Current Comments

The 300 Most-Cited Authors, 1961-1976, Including Co-Authors. 3A. Their Most- Cited Papers — Introduction and Journal Analysis

Number 47 November 20, 1978

In earlier essays on the 300 most-cited authors we explained how the names were selected.[1] We also showed the relationship between citedness, awards, and academy memberships.[2] In this and the next two editorials, we will list the authors' most-cited publications. Approximately 100 articles will be listed in each essay.

In earlier portions of this study we arranged authors' names by their disciplines. However, we soon realized that it would be absurd to list publications by the authors' disciplines. Many of the authors work on interdisciplinary research. Thus, publications are often in fields other than those indicated by the authors' disciplines. For example, the author may be a biochemist, but his or her most-cited paper could be in physiology, endocrinology, etc. Consequently, we have categorized the papers by subject matter rather than the authors' discipline.

Categorizing papers in this way may be quite arbitrary, too. For instance, G. Klein's article on tumor antigens could be categorized under oncology or immunology. In cases like this, we used the journal in which the article was published and/or the author's organization to make a judgment. Nevertheless, some authors may feel that their papers have been misclassified.

The group of papers presented this week cover the fields of biochemistry, endocrinology, pharmacology, and physiology.

For each discipline, the papers are listed alphabetically by the most-cited author whose name is shown in bold face. Following the bibliographic data for each article is the affiliation of the author at the time the paper was published. Some of the papers on the list have been described in the *Citation Classics* section of *Current Contents*® . This is noted below the affiliation.

As we were compiling this list we discovered that several pairs of authors shared the same most-cited publication. In these cases, we have shown for the second author his or her second most-cited publication. A "see" cross-reference directs the reader to the most-cited article.

In this first portion of the list, the following authors shared the same most-cited publication: D. S. Fredrickson and R. S. Lees, O.H. Lowry and J. V. Passoneau, C. N. Hales and P. J. Randle, A. Sjoerdsma and S. Udenfriend, F. C. Greenwood

Figure 1: Part 1 of the list of the 300 most-cited authors' most-cited publications, 1961-1976. Publications are listed by discipline, then alphabetically by most-cited author in bold-face type. Authors' affiliations at the time the papers were written are included in parentheses.

Total Citations 1961-1976	Bibliographic Data

BIOCHEMISTRY

495 **Allfrey V G,** Littau V C & Mirsky A E. On the role of histones in regulating ribonucleic acid synthesis in the cell nucleus.
Proc. Nat. Acad. Sci. US. 49:414-21, 1963.
(Rockefeller Inst. (University), New York, NY 10021)

3,024 Martin R G & **Ames B N.** A method of determining the sedimentation behavior of enzymes: application to protein mixtures.
J. Biol. Chem. 236:1372-9, 1961. (NIH, NIAMDD, Bethesda, MD 20014)

2,321 **Andrews P.** Estimation of the molecular weights of proteins by sephadex gel-filtration. *Biochem. J.* 91:222-33, 1964.
(Nat. Inst. Res. Dairying, Shinfield, Reading RG2 9AT, Berkshire, England)

576 Cuatrecasas P, Wilchek M & **Anfinsen C B.** Selective enzyme purification by affinity chromatography.
Proc. Nat. Acad. Sci. US. 61:636-43, 1968.
(NIH, NIAMDD, Lab. Chem. Biol. Bethesda, MD 20014)

336 Matsuo H, Baba Y, Nair R M G, **Arimura A** & Schally A V. Structure of the porcine LH- and FSH-releasing hormone. I. The proposed amino acid sequence. *Biochem. Biophys. Res. Commun.* 43:1334-9, 1971.
(VA Hospital, New Orleans, LA 70118)

187 Steele W J, Okamura N & **Busch H.** Effects of thioacetamide on the composition and biosynthesis of nucleolar and nuclear ribonucleic acid in rat liver. *J. Biol. Chem.* 240:1742-9, 1965.
(Baylor Univ. Coll. Med., Dept. Pharmacol., Houston, TX 77025)

942 **Cleland W W.** The kinetics of enzyme-catalyzed reactions with two or more substrates or products. 1. Nomenclature and rate equations.
Biochim. Biophys. Acta 67:104-37, 1963.
(Univ. Wisconsin, Coll. Agriculture, Madison, WI 53706)
[Citation Classic. *Current Contents* (28):8, 11 July 1977.]

923 **Cuatrecasas P.** Protein purification by affinity chromatography. Derivations of agarose and polyacrylamide beads. *J. Biol. Chem.* 245:3059-65, 1970.
(NIH, NIAMDD, Lab. Chem. Biol., Bethesda, MD 20014)

259 **Blunt J W, DeLuca H F** & Schnoes H K. 25-hydroxycholecalciferol. A biologically active metabolite of vitamin D_3.
Biochemistry USA 7:3317-22, 1968. (Univ. Wisconsin, Dept. Biochem., Madison, WI 53706)

1,042 Marmur J & **Doty P.** Determination of the base composition of deoxyribonucleic acid from its thermal denaturation temperature.
J. Mol. Biol. 5:109-18, 1962. (Harvard Univ., Dept. Chem., Cambridge, MA 02138)

415 **Edelman G M** & Poulik M D. Studies on structural units of the γ-globulins.
J. Exp. Med. 113:861-84, 1961. (Rockefeller Inst. (University) New York, NY 10021)

433 Greenfield N & **Fasman G D.** Computed circular dichroism spectra for the evaluation of protein conformation.
Biochemistry USA 8:4108-26, 1969.
(Brandeis Univ., Grad. Dept. Biochem., Waltham, MA 02154)

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Biochim. Biophys. Acta 70:554-82, 1963.
(Univ. Wisconsin, Inst. Enzyme Res., Madison, WI 53706)

Widespread occurrence of adenosine 3', 5'-monophosphate-dependent protein kinase in various tissues and phyla of the animal kingdom. *Proc. Nat. Acad. Sci. US.* 64:1349-55, 1969.
(Yale Univ. Sch. Med., Dept. Pharmacol., New Haven, CT 06510)

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(Univ. Cambridge, Dept. Biochem., Cambridge CB2 2QR, England)

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(Dept. Biochem., King's College, London W.C.2, England)

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(Washington Univ. Sch. Med., Metabolism Div. St. Louis, MO 63110)

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(Stanford Univ. Sch. Med., Dept. Biochem., Palo Alto, CA 94305)

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(Brookhaven Nat. Laboratory, Biol. Dept., Upton, NY, 11973)

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(Univ. Oxford, Med. Res. Council Unit, Dept. Biochem., Oxford, England)

263 Shrago E, **Lardy H A,** Nordlie R C & Foster D O. Metabolic and hormonal control of phosphoenolpyruvate carboxykinase and malic enzyme in rat liver. *J. Biol. Chem.* 238:3188-92, 1963.
(Univ. Wisconsin, Inst. Enzyme Res., Madison, WI 53706)

471 **Lees R S** & Hatch F T. Sharper separation of lipoprotein species by paper electrophoresis in albumin-containing buffer. *J. Lab. Clin. Med.* 61:518-28, 1963.
(Mass. Gen. Hosp. Med. Services, Arteriosclerosis Unit, Boston, MA 02114)
(See Fredrickson D S in Physiology)

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(St. Mary's Hospital, Med. Unit, London W.C. 2, England) (See Brown J J in Physiology)

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489 Nathans D & **Lipmann F.** Amino acid transfer from aminoacyl-ribonucleic acids to proteins on ribosomes of *Escherichia coli*. *Proc. Nat. Acad. Sci. US.* 47:497-504, 1961.
(Rockefeller Inst. (University), New York, NY 10021)

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(Univ. Cambridge, Dept. Biochem., Cambridge, England) (See Hales C N)

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(MIT, Dept. Biol., Cambridge, MA 02139)
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(Merck, Sharp & Dohme Res. Lab., Rahway, NJ 07065)

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(Vanderbilt Univ., Dept. Pharmacol. & Physiol., Nashville, TN 37235)

979 **Rodbell M.** Metabolism of isolated fat cells. 1. Effects of hormones on glucose metabolism and lipolysis. *J. Biol. Chem.* 239:375-80, 1964.
(NIH, NIAMDD, Lab. Nutrit. & Endocrin., Bethesda, MD 20014)

318 **Roseman S.** The synthesis of complex carbohydrates by multiglycosyl-transferase systems and their potential function in intercellular adhesion. *Chem. Phys. Lipids* 5:270-97, 1970. (Johns Hopkins Univ., Dept. Biol., Baltimore, MD 21218)

465 Roeder R G & **Rutter W J.** Multiple forms of DNA-dependent RNA polymerase in eukaryotic organisms. *Nature* 224:234-7, 1969.
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J. Biol. Chem. 240:322-31, 1965. (NIH, NIAMDD, Bethesda, MD 20014)

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(NIH, NIAMDD, Sect. Human Biochem. Genet., Bethesda, MD 20014)

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(UCLA Sch. Med., Dept. Biol. Chem., Los Angeles, CA 90024)

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(Duke Univ. Med. Ctr., Dept. Biochem., Durham, NC 27706)

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Biochem. J. 95:731-41, 1965. (Univ. California, Dept. Food Sci. & Tech., Davis, CA 95616)

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Biochemistry USA 10:2606-17, 1971.(Mass. Gen. Hosp., Biochem Res. Lab., Boston, MA 02114)

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J. Biol. Chem. 244:4406-12, 1969. (Harvard Univ., Biol. Labs., Cambridge, MA 02138)

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Figure 1 (continued)

BIOCHEMISTRY (continued)

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(NIH, NIAMDD, Chem. Lab., Bethesda, MD 20014)

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(NIH, NIMH, Lab. Clin. Sci. Bethesda, MD 20014)

ENDOCRINOLOGY

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(NIH, NHLI, Clin. Endocrinol. Branch, Bethesda, MD 20014)

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(Univ. Michigan, Dept. Internal Med., Ann Arbor, MI 48104)

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(Washington Univ. Sch. Med., St. Louis, MO 63110)

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(Imperial Cancer Res. Fund, Div. Chem. Biochem., London W.C.2, England)
[Citation Classics, *Current Contents* (15):12, 11 Ap 1977.]

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(Salk Inst. Neuroendocrin. Lab., La Jolla, CA 92037)

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(Mt. Sinai Hospital, Dept. Hematol., New York, NY 10029)

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(Imperial Cancer Res. Fund, Div. Chem. & Biochem., London W.C.2 England) (See Greenwood F C

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(Vanderbilt Univ. Sch. Med., Dept. Med., Nashville, TN 37203)

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Proc. Soc. Exp. Biol. Med. 128:807-18, 1968.
(Univ. Michigan Med. Sch., Dept. Pathol., Ann Arbor, MI 48104)

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Proc. Nat. Acad. Sci. US. 49:613-7, 1963. (NIH, NHLI, Bethesda, MD 20014)

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(VA Hospital, Radioisotope Service, New York, NY 10068)

201 **Schally A V,** Arimura A, Baba Y, Nair R M G, Matsuo H, Redding T W, Debeljuk L & White W F. Isolation and properties of the FSH and LH-releasing hormone. *Biochem. Biophys. Res. Commun.* 43:393-9, 1971.
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PHARMACOLOGY

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Figure 1 (continued)

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(Karolinska Inst., Dept. Histol, 104 01 Stockholm, Sweden) (See Anden N E in Physiology)

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and A. Arimura, N. E. Anden and K. Fuxe, J. Glowinski and L. L. Iversen, R. W. Butcher and E.W. Sutherland, D. H. Hubel and T. N. Wiesel. J. Roth, R. Yalow, and S. Berson — three authors on the list—shared one most-cited article. J. J. Brown, A. F. Lever, and J.I.S. Robertson also shared a single most-cited paper.

In eight of these twelve cases, both authors also appeared on the second most-cited paper. This is not surprising since the research team is a common phenomenon. We expected the "all-author" data to include members of teams, since each author was given equal treatment just as though he or she had been the first author.

However, we sometimes ran into trouble assigning each of our 300 authors a unique paper. For example, Arimura and Schally shared a most-cited paper. But Schally's second most-cited paper was the *most*-cited article by another author on the list, A. J. Kastin. So we had to go to Schally's third most-cited paper. The purpose of all this was to have an equal number of highly cited papers and authors.

As you look over the list, you will observe a considerable "overlap" in authorship. For example, P. Cuatrecasas appears in the list for his paper on protein purification by affinity chromatography. But he was co-author on C. B. Anfinsen's most-cited paper. Many of these 300 most-cited authors have worked same most-cited article listed.

Since this is the first of three in stallments it may be well to discus the list as a whole.

All 300 publications on the lis are journal articles. This is becaus the data bank used for this stud was the source material covered b the *Science Citation Index®* 1961-1976. From 1961-1976 th *SCI®* indexed only journal litera ture. In most cases, the most-cite journal article shown is in fact th author's most-cited publicatio from the time period. But in som instances an author's book (not o the list) may be more highly cite than the article shown. For exam ple, C. Tanford's most-cited articl received 354 citations. But his 196 book, *Physical chemistry of macro molecules,* received 1,283 citation during the same time period. Sinc it was not a source publication i the 1961 *SCI,* it does not appear o the list.

Some readers may be surprise by the relatively low number c citations certain papers receivec After all, on the average these 30 authors were each cited 5,00 times. These 1,500,000 citation constitute a substantial percentag of the entire file. Yet many items o this list received "only" a few hur dred citations. The reason is tha most of the 300 authors published large number of papers during th time period studied. For example F. Sorm's most-cited publicatio received only 86 citations. Bu

Smith published 309 papers, 492 as first author, 17 as co-author.

Since the data bank for the study included only information on papers published between 1961-1976, it is not surprising that most of the 300 articles are from the early '60s. In fact, over half the articles were published prior to 1966, three-quarters before 1969. Next year, we plan to publish a list of the most-cited authors, 1965-1978. We can expect to see some significant changes. If certain fields were under-represented in our files from 1961 to 1964 then their *relative* status should improve significantly.

The 300 articles appeared in 86 journals. Five journals accounted for more than one-third of the articles, ten for about half. These journals appear in Figure 2. They emphasize the bio-medical bias of the list. This bias can be corrected only by compiling lists based on categories.

The average number of authors per paper is three. This is *very* significant since our methodology gives equal weight to all co-authors. Only 35 papers out of the 300 are authored by one person. Figure 3 shows the number of authors per paper. On a little over half the papers the most-cited author was *not* the first author. This emphasizes the need to take into account all-author citations data when doing evaluations.

Figure 2: The 10 journals which accounted for about half the most-cited articles.

Proceedings of the National Academy of Sciences - USA	26
Journal of Biological Chemistry	23
Journal of the American Chemical Society	23
Science	16
Journal of Experimental Medicine	15
Nature	11
Journal of Cell Biology	9
Journal of Molecular Biology	9
New England Journal of Medicine	9
Journal of Clinical Investigation	8

Figure 3: The number of authors on most-cited papers.

Number of Authors	Number of Papers
1	35
2	110
3	78
4	42
5	19
6	8
7	2
8	3
9	1
10	1
11	1

It is of interest to note that one of the 1978 Nobelists in physiology or medicine, D. Nathans, appears as the primary author on F. Lipmann's most-cited paper in the biochemistry section. If we had extended our all-author list to the first *500* authors, Nathans and another winner in physiology of medicine, H. O. Smith, would have appeared on the list. If we extended our list to the top 700 authors, P. Mitchell, the 1978 Nobelist in chemistry, would have also been included. (Mitchell did appear on our earlier list of the 250 most-cited primary authors.[3]) Again, it is apparent that

in the future we must publish lists of at least the 1,000 most-cited authors.

The choice of two of the 1978 winners in physics — A. Penzias and R. Wilson — underlines the need which I have mentioned before for lists of the most-cited authors in various disciplines. Penzias and Wilson do not appear even among the top 1,000. This is not expected because the field of radio astronomy is relatively small. We checked our "cluster" data for this field and verified that their respective citation counts of 1235 and 1412 are quite high.

W. Arber, who shared the prize in medicine, and P. L. Kapitsa, who shared the physics award, probably do not appear on our list for another reason. Much of Arber's work was done in the late 1950s; Kapitsa's in the 1930s. Since our data are based on articles published since 1961, citations to their earlier work were not counted.

In the second part of this study we will list 100 most-cited papers in immunology, molecular biology, cell biology, oncology, histology, pathology, as well as physics and biophysics.

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