Send Not to Know for Whom the Nobel Tolls: It's Not for Thee

October is Nobel prize season, a time when those with an itch to wear the old dynamite-maker's laurel crown feel their pulses involuntarily quicken at every phone call and mailman's knock. "This is it!" Edmund Wilson cried up to his wife one day when he received a special delivery letter from Stockholm: but it was an appeal for funds from a missionary society.

Wilson's consolation in missing the Nobel prize for literature was that so did writers such as Ibsen, Kafka, Lorca, Proust, and Tolstoy. Science being less a matter of opinion, the three science Nobel committees have had a less erratic batting average. It's too bad that figures such as Mendeleev, Willard Gibbs, and Oswald Avery never made the grade but conversely, the selection committees have committed only a few obvious lulus, such as the award to Johannes Fibiger for what turned out to be a false discovery about the propagation of malignant tumors.

At $165,000 a Nobel prize or even a third-part share in one is not a bad thing to pull down, particularly as it does not seem to be *de rigueur* to spend it on research as the founder had in mind. But if for yet another year the invitation to Stockholm somehow fails to arrive, don't be downhearted. Here are seven reasons for comfort.

First, if you'd gotten the Nobel, your productivity would have suffered. Laureates on average produce six papers a year in the 5 years before being ennobeled, but only about four a year in the quinquennium thereafter. A control set of scientists produced about two papers annually in the same two periods, reports Columbia University sociologist of science Harriet Zuckerman.

Second, there is a fifty-fifty chance that you would have been terribly vexed by the particular aspect of your work cited by the judges, had they chosen you. "Nearly half of the laureates who were interviewed thought that the research earmarked for the Prize was not their best work," Zuckerman reports in the July-August issue of *American Scientist*.

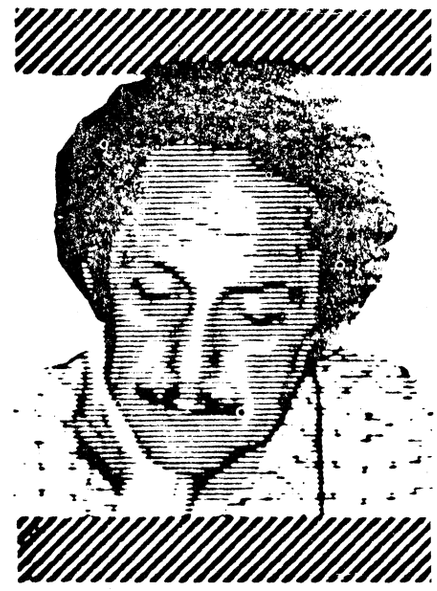
Third, since you have merited the prize for so long, many of your colleagues probably assume you have it anyway. It is widely believed, for example, that Sam Goudsmit and George Uhlenbeck won the prize for their discovery of the electron's spin. "This is all very flattering but it does not supplement my TIAA pension," Goudsmit has written.

Fourth, although your work is of prize quality it may be unprizable through no fault of your own. The Nobel is restricted to three disciplines—physics, chemistry, and medicine—which leaves many subjects out in the cold, and each prize can be split only three ways, which may rule out the discoveries made by four or more collaborators. Cases where priority is disputed may also be avoided by the Nobel committees, since it is not clear that they possess the expertise to sort out tangled claims. Some believe that the design of the prizes no longer conforms to the way science is done. "The great changes that have occurred [since 1901] contribute to the apparently growing conviction among scientists that the prizes have become increasingly parochial and governed by a set of rules no longer adequately meshed with the realities of modern science," Zuckerman notes in *Scientific Elite*,* a study based on interviews with most of the Nobel prizewinners in America.

Fifth, you may just be too young. The potent story of Evariste Galois scribbling out his revolutionary discoveries on the last night of his 20-year-old life may hold a general truth for mathematicians, but it is a myth that scientists do their best work when young. Avery was 67 when he showed that DNA was the hereditary material. Zuckerman has ascertained that the mean age of Nobel laureates when they do their prizewinning work is 36 for physicists, 39 for chemists, and 41 for laureates in medicine and physiology. Add onto that the habitual decade or more which the Nobel committees like to leave between an achievement and their cognizance of it, and it is clear that being over 45 constitutes grounds for hope.

Sixth, the fates may have endowed you with genius but the wrong sociological profile. Genius, no doubt, is randomly distributed among classes and nations. Yet even in a system as eminently meritocratic as American science the ultra-elite, Zuckerman concludes, "continue to come largely from the middle and upper middle strata. Whatever the ultimate explanation of this fact—the interplay between genetic and social components in the process is far from having being worked out—one aspect of the fact itself is clear: the social origins of Nobel laureates remain highly concentrated in families that can provide their offspring with a head start in access to system-recognized opportunities."

Seventh, you may not have the right patrons, or those you have may not be rooting hard enough for you. Zuckerman has documented an intriguing set of master-apprentice lineages among Nobelists. J. J. Thomson had six Nobelists among his pupils, one of whom, Rutherford, saw 11 Nobel prizes come to his apprentices, one of whom, Niels Bohr, had seven laureates among his pupils and so forth. More than half of the 92 laureates who did their prizewinning work in the United States were apprenticed in one form or another to older Nobelists. The apprentices were not the mere creations of their masters; many sought out their masters before the Nobel prize committees did. Between two equally deserving researchers, could an advantage lie with the one who has a Nobelist master? Nobelists get the chance to nominate candidates each year, which could give their students an edge at least in reaching the committees' attention, and some laureates, such as Rutherford, have lobbied vigorously for their apprentices. Politicking for or against worthy candidates is a "potentially effective strategy," but only the members of No-



Eugene Garfield

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bel committees can know if such campaigns are effective in practice, Zuckerman observes.

No system of recognizing merit is perfect, as witnessed by the fact that two of the most elaborate mechanisms for doing so, those of the National Academy of Sciences and the Nobel committees, often fail to select the same people. The Academy, to be sure, has a harder problem with marginal choices: it is aiming for the cream while the Nobel committees have the easier target of finding the *crème de la crème*. Even so, the Academy has managed to identify only four-fifths of the American laureates under its purview before they went to Stockholm, an oversight that some observers attribute to local politics.

A far more objective system of recognizing scientific influence, although it may have other defects, is that of citation analysis. Resting on the seemingly simpleminded notion of counting the number of times an author's papers are cited by others, citation analysis nevertheless produces some remarkably evocative lists of names. Last year Eugene Garfield, founder of the Institute for Scientific Information, published a list of the 250 most cited authors. The list had a major systematic defect, in that it credited a citation only to the first listed author of a paper. Nevertheless, out of the teeming sea of about one million publishing scientists, Garfield's list of the 250 most-cited authors netted no less than 42 of the 320 people who had ever won the Nobel prize, and 110 members of the National Academy of Sciences.

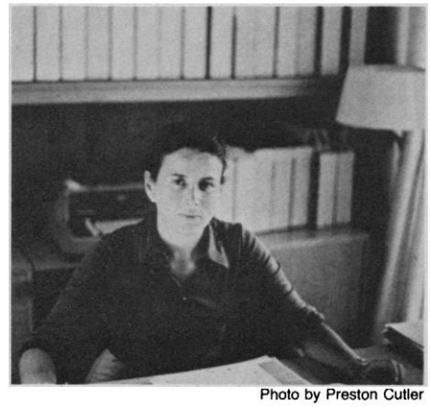

Photo by Preston Cutler

Harriet Zuckerman

Citedness is a quality that requires great care in interpretation. A researcher with few citations may just come from a small field, like astronomy or botany, while a scientist who is heavily cited may only have developed a refinement of a widely used method. Nevertheless, citedness does correlate strongly with conventional measures of distinction, at least in the aggregate.

Garfield recently set his computer running day and night for a month to produce a citation list that would credit all authors of the paper cited, not just the first. The new compilation, containing the 300 most-cited authors, also differs from the old in that it samples a more recent corpus of literature; it is based on citations only to journal articles published between 1961 and 1975, whereas the 250 list included citations to papers published earlier.

Perhaps in part for this reason, the 300 list picks up only 26 Nobelists, although it captures slightly more—115—members of the National Academy of Sciences. Earlier lists have contained the names of several laureates-to-be and the 300 list may do likewise. Garfield has divided the list into 13 specialties, four of which are shown in accompanying table.

Should prize committees test the validity of their own selections against Garfield's objectively derived list? "What I am saying is that no one on that list necessarily deserves a prize, or to be elected to an academy, but everyone certainly deserves at least to be considered," Garfield suggests.

Those not on Garfield's chosen 300 should take solace from the minuteness of his sample which, after all, contains fewer names than the entire Nobel roster. Garfield promises to extend his list in the near future.

As for prize, here are such tips as could be gleaned from Zuckerman. One reliable way of getting in line for a prize, she believes, is to have someone write you a good nomination. The Nobel prize committees request nominations from about a thousand people for each prize. Hard work, and a lot more than listing a candidate's published papers, are required if the nomination is to make an impression.

Among American scientists it is widely believed that decorous behavior both in one's private and public life are a sine qua non of not forfeiting the staid Swedes' approval. Zuckerman does not know if the belief is well founded or not, but one thing that is terribly important is "not to seem to be pushing" should a Nobel committee delegation come touring your laboratory.—NICHOLAS WADE

Author (birthdate)	Total citations	Total papers	Author (birthdate)	Total citations	Total papers	Author (birthdate)	Total citations	Total papers	Author (birthdate)	Total citations	Total papers
Molecular biology			Endocrinology			Cell biology			Physiology		
Baltimore, D. (1938)	5,270	111	Aurbach, G.D. (1927)	3,887	100	Aaronson, S.A. (1942)	3,821	113	Arimura, A. (1923)	5,278	210
Berg, P. (1926)	5,307	111	Bartter, F.C. (1914)	3,736	176	Allison, A.C. (1925)	5,807	187	Brown, J.J. (1928)	3,892	148
Bonner, J. (1910)	7,096	121	Berson, S.A. (1918-72)	5,474	64	Barrnett, R.J. (1920)	5,945	100	Butcher, R.W. (1930)	6,875	48
Changeux, J.P. (1936)	6,208	109	Conn, J.W. (1907)	3,938	108	Brenner, S. (1927)	6,334	78	Carlson, L.A. (1928)	4,002	146
Gros, F. (1925)	3,712	104	Daughaday, W.H. (1918)	3,731	101	Busch, H. (1923)	4,736	256	Eccles, J.C. (1903)	4,579	108
Hurwitz, J. (1928)	4,873	102	Greenwood, F.C. (1927)	5,572	42	Davis, B.J. (1932)	7,602	13	Fredrickson, D.S. (1924)	7,871	128
Jacob, F. (1920)	10,383	115	Guillemin, R. (1924)	4,200	128	Ernster, L. (1920)	5,884	120	Hubel, D.H. (1926)	4,474	35
Leder, P. (1934)	3,892	70	Hunter, W.M. (1929)	5,214	64	Farquhar, M.G. (1928)	5,149	48	Lassen, N.A. (1926)	4,004	121
Maizel, J.V. (1934)	4,807	50	Kastin, A.J. (1934)	3,852	166	Green, D.E. (1910)	5,482	161	McCann, S.M. (1925)	4,956	176
Marmur, J. (1926)	10,254	87	Kipnis, D.M. (1927)	4,805	111	Green, H. (1925)	4,338	89	Meites, J. (1913)	4,665	183
Monod, J. (1910-76)	6,945	33	Laragh, J.H. (1924)	4,763	134	Leblond, C.P. (1910)	5,165	90	Mirsky, A.E. (1900-74)	5,083	61
Nomura, M. (1927)	5,100	147	Lever, A.F. (1929)	3,884	127	McCulloch, E.A. (1926)	4,417	82	Munro, H.N. (1915)	4,414	143
Perutz, M.F. (1914)	4,734	61	Liddle, G.W. (1921)	4,483	105	Palade, G.E. (1912)	11,242	104	Odell, W.D. (1929)	3,720	109
Racker, E. (1913)	4,876	141	Lipsett, M.B. (1921)	3,912	112	Penman, S. (1930)	7,124	101	Page, I.H. (1901)	5,161	178
Rich, A. (1924)	6,075	168	Midgley, A.R. (1933)	5,108	101	Porter, K.R. (1912)	4,221	65	Park, C.R. (1916)	3,763	72
Schimke, R.T. (1932)	4,816	76	Pastan, I. (1931)	5,997	145	Sabatini, D.D. (1931)	4,649	23	Robertson, J.I. (1928)	3,705	135
Singer, S.J. (1924)	4,422	83	Potts, J.T. (1932)	4,148	148	Sachs, L. (1924)	5,982	176	Starzl, T.E. (1926)	4,901	190
Szybalski, W. (1921)	3,753	84	Rasmussen, H. (1925)	4,489	133	Sandberg, A.A. (1921)	4,489	171	Waldmann, T.A. (1930)	4,088	111
Tomkins, G.M. (1926-75)	6,157	135	Roth, J. (1934)	5,647	159	Weissmann, G. (1930)	5,210	164	Wiesel, T.N. (1924)	4,605	34
Vinograd, J. (1913-76)	4,956	75	Schally, A.V. (1926)	10,386	430						
Weissbach, H. (1932)	4,112	163	Unger, R.H. (1924)	4,623	124						
			Wilson, J.D. (1932)	4,140	147						
			Wurtman, R.J. (1936)	6,170	223						
			Yalow, R.S. (1921)	5,595	82						

MOST CITED AUTHORS. The names above are taken from the list of the 300 authors whose articles, published between 1961 and 1976, were cited in aggregate more than 3700 times. The list was compiled by Eugene Garfield of the Institute for Scientific Information and published in *Current Contents* (10 July 1978). Garfield divided the 300 authors into 13 specialty groups, of which four are shown above. Previous lists have been based on citations to only the first author of a paper; the new list credits all authors of the paper to which citations are made.