

# Research Papers: Who's Uncited Now?

Scientists who like to one-up their colleagues in other disciplines can now do so in a new way. Last month, David Pendlebury of the Philadelphia-based Institute for Scientific Information came up with the startling conclusion that 55% of the papers published in journals covered by ISI's citation database did not receive a single citation in the 5 years after they were published (*Science*, 7 December, p. 1331). Now Pendlebury has extended his analysis by looking at how the "uncitedness rate" varies among scientific disciplines. Neither engineering researchers nor social scientists are likely to be happy with the results.

In this latest study, Pendlebury looked only at papers published in 1984 and the citations they accumulated through 1988. (ISI's database covers the top 10% of all scientific journals published worldwide.) When he grouped the data into broad categories, Pendlebury found that physics and chemistry had the lowest rates of uncitedness—36.7% and 38.8% of the papers published in those disciplines, respectively, were not cited at all in the 4 years following publication. Close behind were the biological sciences (41.3%), the geosciences (43.6%), and medicine (46.4%). These subjects all fall below the uncitedness average of 47.4% for the so-called hard sciences—all scientific disciplines including engineering and medi-

cine but excluding the social sciences. (Pendlebury had first reported the hard science average as 40%; the later number, he says, is "more systematically generated.")

The figure for engineering, however, is above that average—well above it, in fact. More than 72% of all papers published in engineering had no citations at all. Pendlebury says he is at a loss to explain this anomaly, although he suggests that "sociological factors" might influence the way engineering researchers cite each other's work.

Within these broad categories, there is a wide variation among individual sub-disciplines. Atomic, molecular, and chemical physics, a field in which only 9.2% of articles go uncited, took top honors. Next was virology, with an uncitedness rate of 14.0%. In rapid succession came particle and field physics (16.7%), inorganic and nuclear chemistry (17.0%), nuclear physics (17.3%), fluid and plasma physics (18.2%), organic chemistry (18.6%), condensed matter physics (19.1%), and biochemistry and molecular biology (19.4%). Among fields that didn't fare so well: electrochemistry (64.6%), developmental biology (61.5%), optics (49.1%), and acoustics (40.1%).

As for engineering, every field showed high

rates of uncitedness, with civil engineering highest at 78.0%. Next came mechanical (76.8%), aerospace (76.8%), electrical (66.2%), chemical (65.8%), and biomedical (59.1%) engineering. A handful of other applied fields showed similarly high rates: construction and building technology (84.2%), energy and fuels (80.3%), applied chemistry (78.0%), materials science-paper and wood (77.6%), metallurgy and mining (75.2%), and materials science-ceramics (72.8%).

Papers published in the social sciences fared

no better. Political science (90.1%), international relations (82.8%), language and linguistics (79.8%), anthropology (79.5%), sociology (77.4%), business (76.6%), and archeology (76.4%) all exceeded the social science average of 74.7%. Social psychology articles, on the

other hand, seem to be relatively highly cited; only 35.4% received no citations at all.

But scientists, social and otherwise, can take heart. Within the arts and humanities (where, admittedly, citation is not so firmly entrenched), uncitedness figures hit the ceiling. Consider, for example, theater (99.9%), American literature (99.8%), architecture (99.6%), and religion (98.2%). And, in one curious anomaly, articles in history (95.5%) and philosophy (92.1%) were relatively uncited, while those in history and philosophy of science (29.2%) were not.

■ DAVID P. HAMILTON

PROPORTION OF PAPERS WITH NO CITATIONS, BY FIELD

ARTS & HUMANITIES	98.0
SOCIAL SCIENCES	74.7
ENGINEERING	72.3
MULTIDISCIPLINARY	58.2
TECHNOLOGY	56.2
MATHEMATICS	55.5
MEDICINE	46.4
GEOSCIENCES	43.6
BIOLOGICAL SCIENCES	41.3
CHEMISTRY	38.8
PHYSICS	36.7

## UNCITEDNESS INDEX

### SUBDISCIPLINES WITH FEWEST UNCITED PAPERS:

ATOMIC, MOLECULAR, AND CHEMICAL PHYSICS	9.2*
VIROLOGY	14.0
PARTICLE AND FIELD PHYSICS	16.7
INORGANIC AND NUCLEAR CHEMISTRY	17.0
NUCLEAR PHYSICS	17.3
FLUID AND PLASMA PHYSICS	18.2
ORGANIC CHEMISTRY	18.6
CONDENSED MATTER PHYSICS	19.1
BIOCHEMISTRY AND MOLECULAR BIOLOGY	19.4

### SUBDISCIPLINES WITH MOST UNCITED PAPERS:

ENGINEERING-GENERAL	86.9
CONSTRUCTION AND BUILDING TECHNOLOGY	84.2
ENERGY AND FUELS	80.3
CIVIL ENGINEERING	78.0
APPLIED CHEMISTRY	78.0
MATERIALS SCIENCE-PAPER AND WOOD	77.6
AEROSPACE ENGINEERING	76.8
MECHANICAL ENGINEERING	76.8
METALLURGY AND MINING	75.2
MATERIALS SCIENCE-CERAMICS	72.8
MATERIAL SCIENCE-GENERAL	66.4
ELECTRICAL ENGINEERING	66.2

\*Fraction of papers with no citations

## Leroy Hood Says No

After an "agonizing" decision, Leroy Hood has turned down an offer of a joint appointment as head of the Human Genome Center at Lawrence Berkeley Laboratory and as a professor at the University of California at Berkeley. His decision ends months of speculation that he would leave Caltech, where he has been for 30 years (*Science*, 9 November, p. 757).

"It was as close as it could have been. I almost went, no question about it," says Hood. In the end, it was "little, nonrational things" that swayed him, "like where I want to be in 5 years." Hood says the fate of his Science and Technology Center at Caltech, funded by the National Science Foundation at \$3.5 million a year, was not an "enormous"

factor, as he was convinced NSF would have let him move it to Berkeley. He would, however, have faced a bruising fight with Caltech, which would have resisted the move.

Hood's unexpected decision leaves LBL without a leader for its genome center, a slot that has been empty since Charles Cantor stepped down in September. Morale at the center, which has lacked a clear focus almost since its inception, had reportedly soared with the news that Hood might be coming. Hood, meanwhile, may turn out to be the lab's best recruiter. "It's an incredible opportunity for someone who wants to take advantage of the resources LBL has to offer and the marvelous biology department at UC," he says.

■ LESLIE ROBERTS