

Current Comments®

EUGENE GARFIELD

INSTITUTE FOR SCIENTIFIC INFORMATION®
3501 MARKET ST., PHILADELPHIA, PA 19104

The Articles Most Cited in the *SCI* from
1961 to 1982. 8. Ninety-Eight More Classic
Papers from Unimolecular Reaction
Velocities to Natural Opiates: The
Changing Frontiers of Science

Number 33

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Over the last year we have used the *Science Citation Index*® (*SCI*®) to identify landmark papers. So far, we have presented seven lists, each containing 100 highly cited papers.¹ These were chosen solely on the basis of their citation counts in the *SCI* from 1961 to 1982. This essay discusses the eighth group of *Citation Classics*® identified by this method. Bibliographic information and citation counts are provided in Table 1.

Although the previous lists in this continuing series included exactly 100 papers, there are just 98 articles cited from 790 to 740 times in this study. Our next listing will include the 102 papers cited from 739 to 697 times. However, there is no particular significance attributed to the precise counts. It is simply an arbitrary method of discussing papers in manageable groups. That is why we list them alphabetically by first author.

The 98 papers exhibit many of the same characteristics already discussed in the series. Generally, articles in the life sciences and methods papers comprise the majority—67 and 40 percent, respectively. In addition, the journals that published at least two of the articles (see Table 2) have not changed significantly from the journals listed in Parts 1 through 7 of the series. However, the *Journal of the American Chemical Society* (*JACS*) reappears with four papers, after being conspicuously absent from the seventh group.² By contrast, some

journals are represented for the first time. A paper published in the *Japanese Circulation Journal* by K. Okamoto and A. Kyuzo, Kyoto University School of Medicine, Japan, describes the development of a strain of hypertensive rats. The *Canadian Medical Association Journal* published R. Boucher's 1964 methods paper on measuring human plasma angiotensin and renin activity levels.

Nobel Prize winners figure prominently among the authors as they have before. Eleven authors (G.M. Edelman [1972], M. Gell-Mann [1969], B. Katz [1970], H.A. Krebs [1953], S. Moore [1972], B. Richter [1976], B. Samuelsson [1982], W. Shockley [1956], W.H. Stein [1972], S. Weinberg [1979], and K.G. Wilson [1982]) have received Nobel awards—eight of them after 1969. Generally, scientists of *Nobel class*³ are cited significantly more often than average, but there are important exceptions. And one highly cited paper does not necessarily make the authors members of this designated group.

The publication-year breakdown for the 98 papers (Table 3) has also not changed much from that reported for the seven previous lists. Over three-quarters of the papers were published in the 20 years from 1955 to 1974. "Only" 17 of the articles appeared earlier. These chronologic dynamics need a separate and detailed analysis. Citation frequen-

Table 1: The eighth group of articles most cited in the *SCJ*[®], 1961-1982, in alphabetic order by first author. A=1961-1982 citations; 1983 citations appear in parentheses. B=bibliographic data. An asterisk (*) indicates that the paper was the subject of a *Citation Classic*[®] commentary. The issue and year follow the bibliographic reference.

| A | B |
|-----------|--|
| 744 (169) | Alwine J C, Kemp D J & Stark G R. Method for detection of specific RNAs in agarose gels by transfer to diazobenzoyloxymethyl-paper and hybridization with DNA probes. <i>Proc. Nat. Acad. Sci. US</i> 74:5350-4, 1977. |
| 763 (20) | * Anbar M & Neta P. A compilation of specific bimolecular rate constants for the reactions of hydrated electrons, hydrogen atoms and hydroxyl radicals with inorganic and organic compounds in aqueous solution. <i>Int. J. Appl. Radiat. Isotop.</i> 18:493-523, 1967. (37/79/PC&ES) |
| 761 (42) | Anderson G W, Zimmerman J E & Callahan F M. The use of esters of N-hydroxysuccinimide in peptide synthesis. <i>J. Amer. Chem. Soc.</i> 86:1839-42, 1964. |
| 754 (17) | Augustin J-E, Boyarski A M, Breidenbach M, Bulos F, Dakin J T, Feldman G J, Fischer G E, Fryberger D, Hanson G, Jean-Marle B, Larsen R R, Luth V, Lynch H L, Lyon D, Morehouse C C, Paterson J M, Perl M L, Richter B, Rapids P, Schwitters R F, Tanenbaum W M, Vannucci F, Abrams G S, Briggs D, Chlunowsky W, Friedberg C E, Goldhaber G, Hollebeek R J, Kadyk J A, Lulu B, Pierre F, Trilling G H, Whitaker J S, Wiss J & Zipse J E. Discovery of a narrow resonance in $e^+ e^-$ annihilation. <i>Phys. Rev. Lett.</i> 33:1406-8, 1974. |
| 750 (51) | Beers R F & Sizer I W. A spectrophotometric method for measuring the breakdown of hydrogen peroxide by catalase. <i>J. Biol. Chem.</i> 195:133-40, 1952. |
| 761 (30) | Belsenherz G, Boltze H J, Bucher T, Czok R, Garbade K H, Meyer-Arendt E & Pfleiderer G. Diphosphofructose-Aldolase, Phosphoglyceralddehyd-Dehydrogenase, Milchsäure-Dehydrogenase, Glycerophosphat-Dehydrogenase und Pyruvat-Kinase aus Kaninchen-muskulatur in einem Arbeitsgang (Diphosphofructose-aldolase, phosphoglyceralddehyde-dehydrogenase, lactic acid-dehydrogenase, glycerophosphate-dehydrogenase and pyruvate-kinase in working rabbit muscles). <i>Z. Naturforsch. B</i> 8:555-77, 1953. |
| 779 (10) | Bennett H S & Luft J H. ζ -Collidine as a basis for buffering fixatives. <i>J. Biophys. Biochem. Cytol.</i> 6:113-4, 1959. |
| 786 (17) | Berenblum I & Chain E. An improved method for the colorimetric determination of phosphate. <i>Biochem. J.</i> 32:295-8, 1938. |
| 767 (131) | Bingham R C, Dewar M J S & Lo D H. Ground states of molecules. XXV. MINDO/3. An improved version of the MINDO semiempirical SCF-MO method. <i>J. Amer. Chem. Soc.</i> 97:1285-93, 1975. |
| 746 (10) | Bishop D H L, Claybrook J R & Spiegelman S. Electrophoretic separation of viral nucleic acids on polyacrylamide gels. <i>J. Mol. Biol.</i> 26:373-87, 1967. |
| 744 (22) | * Bloom B R & Bennett B. Mechanism of a reaction in vitro associated with delayed-type hypersensitivity. <i>Science</i> 153:80-2, 1966. (4/79/LS) |
| 756 (100) | Bohlen P, Stein S, Dairman W & Udenfriend S. Fluorometric assay of proteins in the nanogram range. <i>Arch. Biochem. Biophys.</i> 155:213-20, 1973. |
| 752 (1) | * Boucher R, Veyrat R, de Champlain J & Genest I. New procedures for measurement of human plasma angiotensin and renin activity levels. <i>Can. Med. Assn. J.</i> 90:194-201, 1964. (2/78) |
| 779 (66) | Branton D, Bullivant S, Gilula N B, Karnovsky M J, Moor H, Muhlethaler K, Northcote D H, Packer L, Satir B, Satir P, Speth V, Staehlin L A, Steere R L & Weinstein R S. Freeze-etching nomenclature. <i>Science</i> 190:54-6, 1975. |
| 749 (74) | Britten R J, Graham D E & Neufeld B R. Analysis of repeating DNA sequences by reassociation. <i>Meth. Enzymology</i> 29:363-418, 1974. |
| 748 (67) | * Burnstock G. Purinergic nerves. <i>Pharmacol. Rev.</i> 24:509-81, 1972. (3/85/LS) |
| 770 (23) | Cabibbo N. Unitary symmetry and leptonic decays. <i>Phys. Rev. Lett.</i> 10:531-3, 1963. |
| 777 (35) | Caspersson T, Zech L, Johansson C & Modest E J. Identification of human chromosomes by DNA-binding fluorescent agents. <i>Chromosoma</i> 30:215-27, 1970. |
| 768 (20) | Castellano S & Bothner-By A A. Analysis of NMR spectra by least squares. <i>J. Chem. Phys.</i> 41:3863-9, 1964. |
| 777 (23) | * Cerlotti G. A microchemical determination of deoxyribonucleic acid. <i>J. Biol. Chem.</i> 198:297-303, 1952. (29/85/LS) |
| 776 (23) | Chanutin A & Curnish R B. Effect of organic and inorganic phosphates on the oxygen equilibrium of human erythrocytes. <i>Arch. Biochem. Biophys.</i> 121:96-102, 1967. |
| 742 (28) | * Cohen M L & Bergstresser T K. Band structures and pseudopotential form factors for fourteen semiconductors of the diamond and zinc-blende structures. <i>Phys. Rev.</i> 141:789-96, 1966. (4/80/ET&AS) |

- 762 (10) **Cohn Z A & Hirsch J G.** The isolation and properties of the specific cytoplasmic granules of rabbit polymorphonuclear leucocytes. *J. Exp. Med.* 112:983-1004, 1960.
- 775 (18) **David J R, Al-Askari S, Lawrence H S & Thomas L.** Delayed hypersensitivity *in vitro*. I. The specificity of inhibition of cell migration by antigens. *J. Immunol.* 93:264-82, 1964.
- 754 (10) ***Dawson R M C.** A hydrolytic procedure for the identification and estimation of individual phospholipids in biological samples. *Biochem. J.* 75:45-53, 1960. (8/79/LS)
- 790 (10) **Dement W & Kleitman N.** Cyclic variations in EEG during sleep and their relation to eye movements, body motility, and dreaming. *Electroencephalogr. Clin. Neuro.* 9:673-90, 1957.
- 740 (35) ***DeVita V T, Serpick A A & Carbone P P.** Combination chemotherapy in the treatment of advanced Hodgkin's disease. *Ann. Intern. Med.* 73:881-95, 1970. (12/79/CP)
- 774 (33) ***Dickler H B & Kunkel H G.** Interaction of aggregated γ -globulin with B lymphocytes. *J. Exp. Med.* 136:191-6, 1972. (14/84/LS)
- 788 (118) **Dubowitz L M S, Dubowitz V & Goldberg C.** Clinical assessment of gestational age in the newborn infant. *J. Pediat.* 77:1-10, 1970.
- 757 (11) ***Earle W R, Schilling E L, Stark T H, Straus N P, Brown M F & Shelton E.** Production of malignancy *in vitro*. IV. The mouse fibroblast cultures and changes seen in the living cells. *J. Nat. Cancer Inst.* 4:165-212, 1943. (46/78)
- 785 (73) **Edelman G M.** Surface modulation in cell recognition and cell growth. *Science* 192:218-26, 1976.
- 750 (7) **Endt P M & van der Leun C.** Energy levels of $A=21-44$ nuclei (V). *Nucl. Phys. A* 214:1-625, 1973.
- 757 (26) **Fatt P & Katz B.** An analysis of the end-plate potential recorded with an intra-cellular electrode. *J. Physiol.—London* 115:320-70, 1951.
- 772 (56) **Feshbach H.** Unified theory of nuclear reactions. *Ann. Phys. NY* 5:357-90, 1958.
- 789 (23) **Gell-Mann M.** A schematic model of baryons and mesons. *Phys. Lett.* 8:214-5, 1964.
- 767 (5) **Gell-Mann M.** The symmetry group of vector and axial vector currents. *Physics* 1:63-75, 1964.
- 742 (32) **Gomori G.** A modification of the colorimetric phosphorus determination for use with the photoelectric colorimeter. *J. Lab. Clin. Med.* 27:955-60, 1942.
- 743 (21) **Gray W R.** Sequential degradation plus dansylation. *Meth. Enzymology* 11:469-75, 1967.
- 758 (54) **Gross D J & Włoczek F.** Ultraviolet behavior of non-Abelian gauge theories. *Phys. Rev. Lett.* 30:1343-6, 1973.
- 747 (36) **Guggenheim E A.** On the determination of the velocity constant of a unimolecular reaction. *Phil. Mag.* 2:538-43, 1926.
- 767 (58) **Hamberg M, Svensson J, Wakabayashi T & Samuelsson B.** Isolation and structure of two prostaglandin endoperoxides that cause platelet aggregation. *Proc. Nat. Acad. Sci. US* 71:345-9, 1974.
- 772 (12) ***Hellstrom I, Hellstrom K E, Sjorgen H O & Warner G A.** Demonstration of cell-mediated immunity to human neoplasms of various histological types. *Int. J. Cancer* 7:1-16, 1971. (23/81/LS)
- 770 (11) **Huckabee W E.** Relationships of pyruvate and lactate during anaerobic metabolism. I. Effects of infusion of pyruvate or glucose and of hyperventilation. *J. Clin. Invest.* 37:244-54, 1958.
- 755 (19) ***Huebner R J & Todaro G J.** Oncogenes of RNA tumor viruses as determinants of cancer. *Proc. Nat. Acad. Sci. US* 64:1087-94, 1969. (30/81/LS)
- 788 (44) **Hugh R & Lefson E.** The taxonomic significance of fermentative versus oxidative metabolism of carbohydrates by various gram negative bacteria. *J. Bacteriol.* 66:24-6, 1953.
- 759 (13) ***Hughes E W.** The crystal structure of melamine. *J. Amer. Chem. Soc.* 63:1737-52, 1941. (40/78)
- 752 (38) ***Jerina D M & Daly J W.** Arene oxides: a new aspect of drug metabolism. *Science* 185:573-82, 1974. (36/83/LS)
- 743 (26) ***Kerr J A.** Bond dissociation energies by kinetic methods. *Chem. Rev.* 66:465-500, 1966. (13/85/ET&AS, PC&ES)
- 744 (42) ***Kosower E M.** The effect of solvent on spectra. I. A new empirical measure of solvent polarity: Z-values. *J. Amer. Chem. Soc.* 80:3253-60, 1958. (29/80/PC&ES)
- 767 (135) **Kosterlitz J M & Thouless D J.** Ordering, metastability and phase transitions in two-dimensional systems. *J. Phys.—C—Solid State Phys.* 6:1181-203, 1973.
- 752 (32) ***Kuo J F & Greengard P.** Cyclic nucleotide-dependent protein kinases, IV. 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. (16/83/LS)

- 756 (28) **Lea K R, Leask M J M & Wolf W P.** The raising of angular momentum degeneracy of f-electron terms by cubic crystal fields. *J. Phys. Chem. Solids* 23:1381-6, 1962.
- 742 (200) **Lord J A H, Waterfield A A, Hughes J & Kosterlitz H W.** Endogenous opioid peptides: multiple agonists and receptors. *Nature* 267:495-9, 1977.
- 782 (29) ***Loudon R.** The Raman effect in crystals. *Advan. Phys.* 13:423-82, 1964. (44/79/PC&ES)
- 784 (34) **Lowdin P-O.** Quantum theory of many-particle systems. I. Physical interpretations by means of density matrices, natural spin-orbitals, and convergence problems in the method of configurational interaction. *Phys. Rev.* 97:1474-520, 1955.
- 756 (61) **Luft J H.** Ruthenium red and violet. I. Chemistry, purification, methods of use for electron microscopy and mechanism of action. *Anat. Rec.* 171:347-68, 1971.
- 785 (94) **Mains R E, Elpper B A & Ling N.** Common precursor to corticotropins and endorphins. *Proc. Nat. Acad. Sci. US* 74:3014-8, 1977.
- 782 (77) ***Marchalonis J J.** An enzymic method for the trace iodination of immunoglobulins and other proteins. *Biochem. J.* 113:299-305, 1969. (32/83/LS)
- 776 (60) **Maren T H.** Carbonic anhydrase: chemistry, physiology, and inhibition. *Physiol. Rev.* 47:595-781, 1967.
- 780 (33) ***Marinetti G V.** Chromatographic separation, identification, and analysis of phosphatides. *J. Lipid Res.* 3:1-20, 1962. (20/80/LS)
- 790 (17) ***McLachlan A D.** Self-consistent field theory of the electron spin distribution in π -electron radicals. *Mol. Phys.* 3:233-52, 1960. (24/81/PC&ES)
- 742 (30) **Miller L C & Tainter M L.** Estimation of the ED₅₀ and its error by means of logarithmic-probit graph paper. *Proc. Soc. Exp. Biol. Med.* 57:261-4, 1944.
- 764 (7) ***Moffitt W & Yang J T.** The optical rotatory dispersion of simple polypeptides. I. *Proc. Nat. Acad. Sci. US* 42:596-603, 1956. (8/85/ET&AS, PC&ES)
- 771 (37) ***Morris D L.** Quantitative determination of carbohydrates with Dreywood's anthrone reagent. *Science* 107:254-5, 1948. (6/78)
- 774 (45) **Munro H N.** The determination of nucleic acids. *Meth. Biochem. Anal.* 14:113-76, 1966.
- 749 (53) ***Nisonoff A, Wissler F C, Lipman L N & Woernley D L.** Separation of univalent fragments from the bivalent rabbit antibody molecule by reduction of disulfide bonds. *Arch. Biochem. Biophys.* 89:230-44, 1960. (44/81/LS)
- 781 (72) **Okamoto K & Kyuzo A.** Development of a strain of spontaneously hypertensive rats. *Jpn. Circ. J.* 27:282-93, 1963.
- 751 (36) **O'Malley B W & Means A R.** Female steroid hormones and target cell nuclei. *Science* 183:610-20, 1974.
- 767 (36) ***Osserman E F & Lawlor D P.** Serum and urinary lysozyme (muramidase) in monocytic and monomyelocytic leukemia. *J. Exp. Med.* 124:921-51, 1966. (52/84/LS)
- 766 (30) **Peacock A C & Dingman C W.** Resolution of multiple ribonucleic acid species by polyacrylamide gel electrophoresis. *Biochemistry—USA* 6:1818-27, 1967.
- 770 (13) **Perlmann P & Holm G.** Cytotoxic effects of lymphoid cells *in vitro*. *Advan. Immunol.* 11:117-93, 1969.
- 759 (146) **Perry P & Wolff S.** New Giemsa method for the differential staining of sister chromatids. *Nature* 251:156-8, 1974.
- 768 (29) ***Prehn R T & Main J M.** Immunity to methylcholanthrene-induced sarcomas. *J. Nat. Cancer Inst.* 18:769-78, 1957. (15/85/LS)
- 753 (11) ***Prince A M.** An antigen detected in the blood during the incubation period of serum hepatitis. *Proc. Nat. Acad. Sci. US* 60:814-21, 1968. (43/80/LS)
- 790 (36) **Roe J H & Kuether C A.** The determination of ascorbic acid in whole blood and urine through the 2,4-dinitrophenylhydrazine derivative of dehydroascorbic acid. *J. Biol. Chem.* 147:399-407, 1943.
- 740 (17) ***Rondle C J M & Morgan W T J.** The determination of glucosamine and galactosamine. *Biochem. J.* 61:586-9, 1955. (32/77)
- 763 (35) **Roseman S.** The synthesis of complex carbohydrates by multiglycosyltransferase systems and their potential function in intercellular adhesion. *Chem. Phys. Lipids* 5:270-97, 1970.
- 769 (37) **Rouse P E.** A theory of the linear viscoelastic properties of dilute solutions of coiling polymers. *J. Chem. Phys.* 21:1272-80, 1953.
- 742 (59) **Sainte-Marie G.** A paraffin embedding technique for studies employing immunofluorescence. *J. Histochem. Cytochem.* 10:250-6, 1962.
- 760 (28) ***Sbarra A J & Karnovsky M L.** The biochemical basis of phagocytosis. I. Metabolic changes during the ingestion of particles by polymorphonuclear leukocytes. *J. Biol. Chem.* 234:1355-62, 1959. (27/83/LS)
- 756 (38) **Shreffler D C & David C S.** The H-2 major histocompatibility complex and the I immune response region: genetic variation, function, and organization. *Advan. Immunol.* 20:125-95, 1975.

| A | B |
|-----------|---|
| 777 (15) | Silber R H, Busch R D & Oslapas R. Practical procedure for estimation of corticosterone or hydrocortisone. <i>Clin. Chem.</i> 4:278-85, 1958. |
| 740 (16) | Simonsen M. Graft versus host reactions. Their natural history, and applicability as tools of research. <i>Prog. Allergy</i> 6:349-467, 1962. |
| 748 (30) | Sjogren H O, Hellstrom I, Bansal S C & Hellstrom K E. Suggestive evidence that the "blocking antibodies" of tumor-bearing individuals may be antigen-antibody complexes. <i>Proc. Nat. Acad. Sci. US</i> 68:1372-5, 1971. |
| 742 (37) | Sones F M & Shirey E K. Cine coronary arteriography. <i>Mod. Conc. Cardiovasc. Dis.</i> 31:735-8, 1962. |
| 772 (20) | Stein W H & Moore S. The free amino acids of human blood plasma. <i>J. Biol. Chem.</i> 211:915-26, 1954. |
| 778 (35) | Tessman J R, Kahn A H & Shockley W. Electronic polarizabilities of ions in crystals. <i>Phys. Rev.</i> 92:890-5, 1953. |
| 787 (107) | Van Rossum J M, Hurkmans J A T M & Wolters C J J. Cumulative dose-response curves. II. Technique for the making of dose-response curves in isolated organs and the evaluation of drug parameters. <i>Arch. Int. Pharmacodyn. Ther.</i> 143:299-330, 1963. |
| 773 (70) | Wefel E R, Kistler G S & Scherle W F. Practical stereological methods for morphometric cytology. <i>J. Cell Biol.</i> 30:23-38, 1966. |
| 774 (10) | Weinberg S. Pion scattering lengths. <i>Phys. Rev. Lett.</i> 17:616-21, 1966. |
| 777 (26) | Whittaker V P, Michaelson I A & Kirkland R J A. The separation of synaptic vesicles from nerve-ending particles ('synaptosomes'). <i>Biochem. J.</i> 90:293-303, 1964. |
| 748 (64) | *Williamson D H, Mellanby J & Krebs H A. Enzymic determination of D(-)- β -hydroxybutyric acid and acetoacetic acid in blood. <i>Biochem. J.</i> 82:90-6, 1962. (22/83/LS) |
| 767 (179) | Wilson K G. Confinement of quarks. <i>Phys. Rev. D—Part. Fields</i> 10:2445-59, 1974. |
| 777 (29) | Wilson K G. Non-Lagrangian models of current algebra. <i>Phys. Rev.</i> 179:1499-512, 1969. |
| 785 (18) | Winzler R J. Determination of serum glycoproteins. <i>Meth. Biochem. Anal.</i> 2:279-311, 1955. |
| 753 (46) | *Wollenberger A, Ristau O & Schoffa G. Eine einfache Technik der extrem schnellen Abkühlung grosserer Gewebestücke (A simple technique for the extremely rapid cooling of larger tissue samples). <i>Pflugers Arch. Physiol.</i> 270:399-412, 1960. (31/79/LS) |
| 766 (33) | Yoder H S & Tilley C E. Origin of basalt magmas: an experimental study of natural and synthetic rock systems. <i>J. Petrol.</i> 3:342-532, 1962. |
| 786 (52) | Yoe J H & Jones A L. Colorimetric determination of iron with disodium-1,2-dihydroxybenzene-3,5-disulfonate. <i>Ind. Eng. Chem. Anal. Ed.</i> 16:111-5, 1944. |

Table 2: Journals that published at least two of the eighth group of articles most cited in the *SCF*[®], 1961-1982. A=journal title. B=number of papers. C=1983 impact factor.

| A | B | C |
|--------------------------|---|-------|
| Proc. Nat. Acad. Sci. US | 8 | 8.72 |
| Biochem. J. | 6 | 3.25 |
| Science | 6 | 7.41 |
| J. Biol. Chem. | 5 | 5.80 |
| J. Amer. Chem. Soc. | 4 | 4.47 |
| Phys. Rev. | 4 | --- |
| Phys. Rev. Lett. | 4 | 6.46 |
| Arch. Biochem. Biophys. | 3 | 2.44 |
| J. Exp. Med. | 3 | 11.10 |
| Advan. Immunol. | 2 | 17.80 |
| J. Chem. Phys. | 2 | 2.96 |
| J. Nat. Cancer Inst. | 2 | 2.93 |
| Meth. Biochem. Anal. | 2 | --- |
| Meth. Enzymology | 2 | 1.31 |
| Nature | 2 | 9.26 |

cies for the average paper published in the earlier years are much lower than those of more recent vintage.

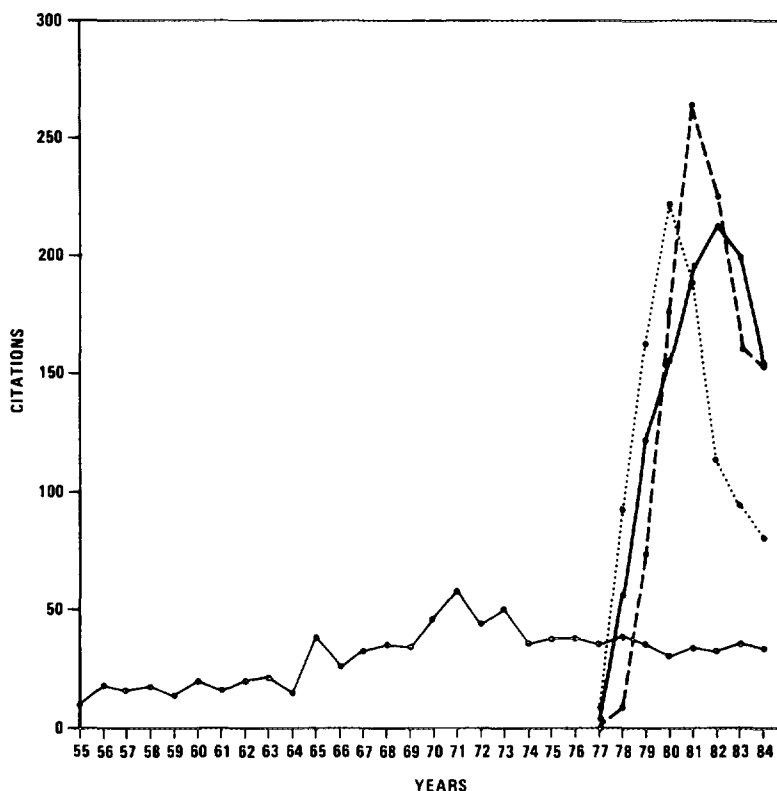
The oldest paper was authored by E.A. Guggenheim, Caius College, Cam-

bridge, UK, and published in the *Philosophical Magazine* in 1926. "On the determination of the velocity constant of a unimolecular reaction" received a steadily increasing number of citations from 1955 until 1971 when it peaked at 58 cites. But it continued to be cited over 30 times per year, including in 1984. In-

Table 3: Chronologic distribution of publication dates for the eighth group of articles most cited in the *SCF*[®], 1961-1982. A=publication years. B=number of papers.

| A | B |
|-----------|----|
| 1926-1939 | 2 |
| 1940-1944 | 6 |
| 1945-1949 | 1 |
| 1950-1954 | 8 |
| 1955-1959 | 12 |
| 1960-1964 | 23 |
| 1965-1969 | 19 |
| 1970-1974 | 20 |
| 1975-1979 | 7 |

Figure 1: Chronologic distribution of citations to Guggenheim's 1926 paper (solid line) and the three 1977 papers by Alwine, Kemp, and Stark (dash line); Lord, Waterfield, Hughes, and Kosterlitz (bold solid line); and Mains, Eipper, and Ling (dotted line). Keep in mind that until our database is complete for the twentieth century we can provide only citation data from 1955 forward for papers published prior to that date.



identally, the *Philosophical Magazine*, published by Taylor & Francis of London, is now a journal of applied physics. It first began publishing in 1798; in 1978 it split into two parts—*Defects and Mechanical Properties*, and *Electronic, Optical, and Magnetic Properties*.

In contrast, the three most-recent articles, published in 1977, peaked just three to five years after they were published. The first authors of these articles are J.C. Alwine, Stanford University, California; J.A.H. Lord, University of Aberdeen, UK; and R.E. Mains, Uni-

versity of Colorado, respectively. Citations to each of these three papers already exceed the number for Guggenheim's article. Their annual citation histories, as well as that of Guggenheim's article, are shown in Figure 1.

Coauthors for the Lord paper include H.W. Kosterlitz and J. Hughes, also then of the University of Aberdeen. They won the Lasker Award for Basic Medical Research in 1978 along with Solomon Snyder, Johns Hopkins University, Baltimore, Maryland, for their research with opiate receptors and en-

kephalins. This prize became a center of controversy shortly after it was awarded.⁴

Scientific discoveries are frequently influenced by the work of many. That such concurrent research occurs can be seen by looking at the publication dates of the papers on a particular topic. For example, from 1964 to 1968 several papers were published that describe a new antigen found in the blood and its relationship to serum hepatitis. One of these papers was authored by Alfred M. Prince, New York Blood Center, and New York Hospital-Cornell Medical Center, New York, and is listed here in Table 1. It is related to a paper published in 1967 by Baruch S. Blumberg and col-

leagues, Fox Chase Cancer Center, Philadelphia. Their now-classic paper was the first to identify the Australia (Au) antigen as the hepatitis virus.⁵ It is among the 100 most-cited articles published in the *Annals of Internal Medicine*⁶ and in 1983 was the subject of a *Citation Classic* commentary.⁷ Prince published his paper just one year later. It had similar conclusions. He commented on this paper and its relationship to Blumberg's work in 1980.⁸ In Figure 2 we have plotted the citation histories of the Prince and Blumberg papers. The curves for these two articles are remarkably similar.

Figure 3 illustrates two additional articles that have had interesting citation

Figure 2: Chronologic distribution of citations to Prince (1968) (solid line) and Blumberg (1967) (dotted line).

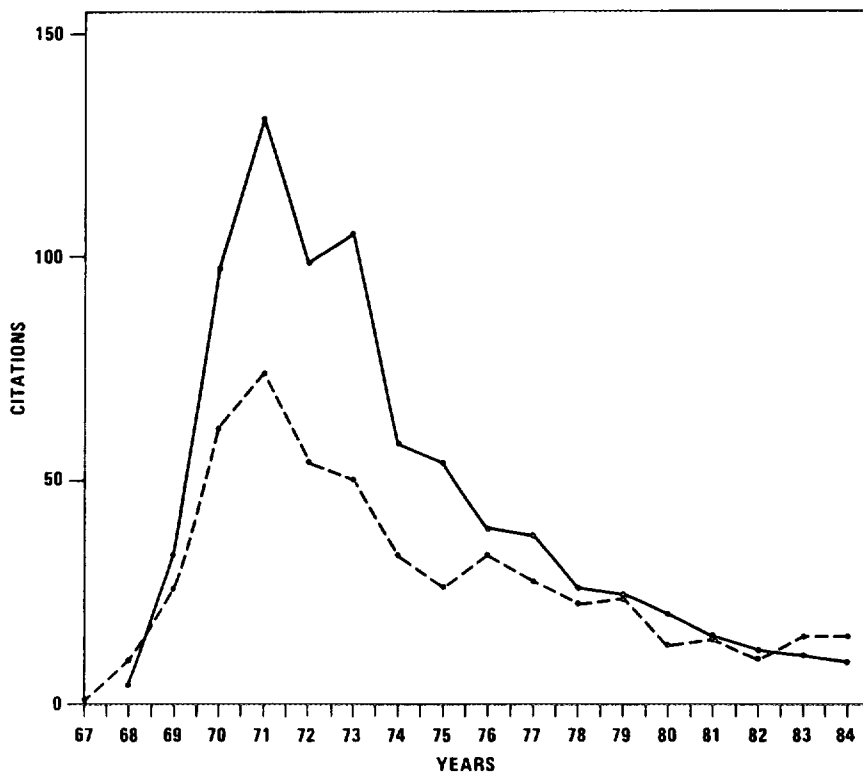
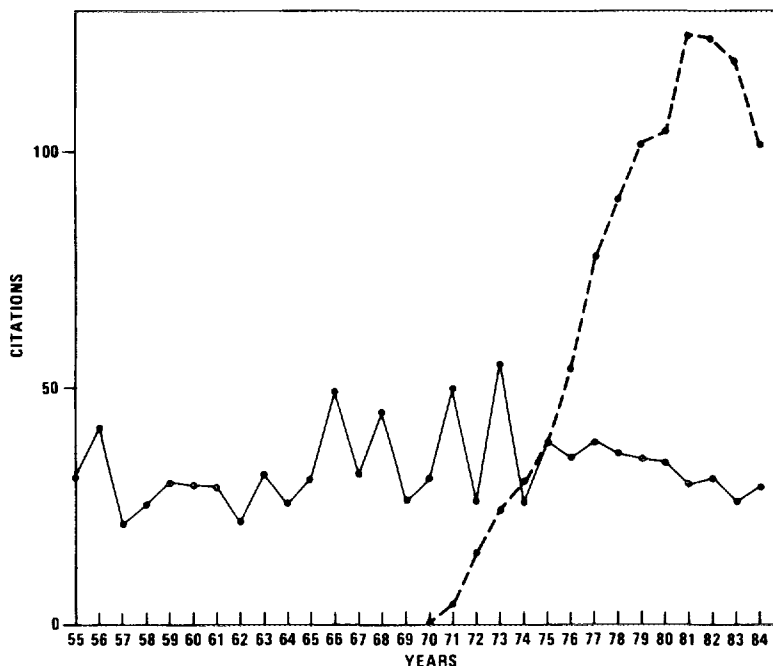


Figure 3: Chronologic distribution of citations to Fatt-Katz (1951) (solid line) and Dubowitz, Dubowitz and Goldberg (1970) (dotted line).



histories. Citations to L.M.S. Dubowitz's 1970 paper on the clinical assessment of gestational age in the newborn infant climbed rapidly until 1981 when they peaked at 125 cites. Since then they have declined a bit—in 1984 the paper was cited "only" 102 times. The 1951 paper by P. Fatt and Katz, "An analysis of the end-plate potential recorded with an intra-cellular electrode," might be described as a "fat cat." It has had a steady and consistent citation history. Since 1955, its citations have ranged between 21 and 55 per year. When the 1945-1954 *SCI* becomes available one day, we can fill in the years just after its publication.

It would be fun to discuss each of the papers listed. About 30 of the authors have done this in *Citation Classic* commentaries. All of the authors have been invited to submit their own retrospective

views of the fields that their papers represent. In the meantime, my library-bibliographic assistants continue to verify and annotate the next groups of most-cited papers.

If any readers have any difficulty locating copies of *Current Contents*® (*CC*®) containing some of the commentaries cited in Table 1, please contact Abigail Grissom or Janet Lieberman at ISI®. I am glad to report, however, that ISI Press® will soon begin to publish a series of volumes that will include all commentaries from 1977 to 1984. I'll be discussing that project in the near future.

* * * * *

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