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Current Comments®

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The 1983 Articles Most Cited in 1983 and 1984. 1. Life Sciences

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While many papers achieve high impact over a long period of time, others have more immediate impact. One measure of that immediacy is citation frequency. If a paper is highly cited shortly after publication, it usually indicates that a new, active area of research is developing. Or it may indicate a controversial topic.

Providing lists of fast-track papers, however, does not necessarily identify the most "important" publications. As we have shown before, many significant papers eventually achieve high and long-lasting impact. The reasons for their delayed recognition have been discussed earlier.[1] And we intend to discuss this phenomenon in more detail in the future. Nevertheless, citation frequency analysis can indicate the growth and development of various fields, helping to identify the "hot" areas of research. Indeed, most of the 1983 papers included in this study help form the core literature of new research fronts. These have been identified through the *Science Citation Index®* (*SCI®*) and *Social Sciences Citation Index®* (*SSCI®*) databases.

The first study in this series was published in 1979. It covered the most-cited life-sciences articles of 1976.[2] Many of the articles in that study are still being highly cited today, almost 10 years after publication. In fact, over one-third of those papers have become Citation Classics cited over 400 times. Of these, seven authors have already published *Citation Classic®* commentaries.

This essay discusses the most-cited life-sciences articles published in 1983. Table 1 lists the 102 articles in this study, in alphabetic order by first author. These articles averaged 96 citations, 20 in 1983 and 75 in 1984, and ranged from 200 to 64 citations.

To categorize these papers into broad subject areas, we used ISI®'s database of research fronts.[3] Of the 102 papers, 95 are core to 48 1983-1984 *SCI/SSCI* research fronts.

1983 and 1984 *SCI/SSCI* Research Fronts

Table 2 lists the 20 fronts that include at least two papers from Table 1 as core documents. The research fronts are named by using key words and phrases in the titles of the citing papers. This results in names that are more detailed than broad subject headings such as "acquired immunodeficiency syndrome" (AIDS). The size of a research front is determined by the number of published, or citing, documents. This year's study includes "popular" fronts as large as 2,445 papers (#84-2565) to "small" ones of 143 papers (#84-0576). This last front was identified by four core papers, two of which are found in Table 1. The other two papers were published in 1982. There were 37 core documents for the front on "Nucleotide sequences, DNA structure and gene expression in *Escherichia coli*, yeast and other systems" (#84-2565), but the number of papers published is not necessarily proportional to the size of the core.

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Table 1: The 1983 life-sciences articles most cited in the *SCI®*, 1983-1984, listed in alphabetic order by first author. The authors' addresses follow each citation. Code numbers indicate the 1983 and 1984 *SCI/SSCI®* research-front specialties for which these are core papers. A = number of 1983 citations. B = number of 1984 citations. C = total number of citations. D = bibliographic data.

A	B	C	D
20	55	75	**Adams J M, Gerondakis S, Webb E, Corcoran L M & Cory S.** Cellular *myc* oncogene is altered by chromosome translocation to an immunoglobulin locus in murine plasmacytomas and is rearranged similarly in human Burkitt lymphomas. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:1982-6, 1983. Walter and Eliza Hall Inst. Med. Res., P.O. Roy. Melbourne Hosp., Victoria, Australia. 84-0211
17	50	67	**Agranoff B W, Murthy P & Seguin E B.** Thrombin-induced phosphodiesteratic cleavage of phosphatidylinositol bisphosphate in human platelets. *J. Biol. Chem.* 258:2076-8, 1983. Univ. Michigan, Mental Hlth. Res. Inst., Ann Arbor, MI. 84-0319
24	69	93	**Alitalo K, Schwab M, Lin C C, Varmus H E & Bishop J M.** Homogeneously staining chromosomal regions contain amplified copies of an abundantly expressed cellular oncogene (c-*myc*) in malignant neuroendocrine cells from a human colon carcinoma. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:1707-11, 1983. Univ. California, Dept. Microbiol. Immunol., San Francisco, CA. 84-0576
9	57	66	**Anderson J L, Marshall H W, Bray B E, Lutz J R, Frederick P R, Yanowitz F G, Datz F L, Klausner S C & Hagan A D.** A randomized trial of intracoronary streptokinase in the treatment of acute myocardial infarction. *N. Engl. J. Med.* 308:1312-8, 1983. Univ. Utah, Coll. Med.; LDS Hosp., Cardiol. Div., Salt Lake City, UT. 84-0841
18	182	200	**Bachmann B J.** Linkage map of *Escherichia coli* K-12, edition 7. *Microbiol. Rev.* 47:180-230, 1983. Yale Univ., Sch. Med., New Haven, CT. 84-1503
26	117	143	**Banerji J, Olson L & Schaffner W.** A lymphocyte-specific cellular enhancer is located downstream of the joining region in immunoglobulin heavy chain genes. *Cell* 33:729-40, 1983. Univ. Zurich, Inst. Mol. Biol. II, Switzerland. 84-1737
31	142	173	**Barre-Sinoussi F, Chermann J C, Rey F, Nugeyre M T, Chamaret S, Gruest J, Dauguet C, Axler-Blin C, Vezinet-Brun F, Rouzioux C, Rozenbaum W & Montagnier L.** Isolation of a T-lymphotropic retrovirus from a patient at risk for acquired immune deficiency syndrome (AIDS). *Science* 220:868-71, 1983. Inst. Pasteur, Dept. Virol.; Hosp. Claude Bernard, Lab. Cent.-Virol.; Hosp. Pitie-Salpetriere, Dept. Publ. Hlth. Trop. Med., Paris, France. 83-1898, 84-1914
12	52	64	**Basham T Y & Merigan T C.** Recombinant interferon-γ increases HLA-DR synthesis and expression. *J. Immunol.* 130:1492-4, 1983. Stanford Univ., Sch. Med., CA. 84-1994
15	58	73	**Benach J L, Bosler E M, Hanrahan J P, Coleman J L, Habicht G S, Bast T F, Cameron D J, Ziegler J L, Barbour A G, Burgdorfer W, Edelman R & Kaslow R A.** Spirochetes isolated from the blood of two patients with Lyme disease. *N. Engl. J. Med.* 308:740-2, 1983. State NY Dept. Hlth., Stony Brook & Albany; SUNY, Dept. Pathol., Stony Brook; NY Hosp.-Cornell Med. Ctr., New York, NY; CDC, Field Serv. Div., Atlanta, GA; Vet. Admin. Med. Ctr., San Francisco, CA; NIH, NIAID, Hamilton, MT & Bethesda, MD. 84-0839
3	86	89	**Berridge M J.** Rapid accumulation of inositol trisphosphate reveals that agonists hydrolyse polyphosphoinositides instead of phosphatidylinositol. *Biochem. J.* 212:849-58, 1983. ARC, Unit Invertebrate Chem. Physiol.; Univ. Cambridge, Dept. Zool., UK. 84-0319
8	66	74	**Berridge M J, Dawson R M C, Downes C P, Heslop J P & Irvine R F.** Changes in the levels of inositol phosphates after agonist-dependent hydrolysis of membrane phosphoinositides. *Biochem. J.* 212:473-82, 1983. Univ. Cambridge, Dept. Zool.; ARC, Inst. Anim. Physiol. & Unit Invertebrate Chem. Physiol.; MRC, Neurochem. Pharmacol. Unit, Cambridge, UK. 84-0319
3	71	74	**Biggin M D, Gibson T J & Hong G F.** Buffer gradient gels and ^{35}S label as an aid to rapid DNA sequence determination. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:3963-5, 1983. MRC, Lab. Mol. Biol., Cambridge, UK.
11	128	139	**Bishop J M.** Cellular oncogenes and retroviruses. *Annu. Rev. Biochem.* 52:301-54, 1983. Univ. California, Dept. Microbiol. Immunol., San Francisco, CA.
23	64	87	**Bokoch G M, Katada T, Northup J K, Hewlett E L & Gilman A G.** Identification of the predominant substrate for ADP-ribosylation by islet activating protein. *J. Biol. Chem.* 258:2072-5, 1983. Univ. Texas, Hlth. Sci. Ctr. Dallas, TX; Univ. Virginia, Sch. Med., Charlottesville, VA. 84-3078
21	76	97	**Brown M S, Anderson R G W & Goldstein J L.** Recycling receptors: the round-trip itinerary of migrant membrane proteins. *Cell* 32:663-7, 1983. Univ. Texas, Hlth. Sci. Ctr. Dallas, TX. 84-2014

A	B	C	D
30	51	81	**Capon D J, Chen E Y, Levinson A D, Seeburg P H & Goeddel D V.** Complete nucleotide sequences of the T24 human bladder carcinoma oncogene and its normal homologue. *Nature* 302:33-7, 1983. Genentech, Inc., Dept. Mol. Biol., San Francisco, CA. 84-4046
8	58	66	**Chandler V L, Maler B A & Yamamoto K R.** DNA sequences bound specifically by glucocorticoid receptor in vitro render a heterologous promoter hormone responsive in vivo. *Cell* 33:489-99, 1983. Univ. California, Dept. Biochem. Biophys., San Francisco, CA. 84-1737
27	44	71	**Claudio T, Ballivet M, Patrick J & Heinemann S.** Nucleotide and deduced amino acid sequences of *Torpedo californica* acetylcholine receptor γ subunit. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:1111-5, 1983. Salk Inst. Biol. Stud., Mol. Neurobiol. Lab., San Diego, CA. 84-4265
17	47	64	**Conner B J, Reyes A A, Morin C, Itakura K, Teplitz R L & Wallace R B.** Detection of sickle cell β^S-globin allele by hybridization with synthetic oligonucleotides. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:278-82, 1983. City of Hope Med. Ctr., Div. Cytogenet. Cytol.; City of Hope Res. Inst., Mol. Genet. Sect., Duarte, CA; Inst. Pasteur, Chem. Lab., Paris, France. 84-1032
10	60	70	**Coyle J T, Price D L & DeLong M R.** Alzheimer's disease: a disorder of cortical cholinergic innervation. *Science* 219:1184-90, 1983. Johns Hopkins Univ., Sch. Med.; Baltimore City Hosps., Dept. Neurol., MD. 84-0426
5	65	70	**Creba J A, Downes C P, Hawkins P T, Brewster G, Michell R H & Kirk C J.** Rapid breakdown of phosphatidylinositol 4-phosphate and phosphatidylinositol 4,5-bisphosphate in rat hepatocytes stimulated by vasopressin and other Ca^{2+}-mobilizing hormones. *Biochem. J.* 212:733-47, 1983. Univ. Birmingham, Dept. Biochem., UK. 84-0319
29	61	90	**Dalla-Favera R, Martinotti S, Gallo R C, Erikson J & Croce C M.** Translocation and rearrangements of the c-*myc* oncogene locus in human undifferentiated B-cell lymphomas. *Science* 219:963-7, 1983. NIH, NCI, Bethesda, MD; Wistar Inst. Anat. Biol., Philadelphia, PA. 84-0211
18	49	67	**Davis K C, Horsburgh C R, Hasiba U, Schocket A L & Kirkpatrick C H.** Acquired immunodeficiency syndrome in a patient with hemophilia. *Ann. Intern. Med.* 98:284-6, 1983. Univ. Colorado, Hlth. Sci. Ctr.; Natl. Jewish Hosp. Res. Ctr./NAC, Dept. Med., Denver, CO. 84-0752
33	59	92	**Dierks P, van Ooyen A, Cochran M D, Dobkin C, Reiser J & Weissmann C.** Three regions upstream from the cap site are required for efficient and accurate transcription of the rabbit β-globin gene in mouse 3T6 cells. *Cell* 32:695-706, 1983. Univ. Zurich, Inst. Mol. Biol., Switzerland. 84-1737
9	57	66	**Doerfler W.** DNA methylation and gene activity. *Annu. Rev. Biochem.* 52:93-124, 1983. Univ. Cologne, Inst. Genet., FRG. 84-5435
17	149	166	**Doolittle R F, Hunkapiller M W, Hood L E, Devare S G, Robbins K C, Aaronson S A & Antoniades H N.** Simian sarcoma virus *onc* gene, v-*sis*, is derived from the gene (or genes) encoding a platelet-derived growth factor. *Science* 221:275-7, 1983. Univ. California, San Diego, Dept. Chem., La Jolla; Caltech, Div. Biol., Pasadena, CA; NIH, NCI, Bethesda, MD; Harvard Univ., Sch. Publ. Hlth., Boston, MA. 84-1033
29	66	95	**Edelman G M.** Cell adhesion molecules. *Science* 219:450-7, 1983. Rockefeller Univ., New York, NY. 84-5676
32	68	100	**Erikson J, ar-Rushdi A, Drwinga H L, Nowell P C & Croce C M.** Transcriptional activation of the translocated c-*myc* oncogene in Burkitt lymphoma. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:820-4, 1983. Wistar Inst. Anat. Biol.; Univ. Pennsylvania, Sch. Med., Philadelphia, PA. 84-0211
38	112	150	**Essex M, McLane M F, Lee T H, Falk L, Howe C W S, Mullins J I, Cabradilla C & Francis D P.** Antibodies to cell membrane antigens associated with human T-cell leukemia virus in patients with AIDS. *Science* 220:859-62, 1983. Harvard Univ., Sch. Publ. Hlth., Boston, MA; CDC, Atlanta, GA. 83-1898, 84-1914
44	96	140	**Gallo R C, Sarin P S, Gelmann E P, Robert-Guroff M, Richardson E, Kalyanaraman V S, Mann D, Sidhu G D, Stahl R E, Zolla-Pazner S, Leibowitch J & Popovic M.** Isolation of human T-cell leukemia virus in acquired immune deficiency syndrome (AIDS). *Science* 220:865-7, 1983. NIH, NCI, Bethesda; Litton Bionet., Inc., Dept. Cell Biol., Kensington, MD; NY Vet. Admin. Hosp., Dept. Pathol., NY; Hosp. Raymond Poincare, Dept. Immunol., Garches, France. 83-1898, 84-1914
22	50	72	**Gauss D H & Sprinzl M.** Compilation of tRNA sequences. *Nucl. Acid. Res.* 11:r1-r53, 1983. Max Planck Soc. Adv. Sci., Inst. Exp. Med., Goettingen; Univ. Bayreuth, Dept. Biochem., FRG.

A	B	C	D
27	74	101	**Gelmann E P, Popovic M, Blayney D, Masur H, Sidhu G, Stahl R E & Gallo R C.** Proviral DNA of a retrovirus, human T-cell leukemia virus, in two patients with AIDS. *Science* 220:862-5, 1983. NIH, NCI & Clin. Ctr., Bethesda, MD; NYU, Med. Ctr.; NY Vet. Admin. Hosp., Dept. Pathol., NY. 84-1914
22	68	90	**Geuze H J, Slot J W, Strous G J A M, Lodish H F & Schwartz A L.** Intracellular site of asialoglycoprotein receptor-ligand uncoupling: double-label immunoelectron microscopy during receptor-mediated endocytosis. *Cell* 32:277-87, 1983. Univ. Utrecht, Med. Sch., The Netherlands; MIT, Dept. Biol., Cambridge; Child.'s Hosp. Med. Ctr., Div. Pediat. Hematol. Oncol.; Sidney Farber Cancer Inst.; Harvard Univ., Med. Sch., Boston, MA. 84-2014
27	137	164	**Gillies S D, Morrison S L, Oi V T & Tonegawa S.** A tissue-specific transcription enhancer element is located in the major intron of a rearranged immunoglobulin heavy chain gene. *Cell* 33:717-28, 1983. MIT, Ctr. Cancer Res. & Dept. Biol., Cambridge, MA; Columbia Coll. Physns. Surgs., Dept. Microbiol., New York, NY; Stanford Univ., Sch. Med., CA. 84-1737
7	66	73	**Gottlieb M S, Groopman J E, Weinstein W M, Fahey J L & Detels R.** The acquired immunodeficiency syndrome. *Ann. Intern. Med.* 99:208-20, 1983. Univ. California, Sch. Med., Los Angeles, CA. 83-1898
24	55	79	**Goubin G, Goldman D S, Luce J, Neiman P E & Cooper G M.** Molecular cloning and nucleotide sequence of a transforming gene detected by transfection of chicken B-cell lymphoma DNA. *Nature* 302:114-9, 1983. Sidney Farber Cancer Inst.; Harvard Univ., Med. Sch., Boston, MA; Fred Hutchinson Cancer Res. Ctr.; Univ. Washington, Depts. Med. & Pathol., Seattle, WA. 84-4046
12	60	72	**Hall A, Marshall C J, Spurr N K & Weiss R A.** Identification of transforming gene in two human sarcoma cell lines as a new member of the *ras* gene family located on chromosome 1. *Nature* 303:396-400, 1983. Inst. Cancer Res., Chester Beatty Labs.; Imperial Cancer Res. Fund Labs., London, UK. 84-4046
10	71	81	**Hanahan D.** Studies on transformation of *Escherichia coli* with plasmids. *J. Mol. Biol.* 166:557-80, 1983. Harvard Univ., Dept. Biochem. Mol. Biol., Cambridge, MA; Cold Spring Harbor Lab., NY.
36	60	96	**Harris C, Small C B, Klein R S, Friedland G H, Moll B, Emeson E E, Spigland I & Steigbigel N H.** Immunodeficiency in female sexual partners of men with the acquired immunodeficiency syndrome. *N. Engl. J. Med.* 308:1181-4, 1983. Montefiore Med. Ctr., Depts. Med. & Pathol.; N. Cent. Bronx Hosp., Dept. Med.; Albert Einstein Coll. Med., Depts. Med. & Pathol., Bronx, NY. 83-1898, 84-0752
24	74	98	**Haskins K, Kubo R, White J, Pigeon M, Kappler J & Marrack P.** The major histocompatibility complex-restricted antigen receptor on T cells. I. Isolation with a monoclonal antibody. *J. Exp. Med.* 157:1149-69, 1983. Natl. Jewish Hosp. Res. Ctr., Dept. Med.; Univ. Colorado, Hlth. Sci. Ctr., Denver, CO. 84-0171
15	100	115	**Hawley D K & McClure W R.** Compilation and analysis of *Escherichia coli* promoter DNA sequences. *Nucl. Acid. Res.* 11:2237-55, 1983. Carnegie-Mellon Univ., Dept. Biol. Sci., Pittsburgh, PA. 84-2565
17	52	69	**Hildebrandt J D, Sekura R D, Codina J, Iyengar R, Manclark C R & Birnbaumer L.** Stimulation and inhibition of adenylyl cyclases mediated by distinct regulatory proteins. *Nature* 302:706-9, 1983. Baylor Coll. Med., Dept. Cell Biol., Houston, TX; US FDA, Natl. Ctr. Drug. Biologics, Bethesda, MD. 84-3078
21	49	70	**Hricik D E, Browning P J, Kopelman R, Goorno W E, Madias N E & Dzau V J.** Captopril-induced functional renal insufficiency in patients with bilateral renal-artery stenoses or renal-artery stenosis in a solitary kidney. *N. Engl. J. Med.* 308:373-6, 1983. Brigham and Women's Hosp., Hypertens. Unit; Tufts-N. Engl. Med. Ctr., Div. Nephrol.; Harvard Univ., Med. Sch.; Tufts Univ., Sch. Med., Boston, MA. 84-4995
11	53	64	**Jaffe H W, Choi K, Thomas P A, Haverkos H W, Auerbach D M, Guinan M E, Rogers M F, Spira T J, Darrow W W, Kramer M A, Friedman S M, Monroe J M, Friedman-Kien A E, Laubenstein L J, Marmor M, Safai B, Dritz S K, Crispi S J, Fannin S L, Orkwis J P, Kelter A, Rushing W R, Thacker S B & Curran J W.** National case-control study of Kaposi's sarcoma and *Pneumocystis carinii* pneumonia in homosexual men: part 1, epidemiologic results. *Ann. Intern. Med.* 99:145-51, 1983. CDC, Ctr. Infect. Dis. & Epidemiol. Program Off., Atlanta, GA; NY City Dept. Hlth.; NYU, Med. Ctr.; Mem. Sloan-Kettering Cancer Ctr., New York, NY; Dept. Publ. Hlth., San Francisco; Dept. Hlth. Serv., Los Angeles, CA. 83-1898, 84-7611
0	92	92	**Kelly K, Cochran B H, Stiles C D & Leder P.** Cell-specific regulation of the c-*myc* gene by lymphocyte mitogens and platelet-derived growth factor. *Cell* 35:603-10, 1983. Harvard Univ., Med. Sch.; Dana-Farber Cancer Inst., Boston, MA. 84-0211

A	B	C	D
11	74	85	**Khoury G & Gruss P.** Enhancer elements. *Cell* 33:313-4, 1983. NIH, NCI, Bethesda, MD. 84-1737
25	74	99	**Klein G.** Specific chromosomal translocations and the genesis of B-cell-derived tumors in mice and men. *Cell* 32:311-5, 1983. Karolinska Inst., Dept. Tumor Biol., Stockholm, Sweden. 84-7956
10	63	73	**Kozak M.** Comparison of initiation of protein synthesis in procaryotes, eucaryotes, and organelles. *Microbiol. Rev.* 47:1-45, 1983. Univ. Pittsburgh, Dept. Biol. Sci., PA. 84-2565
1	81	82	**Land H, Parada L F & Weinberg R A.** Cellular oncogenes and multistep carcinogenesis. *Science* 222:771-8, 1983. MIT, Dept. Biol. & Ctr. Cancer Res.; Whitehead Inst. Biomed. Res., Cambridge, MA.
20	153	173	**Land H, Parada L F & Weinberg R A.** Tumorigenic conversion of primary embryo fibroblasts requires at least two cooperating oncogenes. *Nature* 304:596-602, 1983. MIT, Ctr. Cancer Res. & Dept. Biol.; Whitehead Inst. Biomed. Res., Cambridge, MA. 84-8130
8	81	89	**Lane H C, Masur H, Edgar L C, Whalen G, Rook A H & Fauci A S.** Abnormalities of B-cell activation and immunoregulation in patients with the acquired immunodeficiency syndrome. *N. Engl. J. Med.* 309:453-8, 1983. NIH, NIAID & Clin. Ctr.; US FDA, Off. Biologics, Bethesda, MD. 84-6914
59	77	136	**Lederman M M, Ratnoff O D, Scillian J J, Jones P K & Schacter B.** Impaired cell-mediated immunity in patients with classic hemophilia. *N. Engl. J. Med.* 308:79-83, 1983. Case Western Reserve Univ., Sch. Med.; Univ. Hosps. Cleveland, OH. 83-1898, 84-0752
7	58	65	**Lee K S & Tsien R W.** Mechanism of calcium channel blockade by verapamil, D600, diltiazem and nitrendipine in single dialysed heart cells. *Nature* 302:790-4, 1983. Yale Univ., Sch. Med., New Haven, CT. 84-0658
43	47	90	**Marcu K B, Harris L J, Stanton L W, Erikson J, Watt R & Croce C M.** Transcriptionally active c-*myc* oncogene is contained within NIARD, a DNA sequence associated with chromosome translocations in B-cell neoplasia. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:519-23, 1983. SUNY, Biochem. Dept., Stony Brook, NY; Wistar Inst. Anat. Biol., Philadelphia, PA. 83-1740, 84-0211
16	49	65	**Marsh M, Bolzau E & Helenius A.** Penetration of Semliki Forest virus from acidic prelysosomal vacuoles. *Cell* 32:931-40, 1983. Yale Univ., Sch. Med., New Haven, CT. 84-2014
57	70	127	**Menitove J E, Aster R H, Casper J T, Lauer S J, Gottschall J L, Williams J E, Gill J C, Wheeler D V, Plaskowski V, Kirchner P & Montgomery R R.** T-lymphocyte subpopulations in patients with classic hemophilia treated with cryoprecipitate and lyophilized concentrates. *N. Engl. J. Med.* 308:83-6, 1983. Blood Ctr. SE Wisconsin; Great Lakes Hemophilia Fdn.; Med. Coll. Wisconsin, Depts. Med., Pediat. & Pathol., Milwaukee, WI. 83-1898, 84-0752
8	101	109	**Messing J.** New M13 vectors for cloning. *Meth. Enzymology* 101:20-78, 1983. Univ. Minnesota, Dept. Biochem., St. Paul, MN. 84-2565
12	65	77	**Meuer S C, Acuto O, Hussey R E, Hodgdon J C, Fitzgerald K A, Schlossman S F & Reinherz E L.** Letter to editor. (Evidence for the T3-associated 90K heterodimer as the T-cell antigen receptor.) *Nature* 303:808-10, 1983. Dana-Farber Cancer Inst., Div. Tumor Immunol.; Harvard Univ., Med. Sch., Boston, MA. 84-0171
35	109	144	**Meuer S C, Fitzgerald K A, Hussey R E, Hodgdon J C, Schlossman S F & Reinherz E L.** Clonotypic structures involved in antigen-specific human T cell function. *J. Exp. Med.* 157:705-19, 1983. Sidney Farber Cancer Inst., Div. Tumor Immunol.; Harvard Univ., Med. Sch., Boston, MA. 83-4225, 84-0171
39	132	171	**Niedel J E, Kuhn L J & Vandenbark G R.** Phorbol diester receptor copurifies with protein kinase C. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:36-40, 1983. Duke Univ., Med. Ctr., Durham, NC. 83-1162, 84-0319
16	75	91	**Nishizuka Y.** Phospholipid degradation and signal translation for protein phosphorylation. *Trends Biochem. Sci.* 8:13-6, 1983. Kobe Univ., Sch. Med.; Natl. Inst. Basic Biol., Dept. Cell Biol., Okazaki, Japan.
22	62	84	**Noda M, Takahashi H, Tanabe T, Toyosato M, Kikyotani S, Furutani Y, Hirose T, Takashima H, Inayama S, Miyata T & Numa S.** Letter to editor. (Structural homology of *Torpedo californica* acetylcholine receptor subunits.) *Nature* 302:528-32, 1983. Kyoto Univ., Fac. Med.; Keio Univ., Sch. Med., Tokyo; Kyushu Univ., Fac. Sci., Fukuoka, Japan. 84-4265
30	42	72	**Noda M, Takahashi H, Tanabe T, Toyosato M, Kikyotani S, Hirose T, Asai M, Takashima H, Inayama S, Miyata T & Numa S.** Letter to editor. (Primary structures of β- and δ-subunit precursors of *Torpedo californica* acetylcholine receptor deduced from cDNA sequences.) *Nature* 301:251-5, 1983. Kyoto Univ., Fac. Med.; Keio Univ., Sch. Med., Tokyo; Kyushu Univ., Fac. Sci., Fukuoka, Japan. 83-4227, 84-4265

A	B	C	D
11	62	73	**Nordheim A & Rich A.** Negatively supercoiled simian virus 40 DNA contains Z-DNA segments within transcriptional enhancer sequences. *Nature* 303:674-9, 1983. MIT, Dept. Biol., Cambridge, MA. 84-1223
21	49	70	**Oleske J, Minnefor A, Cooper R, Thomas K, dela Cruz A, Ahdieh H, Guerrero I, Joshi V V & Desposito F.** Immune deficiency syndrome in children. *JAMA—J. Am. Med. Assn.* 249:2345-9, 1983. Univ. Med. Dent. NJ, NJ Med. Sch.; St. Michael's Med. Ctr., Newark; St. Joseph's Hosp. Med. Ctr., Paterson; NJ Dept. Hlth., Trenton, NJ. 84-0752
18	56	74	**Pennica D, Holmes W E, Kohr W J, Harkins R N, Vehar G A, Ward C A, Bennett W F, Yelverton E, Seeburg P H, Heyneker H L, Goeddel D V & Collen D.** Cloning and expression of human tissue-type plasminogen activator cDNA in *E. coli*. *Nature* 301:214-21, 1983. Genentech, Inc., Depts. Mol. Biol. & Protein Biochem., San Francisco, CA; Univ. Leuven, Dept. Med. Res., Belgium. 83-2264, 84-4404
39	69	108	**Pitchenik A E, Fischl M A, Dickinson G M, Becker D M, Fournier A M, O'Connell M T, Colton R M & Spira T J.** Opportunistic infections and Kaposi's sarcoma among Haitians: evidence of a new acquired immunodeficiency state. *Ann. Intern. Med.* 98:277-84, 1983. Univ. Miami, Sch. Med., FL; CDC, Div. Host Factors, Atlanta, GA. 83-1898, 84-0752
16	50	66	**Poon M-C, Landay A, Prasthofer E F & Stagno S.** Acquired immunodeficiency syndrome with *Pneumocystis carinii* pneumonia and *Mycobacterium avium-intracellulare* infection in a previously healthy patient with classic hemophilia. *Ann. Intern. Med.* 98:287-90, 1983. Univ. Alabama in Birmingham, Dept. Med., Tumor Inst., Compr. Cancer Ctr. & Dept. Pediat.; Birmingham Vet. Admin. Med. Ctr., Hematol./Oncol. Serv.; Alabama State Crippled Child. Rehabil. Serv., Birmingham Hemophil. Program, Birmingham, AL. 84-0752
37	85	122	**Popovic M, Sarin P S, Robert-Guroff M, Kalyanaraman V S, Mann D, Minowada J & Gallo R C.** Isolation and transmission of human retrovirus (human T-cell leukemia virus). *Science* 219:856-9, 1983. NIH, NCI, Bethesda; Litton Bionet., Inc., Kensington, MD; Roswell Park Mem. Inst., Dept. Immunol., Buffalo, NY. 83-2933, 84-1914
16	80	96	**Queen C & Baltimore D.** Immunoglobulin gene transcription is activated by downstream sequence elements. *Cell* 33:741-8, 1983. Whitehead Inst. Biomed. Res.; MIT, Dept. Biol. & Ctr. Cancer Res., Cambridge, MA; NIH, NCI, Bethesda, MD. 84-1737
23	80	103	**Reuter H.** Calcium channel modulation by neurotransmitters, enzymes and drugs. *Nature* 301:569-74, 1983. Univ. Berne, Dept. Pharmacol., Switzerland. 84-0222
4	66	70	**Rink T J, Sanchez A & Hallam T J.** Letter to editor. (Diacylglycerol and phorbol ester stimulate secretion without raising cytoplasmic free calcium in human platelets.) *Nature* 305:317-9, 1983. Univ. Cambridge, Physiol. Lab., UK. 84-0319
35	59	94	**Roth R A & Cassell D J.** Insulin receptor: evidence that it is a protein kinase. *Science* 219:299-301, 1983. Mount Zion Hosp. Med. Ctr., Harold Brunn Inst.; Univ. California, Dept. Physiol., San Francisco, CA. 83-0069, 84-1033
36	81	117	**Rowley J D.** Human oncogene locations and chromosome aberrations. *Nature* 301:290-1, 1983. Univ. Chicago, Dept. Med., IL. 84-7956
14	98	112	**Ruley H E.** Adenovirus early region 1A enables viral and cellular transforming genes to transform primary cells in culture. *Nature* 304:602-6, 1983. Cold Spring Harbor Lab., NY. 84-8130
18	95	113	**Samuelsson B.** Leukotrienes: mediators of immediate hypersensitivity reactions and inflammation. *Science* 220:568-75, 1983. Karolinska Inst., Dept. Physiol. Chem., Stockholm, Sweden.
3	72	75	**Schramm M, Thomas G, Towart R & Franckowiak G.** Letter to editor. (Novel dihydropyridines with positive inotropic action through activation of Ca^{2+} channels.) *Nature* 303:535-7, 1983. Pharma Res. Ctr., Wuppertal, FRG. 84-0658
13	62	75	**Schwab M, Alitalo K, Varmus H E, Bishop J M & George D.** Letter to editor. (A cellular oncogene (c-Ki-*ras*) is amplified, overexpressed, and located within karyotypic abnormalities in mouse adrenocortical tumour cells.) *Nature* 303:497-501, 1983. Univ. California, Med. Ctr., San Francisco, CA; Univ. Pennsylvania, Sch. Med., Philadelphia, PA. 84-0576
29	73	102	**Schwartz D E, Tizard R & Gilbert W.** Nucleotide sequence of Rous sarcoma virus. *Cell* 32:853-69, 1983. Harvard Univ., Dept. Biochem. Mol. Biol., Cambridge, MA. 84-9253
8	89	97	**Seiki M, Hattori S, Hirayama Y & Yoshida M.** Human adult T-cell leukemia virus: complete nucleotide sequence of the provirus genome integrated in leukemia cell DNA. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:3618-22, 1983. Cancer Inst., Dept. Viral Oncol., Tokyo, Japan. 84-1914
25	60	85	**Selby P, Buick R N & Tannock I.** A critical appraisal of the "human tumor stem-cell assay." *N. Engl. J. Med.* 308:129-34, 1983. Univ. Toronto, Depts. Med. & Med.

A	B	C	D
			Biophys.; Ontario Cancer Inst.; Princess Margaret Hosp., Toronto, Canada. 83-0449, 84-0479
23	48	71	**Shimizu K, Goldfarb M, Perucho M & Wigler M.** Isolation and preliminary characterization of the transforming gene of a human neuroblastoma cell line. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:383-7, 1983. Cold Spring Harbor Lab., NY. 84-4046
19	48	67	**Shimizu K, Goldfarb M, Suard Y, Perucho M, Li Y, Kamata T, Feramisco J, Stavnezer E, Fogh J & Wigler M H.** Three human transforming genes are related to the viral *ras* oncogenes. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:2112-6, 1983. Cold Spring Harbor Lab.; SUNY, Stony Brook; Mem. Sloan-Kettering Cancer Ctr., Sloan-Kettering Inst. Cancer Res., New York & Rye, NY. 84-4046
10	59	69	**Spiess J, Rivier J & Vale W.** Letter to editor. (Characterization of rat hypothalamic growth hormone-releasing factor.) *Nature* 303:532-5, 1983. Salk Inst. Biol. Stud., Peptide Biol. Lab., San Diego, CA. 84-2930
21	49	70	**Stanton L W, Watt R & Marcu K B.** Translocation, breakage and truncated transcripts of c-*myc* oncogene in murine plasmacytomas. *Nature* 303:401-6, 1983. SUNY, Biochem. Dept. & Mol. Biol. Grad. Program, Stony Brook, NY; Wistar Inst. Anat. Biol., Philadelphia, PA. 84-0211
26	86	112	**Steere A C, Grodzicki R L, Kornblatt A N, Craft J E, Barbour A G, Burgdorfer W, Schmid G P, Johnson E & Malawista S E.** The spirochetal etiology of Lyme disease. *N. Engl. J. Med.* 308:733-40, 1983. Yale Univ., Sch. Med., New Haven, CT; NIH, NIAID, Hamilton, MT; CDC, Ctr. Infect. Dis., Atlanta, GA. 84-0839
39	130	169	**Steinman R M, Mellman I S, Muller W A & Cohn Z A.** Endocytosis and the recycling of plasma membrane. *J. Cell Biol.* 96:1-27, 1983. Rockefeller Univ., New York, NY; Yale Univ., Sch. Med., New Haven, CT. 84-2014
1	128	129	**Streb H, Irvine R F, Berridge M J & Schulz I.** Letter to editor. (Release of Ca^{2+} from a nonmitochondrial intracellular store in pancreatic acinar cells by inositol-1,4,5-trisphosphate.) *Nature* 306:67-9, 1983. Max Planck Soc. Adv. Sci., Inst. Biophys., Frankfurt on Main, FRG; ARC, Inst. Anim. Physiol. & Unit Insect Neurophysiol. Pharmacol.; Univ. Cambridge, Dept. Zool., UK. 84-0319
20	64	84	**Swanson L W, Sawchenko P E, Rivier J & Vale W W.** Organization of ovine corticotropin-releasing factor immunoreactive cells and fibers in the rat brain: an immunohistochemical study. *Neuroendocrinology* 36:165-86, 1983. Salk Inst. Biol Stud., San Diego; Clayton Fdn. Res.-California Div., La Jolla, CA. 84-1226
21	74	95	**Taniguchi T, Matsui H, Fujita T, Takaoka C, Kashima N, Yoshimoto R & Hamuro J.** Structure and expression of a cloned cDNA for human interleukin-2. *Nature* 302:305-10, 1983. Japanese Fdn. Cancer Res., Cancer Inst., Tokyo; Ajinomoto Co. Inc., Cent. Res. Labs., Yokohama, Japan. 84-3115
25	60	85	**Thorner M O, Spiess J, Vance M L, Rogol A D, Kaiser D L, Webster J D, Rivier J, Borges J L, Bloom S R, Cronin M J, Evans W S, MacLeod R M & Vale W.** Human pancreatic growth-hormone-releasing factor selectively stimulates growth-hormone secretion in man. *Lancet* 1:24-8, 1983. Univ. Virginia, Sch. Med., Charlottesville, VA; Salk Inst. Biol. Stud., Peptide Biol. Lab., San Diego, CA; Univ. London, Roy. Postgrad. Med. Sch., UK. 83-2888, 84-2930
16	122	138	**Tonegawa S.** Somatic generation of antibody diversity. *Nature* 302:575-81, 1983. MIT, Ctr. Cancer Res. & Dept. Biol., Cambridge, MA. 84-3207
58	79	137	**Vieira I, Frank E, Spira T J & Landesman S H.** Acquired immune deficiency in Haitians. *N. Engl. J. Med.* 308:125-9, 1983. SUNY-Downstate Med. Ctr., Brooklyn, NY; CDC, Div. Immunol., Atlanta, GA. 83-1898, 84-0752
19	52	71	**Wasylyk B, Wasylyk C, Augereau P & Chambon P.** The SV40 72 bp repeat preferentially potentiates transcription starting from proximal natural or substitute promoter elements. *Cell* 32:503-14, 1983. CNRS, Lab. Genet. Mol. Eucaryotes; INSERM, Fac. Med., Strasbourg, France. 84-1737
28	170	198	**Waterfield M D, Scrace G T, Whittle N, Stroobant P, Johnsson A, Wasteson A, Westermark B, Heldin C-H, Huang J S & Deuel T F.** Platelet-derived growth factor is structurally related to the putative transforming protein $p28^{sis}$ of simian sarcoma virus. *Nature* 304:35-9, 1983. Imperial Cancer Res. Fund Labs., London, UK; Univ. Uppsala, Inst. Med. Physiol. Chem. & Dept. Pathol., Sweden; Washington Univ., Sch. Med., St. Louis, MO. 84-1033
23	67	90	**Weiher H, Konig M & Gruss P.** Multiple point mutations affecting the simian virus 40 enhancer. *Science* 219:626-31, 1983. Univ. Heidelberg, Inst. Microbiol., FRG; NIH, Lab. Mol. Virol., Bethesda, MD. 84-1737
13	52	65	**Weintraub H.** A dominant role for DNA secondary structure in forming hypersensitive structures in chromatin. *Cell* 32:1191-203, 1983. Fred Hutchinson Cancer Res. Ctr., Seattle, WA. 84-1223

A	B	C	D
21	45	66	**Weiss E H, Mellor A, Golden L, Fahrner K, Simpson E, Hurst J & Flavell R A.** The structure of a mutant *H-2* gene suggests that the generation of polymorphism in *H-2* genes may occur by gene conversion-like events. *Nature* 301:671-4, 1983. Natl. Inst. Med. Res., Lab. Gene Struct. Expression; Clin. Res. Ctr., London, UK; Biogen Inc., Cambridge, MA. 84-1707
8	56	64	**Wilbur W J & Lipman D J.** Rapid similarity searches of nucleic acid and protein data banks. *Proc. Nat. Acad. Sci. US—Biol. Sci.* 80:726-30, 1983. NIH, NIADDKD, Bethesda, MD. 84-2565
5	69	74	**Yamada K M.** Cell surface interactions with extracellular materials. *Annu. Rev. Biochem.* 52:761-99, 1983. NIH, NCI, Bethesda, MD. 84-3405
11	61	72	**Yuasa Y, Srivastava S K, Dunn C Y, Rhim J S, Reddy E P & Aaronson S A.** Acquisition of transforming properties by alternative point mutations within c-*bas/has* human proto-oncogene. *Nature* 303:775-9, 1983. NIH, NCI, Bethesda, MD. 84-4046
7	104	111	**Yunis J J.** The chromosomal basis of human neoplasia. *Science* 221:227-36, 1983. Univ. Minnesota, Med. Sch., Minneapolis, MN. 84-7956

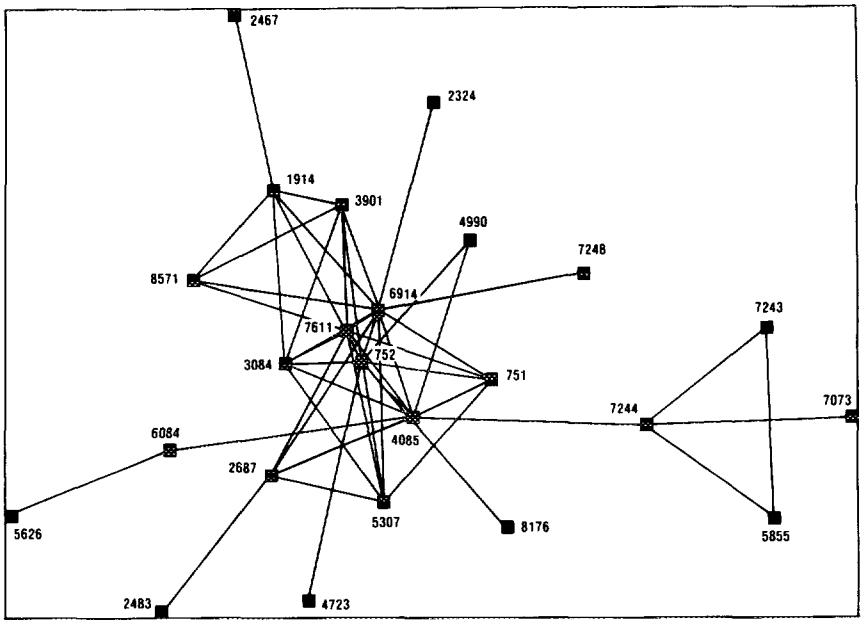
Table 2: The 1983 and 1984 *SCI®/SSCI®* research fronts that include at least two of the 1983 most-cited life-sciences papers as core documents. A = research-front number. B = research-front name. C = number of 1983 most-cited life-sciences papers included in the core of each research front. D = number of core documents. E = number of 1983-1984 citing documents.

A	B	C	D	E
83-1898	Kaposi's sarcoma, cytomegalovirus infection, immunological factors and other aspects of the pathogenesis of acquired immune deficiency syndrome in homosexual men and other populations	10	52	521
84-0171	Clinical aspects and characterization of human T-cell subsets	3	47	1206
84-0211	Role of chromosomal translocation, c-*myc* gene and other oncogenes in the expression of human cancer	6	20	540
84-0319	Phosphorylation and calcium binding of phorbol and inositol; stimulation of protein kinase release	7	58	519
84-0576	Gene amplification, expression of c-*myc* and other oncogenes and other genetic factors in oncogenesis	2	4	143
84-0658	Relationship of calcium channels to binding sites of dihydropyridine, nitrendipine and other calcium channel antagonists	2	16	257
84-0752	Clinical aspects of acquired immunodeficiency syndrome and Kaposi's sarcoma	8	37	594
84-0839	Epidemiological and clinical studies of spirochete-associated Lyme disease	2	55	270
84-1033	Role of polypeptide growth factors and protein kinases in normal and transformed epidermal cells	3	41	932
84-1223	Nuclease sensitive sequence sites, DNA methylation and other conformational and structural studies of genes and chromatin	2	25	598
84-1737	Factors regulating gene transcription and expression in human and animal cells	8	38	878
84-1914	Association of human T-cell leukemia virus and other retroviruses with leukemia lymphoma, acquired immunodeficiency syndrome and related immune disorders	6	41	608
84-2014	Receptor mediated endocytosis and intracellular processing of transferrin and other substances	4	57	1152
84-2565	Nucleotide sequences, DNA structure and gene expression in *Escherichia coli*, yeast and other systems	4	37	2445
84-2930	Experimental and clinical studies of pancreatic and hypothalamic growth hormone releasing factor and somatostatin in humans and rats	2	21	303
84-3078	Pertussis toxin inhibition and other studies of the inhibitory and stimulatory regulation of adenylate cyclase in relation to membrane receptor activity	2	26	524
84-4046	Characterization of human and murine cellular oncogenes	6	28	465
84-4265	Structure of nicotinic acetylcholine receptor and its channels	3	16	264
84-7956	Chromosome translocations in human leukemia and other types of cancer, and mapping of oncogenes on human chromosomes	3	3	211
84-8130	c-*myc* gene and other cellular and viral oncogenes involved in carcinogenetic transformation	2	4	196

AIDS Research

Fifteen of the papers in Table 1 deal with AIDS, confirming that research in this area has accelerated enormously. (In our study on the most-cited 1982 life-sciences articles, only 5 percent dealt with AIDS.[4]) In fact, had we examined the 1983 list earlier, we would have found that most of these papers had al-

Figure 1: Higher level map for cluster #84-0332, "Immunology and pathology of acquired immunodeficiency syndrome," showing the relationship of research fronts #84-0752 and #84-1914 from Table 2 to other AIDS-related research fronts.



Key

751 Immunological studies of acquired immunodeficiency syndrome
752 Clinical aspects of acquired immunodeficiency syndrome and Kaposi's sarcoma
1914 Association of human T-cell leukemia virus and other retroviruses with leukemia lymphoma, acquired immunodeficiency syndrome and related immune disorders
2324 Relationship of acquired immunodeficiency syndrome and related cell-mediated immune-response diseases to human T-cell antigens
2467 Use of monoclonal antibodies in diagnosis of cutaneous T-cell lymphoma, mycosis fungoides, Sezary syndrome and related lymphomas
2483 Monitoring of serum and urine levels of beta-2 microglobulin in patients with various cancers
2687 Beta-2 microglobulin in acquired immunodeficiency syndrome and hemophilia
3084 Kaposi's sarcoma in relation to acquired immunodeficiency syndrome and oncogenic potential of human cytomegalovirus
3901 Role of African type retrovirus in epidemiology of acquired immunodeficiency syndrome and Kaposi's sarcoma
4085 T-cell suppression and other immunoregulatory abnormalities in cytomegalovirus and other viral infections
4723 Diagnosis of toxoplasmosis infection in patients with acquired immunodeficiency syndrome and other immune system disorders
4990 Acquired immunodeficiency syndrome in hemophiliacs and other complications of transfusions in substitution therapy
5307 Interferon production in patients with acquired immunodeficiency syndrome and autoimmune diseases
5626 Biochemical analysis and clinical features of cytomegalovirus and other infectious diseases
5855 Role of Epstein-Barr virus and other herpes viruses in etiology of Burkitt's lymphoma, infectious mononucleosis and other lymphoid disease
6084 Occurrence of cytomegalovirus and other viral infections in renal-transplant recipients and other immunocompromised patients
6914 Basic and clinical studies of acquired immunodeficiency syndrome and related conditions

7073 Epstein-Barr virus induced lymphoma and other secondary malignancies and infections or other immunodeficiency conditions in patients treated with cyclosporine
7243 Epstein-Barr virus and its association with human malignant diseases
7244 Infectious mononucleosis and other human diseases associated with Epstein-Barr virus
7248 Isolation of type-D retrovirus from macaques with simian acquired immunodeficiency syndrome
7611 Epidemiology and diagnosis of acquired immunodeficiency syndrome and associated viral infections in homosexual men and immunosuppressed patients
8176 Clinical features and treatment of *Pneumocystis carinii* pneumonia in patients with acquired immunodeficiency syndrome
8571 Immunology and pathogenesis of acquired immunodeficiency syndrome and related viral infections

ready surfaced as highly cited within one year of publication. We may want to go back to our previous practice of identifying the previous year's highly cited papers shortly after we finish the annual *SCI* or even do the analysis based on the bimonthly cumulations of the *SCI*.

In the study of 1982 papers, only one research front dealt with AIDS.[4] For the 1983 study there are three, another reflection of the increase in intensity and range of AIDS studies. "Kaposi's sarcoma, cytomegalovirus infection, immunological factors and other aspects of the pathogenesis of acquired immune deficiency syndrome in homosexual men and other populations" (#83-1898) is the only 1983 front in Table 2, indicating there was immediate high co-citation activity for the core papers on this topic in 1983. The emphasis on AIDS research is not surprising since the disease, which has no cure as yet, has reached frightening proportions. At least 12,000 cases have been reported to the Centers for Disease Control (CDC) in Atlanta, Georgia, since 1981.[5] And in the preliminary list of 1984 research fronts, there are 24 AIDS fronts included in the area shown in Figure 1.

The AIDS virus is thought to prevent T-lymphocytes—the cells that mediate one part of the immune system's response—from acting normally, forcing them to become a factory for making more AIDS virus. However, not all individuals infected with the AIDS virus develop the disease.

Much of the recent highly cited French research seems to be devoted to AIDS. Of the four papers in Table 1 authored by researchers from French institutions, two deal with AIDS. In comparison, in the 1982 life-sciences study only two papers were authored by French scientists on subject matter not associated with AIDS. While I once observed that French science appeared to be in decline,[6] it would seem that, at least where AIDS is concerned, the French are reversing this trend. I suspect that future studies will confirm this trend in other fields.

In fact, the third most-cited paper in this study was authored by a French team of scientists led by L. Montagnier and F. Barré-Sinoussi at the Pasteur Institute in Paris. This 1983 paper, "Isolation of a T-lymphotropic retrovirus from a patient at risk for acquired immune deficiency syndrome (AIDS),"[7] is one of six in this study that are core documents in the research front "Association of human T-cell leukemia virus and other retroviruses with leukemia lymphoma, acquired immunodeficiency syndrome and related immune disorders" (#84-1914). Montagnier and colleagues present evidence for the existence of a new virus that has since been defined as the cause of AIDS. Listed under its first author, Barré-Sinoussi, in Table 1, this paper has already achieved Citation Classic status. We await the group's commentary.

In a similar study, the paper by Robert C. Gallo, National Cancer Institute, Bethesda, Maryland, and colleagues is core to research front #83-1898 as well as to the previously mentioned front #84-1914. This paper reported the isolation of a virus known as human T-cell leukemia virus (HTLV), considered to be associated with AIDS. They propose using this virus to determine the possible routes of transmission of AIDS. Transmission by blood transfusion, intrave-

nous drug administration, and sexual contact by sperm or saliva have been suggested.

In a 1984 paper, Gallo and colleagues[8] found a virus they called HTLV-III that has since been shown to be closely related to the virus discovered earlier by Montagnier's team.[7] While the French team was the first to detect the virus defined as the cause of AIDS, the priority of their discovery is often overlooked by the onslaught of attention by the press to the later US discovery of HTLV-III. It is of some comfort to citation analysts that the scholarly record reflects the immediate and high impact of the French work. In 1985 the French paper was cited 218 times.

Multiauthored Works

The 102 papers in Table 1 represent the work of 426 authors. Table 3 shows the number of authors per paper.

Fifty-six authors have more than one paper listed in Table 1. Gallo coauthored four, while eight other authors wrote three papers: M.J. Berridge, J.M. Bishop, C.M. Croce, J. Erikson, M. Popovic, J. Rivier, T.J. Spira, and W. Vale. Forty-seven authors have two papers listed.

Table 1 also includes four Nobel laureates. Three authors won the prize for medicine—Gerald M. Edelman in 1972, David Baltimore in 1975, and Bengt I. Samuelsson in 1982. Walter Gilbert won the 1980 prize for chemistry.

Table 3: The number of authors per paper for the 1983 life-sciences articles most cited in the *SCI®*, 1983-1984. A = number of authors. B = number of papers listing that number of authors.

A	B
24	1
13	1
12	4
11	3
10	2
9	3
8	3
7	6
6	10
5	13
4	13
3	16
2	9
1	18

Author Affiliations

The authors in this study were affiliated with 109 institutions from 11 countries. These institutions are listed in Table 4 in order of the number of times they appear in Table 1. Seventy-one of the institutions (65 percent) are located in the US, nine institutions in the UK, eight in Japan, six in France, five in the Federal Republic of Germany (FRG), three in Canada, and two each in Sweden and Switzerland. Australia, Belgium, and The Netherlands each account for one institution.

While authors of the papers in Table 1 are affiliated with institutions in 11 countries, all 102 papers were published in English. Table 5 provides the number of papers produced by the authors affiliated with institutions in each nation. US authors appeared in 78 papers, of which 70 were written entirely by a US team. The eight remaining were coauthored with researchers from Belgium, France, FRG, The Netherlands, Sweden, and the UK.

There are five articles this year by authors affiliated with institutions in Japan, compared to seven in the study of 1982 life-sciences papers.[4] In fact, this is the percentage of papers one would expect from Japan using the census of authors in ISI's *Current Bibliographic Directory®*, now called the *Current Contents® Address Directory*. Japanese authors accounted for 5.4 percent of all primary authors publishing 1983 articles.

The 102 papers in Table 1 were published in the 20 journals listed in Table 6, with 3 journals accounting for over half. They are *Nature*, with 25 papers, and *Cell* and *Science*, each with 14 papers. There are no surprises in this list, although the appearance of *Neuroendocrinology* may be a harbinger of the growth in this area. Table 6 also includes the 1983 impact factors that are calculat-

Table 4: The institutional affiliations of the authors on the list. Institutions are listed in descending order of the number of times they appear in Table 1.

NIH, Bethesda, MD		17
NCI	9	
NIAID	4	
Bethesda, MD	2	
Hamilton, MT	2	
Clin. Ctr.	2	
Lab. Mol. Virol.	1	
NIADDKD	1	
MIT, Cambridge, MA		12
Harvard Univ., MA		11
Boston	8	
Cambridge	3	
Univ. California, CA		7
San Francisco	5	
La Jolla	1	
Los Angeles	1	
CDC, Atlanta, GA		6
SUNY, NY		6
Stony Brook	5	
Brooklyn	1	
ARC, Cambridge, UK		5
Inst. Anim. Physiol.	2	
Unit Invertebrate Chem. Physiol.	2	
Unit Insect Neurophysiol. Pharmacol.	1	
Dana-Farber Cancer Inst., Boston, MA		5
Univ. Alabama in Birmingham, AL		5
Yale Univ., New Haven, CT		5
Cold Spring Harbor Lab., NY		4
Salk Inst. Biol. Stud., San Diego, CA		4
Univ. Cambridge, UK		4
Wistar Inst. Anat. Biol., Philadelphia, PA		4
Genentech, Inc., San Francisco, CA		3
Med. Coll. Wisconsin, Milwaukee, WI		3
Mem. Sloan-Kettering Cancer Ctr., NY		3
New York	2	
Rye	1	
Whitehead Inst. Biomed. Res., Cambridge, MA		3
Albert Einstein Coll. Med., Bronx, NY		2
Case Western Reserve Univ., Cleveland, OH		2
Sch. Med.	1	
Univ. Hosps.	1	
Fred Hutchinson Cancer Res. Ctr., Seattle, WA		2
Imperial Cancer Res. Fund Labs., London, UK		2
Inst. Pasteur, Paris, France		2
Karolinska Inst., Stockholm, Sweden		2
Keio Univ., Tokyo, Japan		2
Kyoto Univ., Japan		2
Kyushu Univ., Fukuoka, Japan		2
Litton Bionet., Inc., Kensington, MD		2
MRC, Cambridge, UK		2
Lab. Mol. Biol.	1	
Neurochem. Pharmacol. Unit	1	
Max Planck Soc. Adv. Sci., FRG		2
Inst. Biophys., Frankfurt on Main	1	
Inst. Exp. Med., Goettingen	1	
Montefiore Med. Ctr., Bronx, NY		2
Natl. Jewish Hosp. Res. Ctr., Denver, CO		2
NY Vet. Admin. Hosp., NY		2
NYU, NY		2
Rockefeller Univ., New York, NY		2
Stanford Univ., CA		2
State NY Dept. Hlth., NY		2
Albany	1	
Stony Brook	1	
Univ. Colorado, Denver, CO		2
Univ. Leuven, Belgium		2
Univ. Minnesota, MN		2
Minneapolis	1	
St. Paul	1	
Univ. Pennsylvania, Philadelphia, PA		2
Univ. Texas, Dallas, TX		2
Univ. Toronto, Canada		2
Univ. Uppsala, Sweden		2
Univ. Virginia, Charlottesville, VA		2
Univ. Washington, Seattle, WA		2
Univ. Zurich, Switzerland		2
US FDA, Bethesda, MD		2
Natl. Ctr. Drug. Biologics	1	
Off. Biologics	1	
Ajinomoto Co. Inc., Yokohama, Japan		1
Alabama State Crippled Child. Rehabil. Serv., Birmingham, AL		1
Baltimore City Hosps., MD		1
Baylor Coll. Med., Houston, TX		1
Biogen Inc., Cambridge, MA		1
Birmingham Vet. Admin. Med. Ctr., AL		1
Blood Ctr. SE Wisconsin, Milwaukee, WI		1
Brigham and Women's Hosp., Boston, MA		1
Caltech, Pasadena, CA		1
Cancer Inst., Tokyo, Japan		1
Carnegie-Mellon Univ., Pittsburgh, PA		1
Child.'s Hosp. Med. Ctr., Boston, MA		1
City of Hope Med. Ctr., Duarte, CA		1
City of Hope Res. Inst., Duarte, CA		1
Clayton Fdn. Res., La Jolla, CA		1
Clin. Res. Ctr., London, UK		1
CNRS, Strasbourg, France		1
Columbia Coll. Physns. Surgs., New York, NY		1
Dept. Hlth. Serv., Los Angeles, CA		1
Dept. Publ. Hlth., San Francisco, CA		1
Duke Univ., Durham, NC		1
Great Lakes Hemophilia Fdn., Milwaukee, WI		1
Hosp. Claude Bernard, Paris, France		1
Hosp. Pitie-Salpetriere, Paris, France		1
Hosp. Raymond Poincare, Garches, France		1
INSERM, Strasbourg, France		1
Inst. Cancer Res., London, UK		1
Japanese Fdn. Cancer Res., Tokyo, Japan		1
Johns Hopkins Univ., Baltimore, MD		1

Kobe Univ., Okazaki, Japan	1
LDS Hosp., Salt Lake City, UT	1
Mount Zion Hosp. Med. Ctr., San Francisco, CA	1
N. Cent. Bronx Hosp., NY	1
NJ Dept. Hlth., Trenton, NJ	1
NY City Dept. Hlth., NY	1
NY Hosp.-Cornell Med. Ctr., NY	1
Natl. Inst. Basic Biol., Okazaki, Japan	1
Natl. Inst. Med. Res., London, UK	1
Ontario Cancer Inst., Toronto, Canada	1
Pharma Res. Ctr., Wuppertal, FRG	1
Princess Margaret Hosp., Toronto, Canada	1
Roswell Park Mem. Inst., Buffalo, NY	1
St. Joseph's Hosp. Med. Ctr., Paterson, NJ	1
St. Michael's Med. Ctr., Newark, NJ	1
Tufts-N. Engl. Med. Ctr., Boston, MA	1
Tufts Univ., Boston, MA	1
Univ. Bayreuth, FRG	1
Univ. Berne, Switzerland	1
Univ. Birmingham, UK	1
Univ. Chicago, IL	1
Univ. Cologne, FRG	1
Univ. Heidelberg, FRG	1
Univ. London, UK	1
Univ. Med. Dent. NJ, Newark, NJ	1
Univ. Miami, FL	1
Univ. Michigan, Ann Arbor, MI	1
Univ. Pittsburgh, PA	1
Univ. Utah, Salt Lake City, UT	1
Univ. Utrecht, The Netherlands	1
Vet. Admin. Med. Ctr., San Francisco, CA	1
Walter and Eliza Hall Inst. Med. Res., Victoria, Australia	1
Washington Univ., St. Louis, MO	1

ed by dividing the 1983 citations to 1981 and 1982 articles in a journal by the number of articles published by that journal in those two years. It is interesting that the relative rankings by impact may not change but the overall impact of these journals is increasing somewhat each year. Keep in mind that the impact for multidisciplinary journals is lowered by the publication of papers from non-life-sciences subjects. And the impacts do not include an adjustment for citations to letters, which in a few cases may distort calculations, as in the *Lancet* or the *New England Journal of Medicine*. A more detailed study of impact for medical journals has been submitted for publication elsewhere.

The most-cited paper in this study, by geneticist Barbara J. Bachmann, Yale University School of Medicine, New Haven, Connecticut, is 1 of the 17 core papers in research front "Gene expression, signal sequence analysis, synthesis site and other regulation factors in protein processing and transport in *Escherichia coli* and other cells" (#84-1503). This research front is not included in Table 2 because Bachmann's paper is the only one of this core that reached the citation threshold for this study. However, the other 16 core papers were all cited at least 17 times. There were 1,054 papers published on this topic in 1984.

Published in *Microbiological Reviews*, Bachmann's "Linkage map of *Escherichia coli* K-12, edition 7" provides a comprehensive review of the experimental literature on mapping data published between June 1979 and July 1982 and of manuscripts of later-appearing papers received before publication. The paper was cited 200 times during the period 1983-84. The previous editions have also been well cited. For example, "Linkage map of *Escherichia coli* K-12, edition 6,"[9] published in 1980, was cited over 740 times between 1980 and 1984 and was one of the most-cited life-sciences articles published in 1980.[10]

Cancer Research

Cancer research continues at an active pace. The work of the late Oswald

Table 5: National affiliations of the authors of the 1983 life-sciences papers most cited in 1983-1984, in order of the total number of papers on which authors from each nation's institutions appeared (column A). B = number of papers coauthored with scientists from institutions from other countries. C = national affiliations of coauthors.

Country	A	B	C
US	78	8	Belgium, France, FRG, The Netherlands, Sweden, UK
UK	10	4	FRG, Sweden, US
FRG	5	2	UK, US
Japan	5	0	
France	4	2	US
Sweden	3	1	UK, US
Switzerland	3	0	
Australia	1	0	
Belgium	1	1	US
Canada	1	0	
The Netherlands	1	1	US

Table 6: The 20 journals represented on the list of 102 1983 life-sciences papers most cited in 1983-1984. The numbers in parentheses are the impact factors for the journals. (The 1983 impact factor equals the number of 1983 citations received by 1981-1982 articles in a journal divided by the number of articles published by the journal during the same period.) Data were taken from the 1983 *JCR®*. The figures at the right indicate the number of papers from each journal that appears on the list.

Journal	Number of Papers
Nature (9.3)	25
Cell (15.0)	14
Science (7.4)	14
Proc. Nat. Acad. Sci. US—Biol. Sci. (8.7)	12
N. Engl. J. Med. (16.5)	10
Ann. Intern. Med. (7.0)	5
Annu. Rev. Biochem. (26.9)	3
Biochem. J. (3.3)	3
J. Biol. Chem. (5.8)	2
J. Exp. Med. (11.1)	2
Microbiol. Rev. (9.4)	2
Nucl. Acid. Res. (6.4)	2
J. Cell Biol. (9.2)	1
J. Immunol. (6.5)	1
J. Mol. Biol. (6.7)	1
JAMA—J. Am. Med. Assn. (3.4)	1
Lancet (12.3)	1
Meth. Enzymology (1.3)	1
Neuroendocrinology (3.3)	1
Trends Biochem. Sci. (3.5)	1

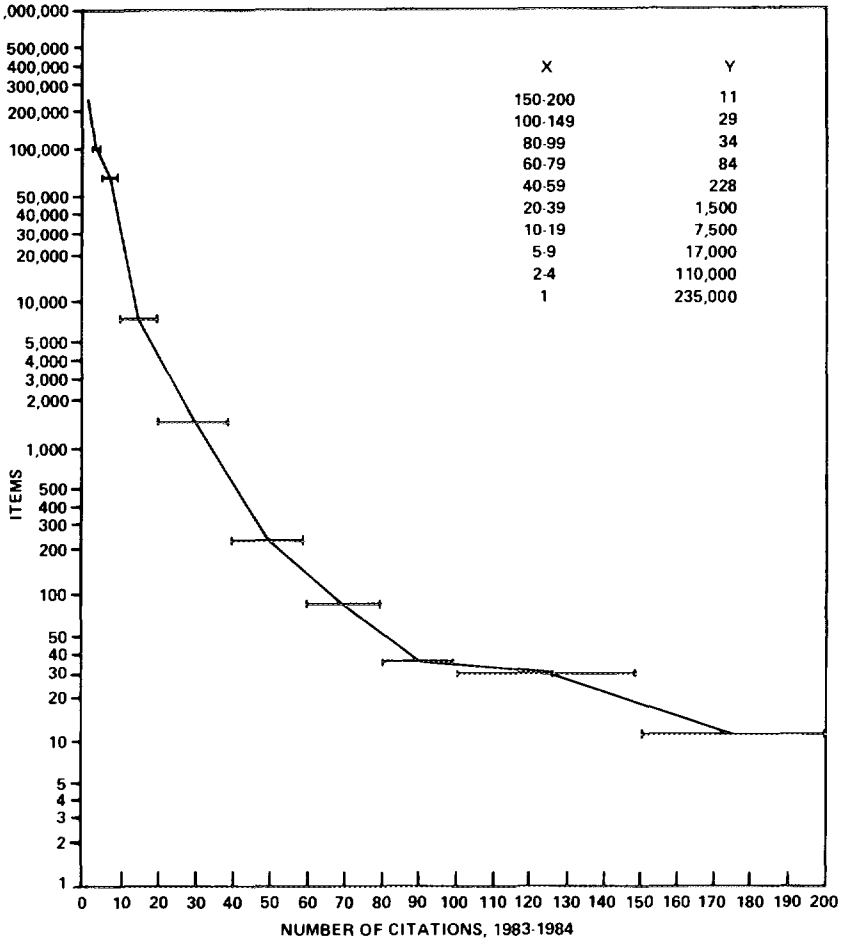
T. Avery, then at Rockefeller, continues to have an impact on modern research.[11] His 1944 discovery that genes are made of DNA initiated a cascade of experiments—from the Watson and Crick paper delineating the double-helix structure of DNA[12] to today's investigations of oncogenes, those strings of nucleic acids found in all cells that can produce unrestrained growth in cell culture. I recently discovered a marvelous description of Avery's impact on today's research by Lewis Thomas, that science popularizer extraordinaire.[13]

The paper by Hartmut Land, Luis F. Parada, and Robert A. Weinberg, MIT and Whitehead Institute for Biomedical Research, Cambridge, Massachusetts, was cited 173 times. "Tumorigenic conversion of primary embryo fibroblasts requires at least two cooperating oncogenes" is a core document in research front "c-*myc* gene and other cellular and viral oncogenes involved in carcinogenetic transformation" (#84-8130). The paper attempts to unravel the puzzle of carcinogenesis.

Carcinogenesis is the transformation of healthy cells into tumor cells. It is thought to be a process involving multiple, independent steps at the genetic level. Each step may require the activation of a distinct gene, and the final carcinogenic effect requires the cooperation of many previously activated genes. However, Land and colleagues found that carcinogenesis requires the cooperation of two types of oncogenes (genes that transform normal cells into malignant cells) to cause tumorigenesis in the embryo fibroblast, a prototype cell of connective tissue. These two oncogene types together achieve an effect that neither is able to achieve alone. These findings of multiple oncogene cooperation suggest that the number of distinct steps in carcinogenesis is limited and that each step may soon be described at the molecular level.

Three papers in this study are core to the *SCI/SSCI* research front "Role of polypeptide growth factors and protein kinases in normal and transformed epidermal cells" (#84-1033). This front includes the second most-cited paper in this study, by Michael D. Waterfield, Imperial Cancer Research Fund Laboratories, London, and nine other colleagues. This Citation Classic was cited 198 times in 1983 and 1984 and has already been cited 109 times in the first half of 1985. The paper "Platelet-derived growth factor is structurally related to the putative transforming protein $p28^{sis}$ of simian sarcoma virus" investigates the relationship between tumor cells and platelet-derived growth factor (PDGF), a substance thought to be involved in tissue-repair processes. The group at Imperial Cancer Research Fund Labs, whose director is Walter Bodmer, determined a partial sequence of amino acids (molecular building blocks) for PDGF. Understanding its structure is important because abnormal expression of PDGF

Figure 2: Citation frequency distribution for papers published in 1983. Items were tabulated for ranges of citations. The midpoint of each citation range is plotted. The horizontal bars through the points indicate the actual ranges. The table of values shows the actual ranges of citation values (x) and of number of items (y).



X	Y
150-200	11
100-149	29
80-99	34
60-79	84
40-59	228
20-39	1,500
10-19	7,500
5-9	17,000
2-4	110,000
1	235,000

may lead to uncontrolled growth by tumor cells.

In a related study, the paper by Russell F. Doolittle, University of California, San Diego, La Jolla, and colleagues demonstrates that an oncogene and a platelet-derived growth factor have extensive sequence similarity, showing that the two are derived evolutionarily from the same gene. In the paper "Simian sarcoma virus *onc* gene, v-*sis*, is derived from the gene (or genes) encoding a platelet-derived growth factor," the authors propose that the mechanism by which the oncogene transforms cells may involve a protein with functions similar to those of a factor active during normal cell growth. Like the Waterfield paper, this paper is core to research front #84-1033. It was cited 166 times in 1983-1984 and 122 times in the first half of 1985.

Let me reiterate that this list of 102 papers only scratches the surface of the im-

portant work reported throughout the world. Over 560,000 papers are indexed by the *SCI* alone each year, 400,000 of which are actually cited. We could not justify the space to list here even the less than 1 percent, or 4,000 papers, cited at least 15 times in the subsequent two-year period. Figure 2 shows that the 102 articles from this study constitute less than one-thirtieth of these 4,000 papers. Possibly this listing could be done in a separate feature of *CC* in the future. By listing 100 papers each week, we could cover a lot of interesting material. For the time being, however, we believe it is a higher priority to continue with our series of most-cited Citation Classics.

This concludes our study on the 1983 life-sciences papers most cited in 1983 and 1984. The next essay in this series will examine the physical sciences.

* * * * *

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