society for Clinical Nutrition—for outstanding research in clinical nutrition.
<i>Middleton</i>	William S. Middleton Award—given by US Veterans Administration—for recognition of outstanding achievements in medical research by clinical investigators who are employed by the Vet. Administration.



## Abbreviations (cont'd.)

<i>Modern Medicine</i>	Modern Medicine Award for Distinguished Achievement—given by Modern Medicine Publications—for recognition of great discoveries and practical applications in medical science.
<i>Morley</i>	Morley Award—given by Cleveland section of ACS—to recognize outstanding contributions to chemistry.
<i>National (Am. Cancer Soc.)</i>	National Award of the American Cancer Society—given by American Cancer Society—the society's highest award—in recognition of outstanding contributions in the field of oncology.
<i>Nichols</i>	William H. Nichols Medal—given by N.Y. section of ACS—for recognition of outstanding contributions to physical organic chemistry.
<i>NIH Lecture</i>	National Institutes of Health Lectureship—given by NIH—for recognition of outstanding scientific accomplishment.
<i>NMS</i>	National Medal of Science—given by National Science Foundation—for recognition of outstanding contributions in the physical, biological, mathematical and engineering sciences. Individuals are nominated by NMS Committee and then selected by President of US.
<i>Nobel/C Nobel/Physics Nobel/M or P</i>	Nobel Prizes given by Nobel Foundation — a) <i>in Chemistry</i> — b) <i>in Physics</i> —presented and administered by the Royal Swedish Academy—given to persons who have made the most important discovery or improvement in chemistry or physics c) <i>in Medicine/Physiology</i> —presented and administered by Karolinska Institute Faculty of Medicine, Stockholm for most important discovery or improvement in the field of medicine/physiology.
<i>Norris</i>	James Flack Norris Award in Physical Organic Chemistry—sponsored by Northeast Section of ACS—for outstanding contribution to physical organic chemistry.
<i>Oppenheimer</i>	Ernst Oppenheimer Award—awarded by Endocrine Society and sponsored by CIBA-GEIGY Corp.—for recognition of meritorious accomplishments in basic clinical endocrinology.
<i>Pauling</i>	Linus Pauling Award—given jointly by Oregon and Puget Sound Sections of ACS—for outstanding contributions to chemistry of a character that has merited national and international recognition.
<i>Petroleum Chem.</i>	ACS Award in Petroleum Chemistry—sponsored by Lubrizol Corp.—to recognize, encourage, and stimulate outstanding achievements in the field of petroleum chemistry in US and Canada.

## Abbreviations (cont'd.)

<i>Pfizer</i>	Pfizer Award—also called ACS Award in Enzyme Chemistry, superseded the Paul-Lewis Labs Award—to recognize outstanding fundamental research in enzyme chemistry.
<i>Pius XI</i>	Pius XI Gold Medal—given by Pontifical Academy of Science—to reward a young scientist having reached international reputation due to his research activity.
<i>Priestley</i>	Priestley Medal—given by ACS—to recognize distinguished services to chemistry in any nation.
<i>Pure Chem.</i>	ACS Award in Pure Chemistry—sponsored by Alpha Chi Sigma Fraternity—to recognize and encourage fundamental research in pure chemistry.
<i>Sloan</i>	Alfred P. Sloan Award for Cancer Research—awarded by Sloan-Kettering Institute—for outstanding work in cancer research.
<i>Sloan (math)</i> <i>Sloan (physics)</i> <i>Sloan (chem.)</i> <i>Sloan (neuroscience)</i>	Sloan Fellowships—awarded by Sloan Foundation of the Sloan-Kettering Institute for Cancer Research—funding for continued research in math, physics, chemistry, and neuroscience.
<i>Sollmann</i>	Torald Sollmann Award—given by American Society for Pharmacology & Experimental Therapeutics—for outstanding pharmacological research.
<i>Synth. Org. Chem.</i>	ACS Award for Creative Work in Synthetic Organic Chemistry—sponsored by the Aldrich Chemical Company, Inc.—to recognize and encourage creative work in synthetic organic chemistry.
<i>Tyler</i>	E.T. Tyler Fertility Award—given by International Fertility Society—for outstanding research in the medical/endocrinology field.
<i>Van Meter</i>	Van Meter Prize Award—given by American Thyroid Association—to acknowledge investigators doing outstanding research in thyroid physiology or pathology.
<i>Virchow</i>	Rudolph Virchow Medal—given by Virchow-Pirquet Medical Society—for outstanding research in medicine and/or pathology.
<i>Waksman</i>	Waksman Award—given by Institute of Microbiology at Rutgers University—for outstanding contributions to microbiological research.
<i>Weizmann</i>	Weizmann Fellowship—awarded by the Weizmann Institute of Science in Israel—to eminent scientists and public figures.
<i>Wolf</i>	Wolf Prize—given by Wolf Foundation in Israel—for outstanding scientific research.