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Current Comments®

Journal Citation Studies. 42. Analytical Chemistry Journals— What They Cite and What Cites Them

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We've published many studies of journal citation patterns covering various fields of science, social sciences, and arts and humanities. Recently, we presented data on journals in entomology,[1] anthropology,[2] and earth sciences.[3] I've often commented on different aspects of the chemical literature, since ISI® publishes *Current Abstracts of Chemistry and Index Chemicus*® (*CAC&IC*®).[4] In earlier studies, we looked at citation patterns in individual journals, such as *Journal of the American Chemical Society*, *Biochemistry*, and *Journal of Chemical Physics*, for example,[5,6] rather than groups of journals. This study of analytical chemistry journals is the first time we've done the type of in-depth analysis where we treat the "core" journals in a unified manner. In the near future, we'll do the same type of analysis for physical chemistry as well as astrosciences.

This study coincides with the centennial of the Association of Official Analytical Chemists (AOAC). The AOAC has scheduled a spring workshop to be held in Philadelphia from April 30 to May 2. Among the topics to be discussed at this meeting are: immunoligand, chromatographic, and instrumental techniques; drug delivery systems; drug metabolism; genetic toxicology; environmental contamination; robotics in laboratory automation; forensic science; and adulteration and food analysis. The last topic is especially relevant in light of the current controversy surrounding grains treated with ethylene dibromide (EDB), a cancer-causing agent. For more information on the AOAC spring workshop, contact the program chairman, Walter Fiddler, US Department of Agriculture, 600 East Mermaid Lane, Philadelphia, Pennsylvania 19118; telephone: (215) 233-6502.

Analytical chemistry deals with the characterization and measurement of the composition of matter in solid, liquid, or gaseous form. One of the earliest applications of analytical chemistry was to determine the purity of gold and silver samples. Crude analytical methods have been traced back to ancient Babylonian times—as early as 2600 BC. More sophisticated methods, including titration, flame tests, bead tests, etc., were developed in Britain, France, and Germany in the seventeenth through nineteenth centuries. The methods were used to analyze a wide variety of elements, metals, alloys, and compounds.[7]

In the US, analytical chemistry developed in the late nineteenth century, when chemical fertilizers were first introduced. Certain states passed laws requiring manufacturers to provide labels showing the amounts of nitrogen, potash, and phosphorus in their fertilizers. The AOAC, then known as the Association of Official *Agricultural* Chemists, was established in 1884 to standardize the methods of chemical fertilizer analyses. Harvey Wiley, one of the founders of AOAC, was also a central figure in the passage of the Pure Food and Drug Act of 1906. One of its main objectives was

to combat the adulteration or contamination of food and drugs.[8]

So analytical chemistry has a long and international history. This is reflected in the list of 28 analytical chemistry journals indexed in *Science Citation Index®* (*SCI®*) that are included in this study (see Table 1). Nine of these "core" journals are published in the US. The Federal Republic of Germany, the Netherlands, Switzerland, and the UK each publish three of the journals listed. Spain accounts for two journals, while Austria, France, Japan, Poland, and the USSR each publish one of the core journals. *Journal of Analytical Chemistry of the USSR* is a cover-to-cover translation of *Zhurnal Analiticheskoi Khimii*.

Table 1 also shows the year each journal began publication. Several existed before the dates shown but under different titles, or as parts of a larger journal that subsequently split into separate sections. For example, the *Journal of the Association of Official Agricultural Chemists* began publication in 1915 but changed its name to *Journal of the Association of Official Analytical Chemists* in 1966. In this study, journals that changed names or split are combined under the current title.

As in previous studies, we'll consider the core journals analyzed here as if they were a single "Macro Journal of Analytical Chemistry." We'll examine what this macro journal cites and, in turn, what cites it. Data are taken from the 1982 *Journal Citation Reports®* (*JCR™*), which is volume 14 of *SCI*. Incidentally, this volume can be purchased separately.

The 28 core analytical chemistry journals published 6,000 articles in 1982. This represents 1.6 percent of the 380,000 research articles included in the 1982 *JCR*. The core journals cited about 115,600 references that year, or 1.5 percent of the eight million references processed in *JCR*. Thus, the average analytical chemistry article cited about 19 references, as compared to 21 for the average *JCR* article.

Table 1: Core analytical chemistry journals indexed by *SCI®* and the year each began publication.

Afinidad—1924
Anales de Quimica Serie B—Quimica Inorganica y Quimica Analytica—1980
Analusis—1972
Analyst—1877
Analytica Chimica Acta—1947
Analytical Chemistry—1947
Analytical Letters Parts A & B—1967
Bunseki Kagaku—1952
Chemia Analityczna—1956
Chromatographia—1968
CRC Critical Reviews in Analytical Chemistry—1970
Fresenius Zeitschrift für Analytische Chemie—1947
International Journal of Environmental Analytical Chemistry—1971
Journal of Analytical Chemistry of the USSR—1952
Journal of Chromatographic Science—1969
Journal of Chromatography—1958
Journal of Electroanalytical Chemistry and Interfacial Electrochemistry—1967
Journal of High Resolution Chromatography & Chromatography Communications—1978
Journal of Liquid Chromatography—1978
Journal of Radioanalytical Chemistry—1968
Journal of the Association of Official Analytical Chemists—1966
Microchemical Journal—1957
Mikrochimica Acta—1966
Radiochemical and Radioanalytical Letters—1969
Separation and Purification Methods—1972
Separation Science and Technology—1978
Talanta—1958
TRAC—Trends in Analytical Chemistry—1981

Articles in the core *received* nearly 82,000 citations in 1982—about one percent of the total processed in *JCR*. Just two core journals account for 52 percent of these citations—*Analytical Chemistry* (23,500) and *Journal of Chromatography* (18,300). The same two journals also account for 36 percent of all papers published by the core group in 1982. The analytical chemistry journals dramatically demonstrate the "concentration effect" that applies to the scientific literature in general—a small number of journals accounts for the majority of citations and published articles.[9]

Table 2 shows the 50 journals most frequently cited *by* the core analytical chemistry journals in 1982. They are ranked by the number of core citations they received (column A). Also shown are the number of citations from *all* journals (column B), each journal's self-citations (column C), impact factor (column G), immediacy index (column H), and the number of source items each journal published in 1982 (column I). Impact indicates how often articles published in the previous two years were cited in the year studied. Immediacy measures the impact of a journal's articles in the same year they were published.

The 50 journals in Table 2 *received* about 57,200 citations from the core analytical chemistry journals. This represents 50 percent of all references cited

Table 2: The 50 journals most cited by core analytical chemistry journals in 1982. An asterisk indicates a core journal. A = citations received from core journals. B = citations received from all journals. C = self-citations. D = percent of citations from all journals that are core journal citations (A/B). E = percent of citations from all journals that are self-citations (self-cited rate, C/B). F = percent of core citations that are self-citations (C/A). G = impact factor. H = immediacy index. I = 1982 source items.

	A	B	C	D	E	F	G	H	I
*Anal. Chem.	10,243	23,406	3910	43.8	16.7	38.2	3.71	.59	691
*J. Chromatogr.	9833	18,259	5064	53.9	27.7	51.5	2.00	.45	1454
*Anal. Chim. Acta	3874	6667	953	58.1	14.3	24.6	2.45	.25	430
*J. Electroanal. Chem. Interfac.	2612	6557	1859	39.8	28.4	71.2	2.15	.45	371
J. Amer. Chem. Soc.	2296	111,901	—	2.1	—	—	4.72	.90	1835
*Fresenius Z. Anal. Chem.	1641	3048	499	53.8	16.4	30.4	1.23	.32	267
*Talanta	1625	2784	349	58.4	12.5	21.5	1.40	.18	218
*J. Chromatogr. Sci.	1588	2469	156	64.3	6.3	9.8	3.43	.25	99
*Analyst	1468	2970	301	49.4	10.1	20.5	1.40	.19	229
*J. Anal. Chem.—USSR	1216	1995	410	61.0	20.6	33.7	.54	.04	222
Anal. Biochem.	1157	22,737	—	5.1	—	—	2.88	.36	572
*J. Assn. Offic. Anal. Chem.	1081	2665	543	40.6	20.4	50.2	.84	.18	240
*Chromatographia	1008	1410	192	71.5	13.6	19.1	1.69	.18	206
Clin. Chem.	956	10,120	—	9.5	—	—	3.16	.69	408
*J. High Res. Chromatogr.	824	995	273	82.8	27.4	33.1	—	—	—
*J. Radioanal. Chem.	821	1412	419	58.1	29.7	51.0	.69	.15	232
J. Phys. Chem.	813	22,314	—	3.6	—	—	2.44	.57	898
J. Pharm. Sci.	719	7201	—	10.0	—	—	1.16	.25	349
*Bunseki Kagaku	670	985	119	68.0	12.1	17.8	.54	.10	265
*Anal. Lett. Pts. A & B	612	1248	39	49.0	3.1	6.4	1.18	.15	134
*J. Liq. Chromatogr.	607	1026	134	59.2	13.1	22.1	1.90	.15	188
J. Biol. Chem.	573	131,922	—	.4	—	—	5.87	1.18	2380
Nature	533	110,923	—	.5	—	—	8.75	2.10	1362
*Mikrochim. Acta	526	872	86	60.3	9.9	16.4	.94	.11	100
J. Electrochem. Soc.	521	10,401	—	5.0	—	—	1.95	.33	602
Clin. Chim. Acta	504	8973	—	5.6	—	—	1.78	.27	379
J. Chem. Phys.	502	71,173	—	.7	—	—	2.95	.63	1714
Spectrochim. Acta Pt. B—At. Spec.	496	1166	—	42.5	—	—	2.47	.22	96
Science	495	70,867	—	.7	—	—	6.81	1.73	988
Appl. Spectrosc.	491	1693	—	29.0	—	—	2.42	.24	140
Biochim. Biophys. Acta	467	71,656	—	.7	—	—	2.65	.48	2213
J. Inorg. Nucl. Chem.	427	6102	—	7.0	—	—	.68	—	—
Electrochim. Acta	423	2969	—	14.3	—	—	1.14	.20	256
Amer. Lab.	403	630	—	64.0	—	—	1.05	.09	143
J. Agr. Food Chem.	403	5385	—	7.5	—	—	1.20	.34	320
Bull. Chem. Soc. Jpn.	387	10,452	—	3.7	—	—	.99	.27	912
Biochem. J.	365	38,440	—	1.0	—	—	3.38	.69	791
Nucl. Instrum. Method. Phys. Res.	365	8035	—	4.5	—	—	1.17	.35	1058
Environ. Sci. Technol.	353	3345	—	10.6	—	—	1.81	.32	213
*Radiochem. Radioanal. Lett.	348	749	168	46.5	22.4	48.3	.48	.13	207
Biomed. Mass. Spectrom.	344	1250	—	27.5	—	—	2.32	.36	92
Zavod. Lab.	332	970	—	34.2	—	—	.18	.02	163
*Separ. Sci. Technol.	310	563	146	55.1	25.9	47.1	.76	.36	88
Elektrokhimiya	308	1784	—	17.3	—	—	.34	.18	208
Inorg. Chem.	302	22,487	—	1.3	—	—	2.90	.56	888
J. Chem. Soc.	283	13,236	—	2.1	—	—	—	—	—
Biochemistry—USA	268	46,682	—	.6	—	—	4.50	.86	1045
Collect. Czech. Chem. Commun.	268	3936	—	6.8	—	—	.59	.32	366
*Chem. Anal.	255	449	—	56.8	—	—	.32	—	—
Surface Sci.	254	13,318	—	1.9	—	—	3.59	.65	538

by the core in 1982. Twenty of these journals are themselves members of the core group. They are indicated by asterisks. Fifty-one percent of the citations these 20 journals received in 1982 came from the core journals. *Journal of High Resolution Chromatography & Chromatography Communications* is the core journal with the highest percentage of its overall citations from core journals—83 percent of the 995 citations it received in 1982.

Analytical Chemistry has the highest impact of the 28 core journals—3.7. *Journal of Chromatographic Science* follows at 3.4, followed by *Analytica Chimica Acta* (2.5), and *Journal of Electroanalytical Chemistry and Interfacial Electrochemistry* (2.2). *CRC Critical Reviews in Analytical Chemistry* (2.0) does not appear in Table 2. It was cited only 91 times by the core group in 1982. This is 163 short of the 254 cutoff.

Impact is determined by dividing the number of 1982 citations to a journal's 1980 and 1981 articles by the combined number of articles it published in those two years. We are aware that the way impact is calculated may be biased in favor of "fast moving" fields, such as biochemistry or molecular biology. Papers in some fields are cited very soon after publication, but the same may not be true of other fields, such as mathematics or geosciences. That is, the "peak" citation year may be later than the two-year base used in this study.

The *JCR* reports data on a journal's "half-life," which indicates the median age for a given field's cited and citing literature. Table 3 shows half-lives for the core analytical chemistry journals. Column A gives each journal's cit*ed* half-life—that is, the median age of articles from each journal which were cited in 1982. For example, *Afinidad*'s cited half-life is 3.1 years. Thus, half of the citations this journal *received* in 1982 were to articles it published over the past three years, from 1980 to 1982. One has to be careful in interpreting half-life. Many journals are now much larger than they were even a decade ago.

Table 3: 1982 *SCI*® cit*ed* and cit*ing* half-lives of core analytical chemistry journals. Journals with no listing either received less than 100 citations in 1982, or gave out less than 100 citations in 1982. A = cit*ed* half-life. B = cit*ing* half-life. C = core analytical chemistry journal.

A	B	C
3.1	>10.0	Afinidad
—	>10.0	An. Quim. B—Inorg. Anal.
3.8	6.7	Analusis
8.2	8.2	Analyst
5.0	5.6	Anal. *Chim. Acta*
7.6	2.8	Anal. Chem.
5.1	6.4	Anal. Lett. Pts. A & B
5.4	7.3	Bunseki Kagaku
6.9	—	Chem. Anal.
5.0	5.2	Chromatographia
4.3	6.0	CRC Crit. Rev. Anal. Chem.
5.3	5.7	Fresenius Z. Anal. Chem.
3.1	5.4	Int. J. Environ. Anal. Chem.
7.0	7.5	J. Anal. Chem.—USSR
4.3	5.0	J. Chromatogr.
5.2	5.8	J. Chromatogr. Sci.
5.3	7.3	J. Electroanal. Chem. Interfac.
—	—	J. High Res. Chromatogr.
2.6	4.5	J. Liq. Chromatogr.
5.0	8.3	J. Radioanal. Chem.
7.1	5.8	J. Assn. Offic. Anal. Chem.
4.5	9.6	Microchem. J.
6.6	>10.0	Mikrochim. Acta
4.5	8.6	Radiochem. Radioanal. Lett.
—	5.6	Separ. Purif. Method.
4.9	8.2	Separ. Sci. Technol.
7.3	8.1	Talanta
—	—	TRAC—Trend. Anal. Chem.

Cit*ing* half-life, shown in column B in Table 3, indicates the age of the literature that each journal cites. Again, citing half-life is the median age of the literature cited *by* a journal. A figure greater than ten means that more than 50 percent of a journal's 1982 references cited articles published before 1973, as is the case with *Afinidad*. *Analytical Chemistry* has the shortest citing half-life of all the core journals. Half of its 1982 references were to articles published between 1980 and 1982.

Analytical Chemistry ranks first in immediacy, at .59, as well as in impact. Immediacy is calculated by dividing the number of citations a journal's 1982 articles received by the number of articles published in 1982. The *Journal of Chromatography* (.45) and *Journal of Electroanalytical Chemistry and Interfacial Electrochemistry* (.45) are followed by

Table 4: The 50 journals which most frequently cited core analytical chemistry journals in 1982. An asterisk indicates a core journal. A = citations to core journals. B = citations to all journals. C = self-citations. D = percent of total citations that are core journal citations (A/B). E = percent of total citations that are self-citations (self-citing rate, C/B). F = percent of citations to core journals that are self-citations (C/A). G = impact factor. H = immediacy index. I = 1982 source items.

	A	B	C	D	E	F	G	H	I
*Anal. Chem.	9113	27,006	3910	33.7	14.5	42.9	3.71	.59	691
*J. Chromatogr.	8381	24,013	5064	34.9	21.1	60.4	2.00	.45	1454
*Anal. Chim. Acta	3387	8082	953	41.9	11.8	28.1	2.45	.25	430
*J. Electroanal. Chem. Interfac.	2278	7968	1859	28.6	23.3	81.6	2.15	.45	371
*Talanta	1923	4589	349	41.9	7.6	18.2	1.40	.18	218
*Chromatographia	1656	3123	192	53.0	6.2	11.6	1.69	.18	206
*Fresenius Z. Anal. Chem.	1537	4254	499	36.1	11.7	32.5	1.23	.32	267
*Analyst	1395	3289	301	42.4	9.2	21.6	1.40	.19	229
*J. Liq. Chromatogr.	1393	3466	134	40.2	3.9	9.6	1.90	.15	188
*Bunseki Kagaku	1062	2127	119	49.9	5.6	11.2	.54	.10	265
*J. High Res. Chromatogr.	948	1987	273	47.7	13.7	28.8	—	—	—
*J. Assn. Offic. Anal. Chem.	936	2697	543	34.7	20.1	58.0	.84	.18	240
*J. Radioanal. Chem.	899	4020	419	22.4	10.4	46.6	.69	.15	232
*J. Chromatogr. Sci.	757	1621	156	46.7	9.6	20.6	3.43	.25	99
Chem. Listy	724	4122	—	17.6	—	—	.41	.10	80
*CRC Crit. Rev. Anal. Chem.	697	2012	3	34.6	.2	.4	2.03	.25	8
Anal. Biochem.	672	10,987	—	6.1	—	—	2.88	.36	572
Electrochim. Acta	641	5102	—	12.6	—	—	1.14	.20	256
Prog. Anal. Atom. Spectrosc.	585	1653	—	35.4	—	—	—	—	—
*J. Anal. Chem.—USSR	579	2976	410	19.5	13.8	70.8	.54	.04	222
J. Amer. Chem. Soc.	568	56,674	—	1.0	—	—	4.72	.90	1835
Pure Appl. Chem.	563	7906	—	7.1	—	—	2.03	.45	188
*Anal. Lett. Pt. A & Pt. B	544	1814	39	30.0	2.1	7.2	1.18	.15	134
*Analusis	530	1374	47	38.6	3.4	8.9	.54	.18	73
Clin. Chem.	478	9400	—	5.1	—	—	3.16	.69	408
J. Electrochem. Soc.	436	11,564	—	3.8	—	—	1.95	.33	602
*Mikrochim. Acta	422	1117	86	37.8	7.7	20.4	.94	.11	100
Appl. Spectrosc.	419	2182	—	19.2	—	—	2.42	.24	140
Spectrochim. Acta Pt. B—At. Spec.	401	1815	—	22.1	—	—	2.47	.22	96
Bull. Chem. Soc. Jpn.	395	15,759	—	2.5	—	—	.99	.27	912
J. Pharm. Sci.	374	6691	—	5.6	—	—	1.16	.25	349
Biochim. Biophys. Acta	368	68,118	—	.5	—	—	2.65	.48	2213
*Radiochem. Radioanal. Lett.	356	2120	168	16.8	7.9	47.2	.48	.13	207
*Separ. Sci. Technol.	355	1659	146	21.4	8.8	41.1	.76	.36	88
J. Water Pollut. Contr. Fed.	348	8448	—	4.1	—	—	.89	.16	178
J. Biol. Chem.	347	79,759	—	.4	—	—	5.87	1.18	2380
*Microchem. J.	337	918	84	36.7	9.2	24.9	.83	.11	79
Int. J. Mass Spectrom. Ion Phys.	329	3076	—	10.7	—	—	1.81	.39	111
J. Agr. Food Chem.	325	5410	—	6.0	—	—	1.20	.34	320
Environ. Sci. Technol.	324	5089	—	6.4	—	—	1.81	.32	213
Collect. Czech. Chem. Commun.	299	6372	—	4.7	—	—	.59	.32	366
Inorg. Chem.	287	25,350	—	1.1	—	—	2.90	.56	888
J. Phys. Chem.	284	28,408	—	1.0	—	—	2.44	.57	898
ACS Symp. Ser.	279	16,457	—	1.7	—	—	.56	.14	616
J. Indian Chem. Soc.	273	5716	—	4.8	—	—	.27	.03	384
Biomed. Mass Spectrom.	272	1904	—	14.3	—	—	2.32	.36	92
*Int. J. Environ. Anal. Chem.	267	989	19	27.0	1.9	7.1	1.27	.12	57
Bull. Soc. Chim. Fr.	262	3895	—	6.7	—	—	.54	.13	132
Indian J. Chem. Sect. A	261	4917	—	5.3	—	—	.38	.06	354
Ind. Lab.—Engl. Tr.	232	1945	—	11.9	—	—	.01	.00	163

Separation Science and Technology (.36), *Fresenius Zeitschrift für Analytische Chemie* (.32), and *Analytica Chimica Acta*, *CRC Critical Reviews in Analytical Chemistry*, and *Journal of Chromatographic Science*, each with an immediacy of .25.

Table 4 lists the 50 journals that most frequently cited the core analytical chemistry journals in 1982. These 50 represent just two percent of the 2,200 journals that cited the core that year. Yet they account for 62 percent of the 82,000 citations received by the core in 1982.

Twenty-three of the journals in Table 4 are core journals. Again, they are indicated by asterisks. Of the 113,000 references these 23 journals cited in 1982, 35 percent were to the core group. *Chro-*

matographia has the highest percentage of its references to the core group. Of the 3,100 references cited in its 1982 articles, 53 percent were to the core journals. The 27 *non*-core journals in Table 4 cited 400,000 references in 1982, and only three percent of these were to the core journals.

Another important factor in journal analyses is the number of "superstar" articles they publish. The 62 most-cited articles from the core analytical chemistry journals are listed in Table 5 in alphabetical order by first author. Also shown are the number of citations each received from 1961 through 1982 in *SCI*. We were also able to add citations from 1955 through 1960 to papers published in 1960 and earlier, shown in parentheses.

Table 5 includes only those 62 articles cited 300 times or more. Six of the 28 core journals met or exceeded this threshold. *Analytical Chemistry* dominates the list, accounting for 48 papers. *Analyst* and *Journal of Chromatography* each published five of the most-cited papers, the *Journal of the Association of Official Analytical Chemists* published two, and *Analytica Chimica Acta* and *Fresenius Zeitschrift für Analytische Chemie* each account for one paper.

The most-cited paper, by D.H. Spackman, W.H. Stein, and S. Moore, Rockefeller Institute for Medical Research,

Table 5: The 62 most-cited articles from the core analytical chemistry journals cited 300 or more times, 1961-1982 *SCI*®, in alphabetical order by first author. We have added (in parentheses) the additional citations to the papers published in 1960 and earlier.

Citations 1961-1982		Bibliographic Data
301		**Albee A L & Ray L.** Correction factors for electron probe microanalysis of silicates, oxides, carbonates, phosphates, and sulfates. *Anal. Chem.* 42:1408-14, 1970.
678	(16)	**Bencze W L & Schmid K.** Determination of tyrosine and tryptophan in proteins. *Anal. Chem.* 29:1193-6, 1957.
395		**Bergman I & Loxley R.** Two improved and simplified methods for the spectrophotometric determination of hydroxyproline. *Anal. Chem.* 35:1961-5, 1963.
581		**Bruno G A & Christian J E.** Determination of carbon-14 in aqueous bicarbonate solutions by liquid scintillation counting techniques. *Anal. Chem.* 33:1216-8, 1961.
3809	(48)	**Chen P S, Toribara T Y & Warner H.** Microdetermination of phosphorus. *Anal. Chem.* 28:1756-8, 1956.
353	(60)	**Cifonelli J A & Smith F.** Detection of glycosides and other carbohydrate compounds on paper chromatograms. *Anal. Chem.* 26:1132-4, 1954.
371		**Currie L A.** Limits for qualitative detection and quantitative determination. *Anal. Chem.* 40:586-93, 1968.
351	(60)	**Dixon J S & Lipkin D.** Spectrophotometric determination of vicinal glycols. *Anal. Chem.* 26:1092-3, 1954.
6052	(63)	**Dubois M, Gilles K A, Hamilton J K, Rebers P A & Smith F.** Colorimetric method for determination of sugars and related substances. *Anal. Chem.* 28:350-6, 1956.
600	(1)	**Gelotte B.** Studies on gel filtration: sorption properties of the bed material Sephadex. *J. Chromatogr.* 3:330-42, 1960.
359	(31)	**Gordon H T, Thornburg W & Werum L N.** Rapid paper chromatography of carbohydrates and related compounds. *Anal. Chem.* 28:849-55, 1956.
564	(17)	**Gran G.** Determination of the equivalence point in potentiometric titrations. Part II. *Analyst* 77:661-71, 1952.
521		**Hamilton P B.** Ion exchange chromatography of amino acids. *Anal. Chem.* 35:2055-64, 1963.
556		**Hatch W R & Ott W L.** Determination of sub-microgram quantities of mercury by atomic absorption spectrophotometry. *Anal. Chem.* 40:2085-7, 1968.
478	(2)	**Herberg R J.** Determination of carbon-14 and tritium in blood and other whole tissues. *Anal. Chem.* 32:42-6, 1960.
335		**Huang T C, Chen C P, Wefler V & Raftery A.** A stable reagent for the Liebermann-Burchard reaction. *Anal. Chem.* 33:1405-7, 1961.
529		**Huisman T H J & Dozy A M.** Studies on the heterogeneity of hemoglobin. IX. The use of tris-(hydroxymethyl)aminomethane-HCl buffers in the anion-exchange chromatography of hemoglobins. *J. Chromatogr.* 19:160-9, 1965.
334		**Hutchison W C & Munro H N.** The determination of nucleic acids in biological materials—a review. *Analyst* 86:768-813, 1961.
447		**Jeffay H & Alvarez J.** Liquid scintillation counting of carbon-14. *Anal. Chem.* 33:612-5, 1961.
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The second and third most-cited papers were also published in *Analytical Chemistry*, both in 1956. The paper by M. Dubois and colleagues, University of Minnesota, St. Paul, "Colorimetric method for determination of sugars and related substances," was cited in over 6,100 publications from 1956 through 1982.

The paper by P.S. Chen, T.Y. Toribara, and H. Warner, University of Rochester School of Medicine and Den-

Table 6: The 26 most-cited articles from *Journal of the Association of Official Analytical Chemists* cited 80 or more times, 1961-1982 *SCI*®, in alphabetical order by first author. We have added (in parentheses) the additional citations to the papers published in 1960 and earlier.

Citations 1961-1982		Bibliographic Data
183		**Armour J A & Burke J A.** Method for separating polychlorinated biphenyls from DDT and its analogs. *J. Assn. Offic. Anal. Chem.* 53:761-8, 1970.
93		**Bowman M C & Beroza M.** Extraction *p*-values of pesticides and related compounds in six binary solvent systems. *J. Assn. Offic. Agr. Chem.* 48:943-52, 1965.
81		**Burke J A & Holswade W.** A gas chromatographic column for pesticide residue analysis: retention times and response data. *J. Assn. Offic. Anal. Chem.* 49:374-85, 1966.
153		**Eppley R M.** Screening method for zearalenone, aflatoxin, and ochratoxin. *J. Assn. Offic. Anal. Chem.* 51:74-8, 1968.
93		**Fazio T, White R H, Dusold L R & Howard J W.** Food additives. Nitrosopyrrolidine in cooked bacon. *J. Assn. Offic. Anal. Chem.* 56:919-21, 1973.
97		**Firestone D, Ress J, Brown N L, Barron R P & Damico J N.** Determination of polychlorodibenzo-*p*-dioxins and related compounds in commercial chlorophenols. *J. Assn. Offic. Anal. Chem.* 55:85-92, 1972.
99		**Giuffrida L.** A flame ionization detector highly selective and sensitive to phosphorus—a sodium thermionic detector. *J. Assn. Offic. Agr. Chem.* 47:293-300, 1964.
131		**Hoffman I, Westerby R J & Hidiroglou M.** Metals and other elements. Precise fluorometric microdetermination of selenium in agricultural materials. *J. Assn. Offic. Anal. Chem.* 51:1039-42, 1968.
87		**Howard J W, Fazio T & Watts J O.** Food additives. Extraction and gas chromatographic determination of *N*-nitrosodimethylamine in smoked fish: application to smoked nitrite-treated chub. *J. Assn. Offic. Anal. Chem.* 53:269-74, 1970.
89		**Kamm L, McKeown G G & Smith D M.** Food additives. New colorimetric method for the determination of the nitrate and nitrite content of baby foods. *J. Assn. Offic. Agr. Chem.* 48:892-7, 1965.
136		**Kovacs M F.** Thin-layer chromatography for chlorinated pesticide residue analysis. *J. Assn. Offic. Agr. Chem.* 46:884-93, 1963.
88		**Magos L & Clarkson T W.** Atomic absorption determination of total, inorganic, and organic mercury in blood. *J. Assn. Offic. Anal. Chem.* 55:966-71, 1972.
85		**Mills P A.** Collaborative study of certain chlorinated organic pesticides in dairy products. *J. Assn. Offic. Agr. Chem.* 44:171-7, 1961.
167	(7)	**Mills P A.** Detection and semiquantitative estimation of chlorinated organic pesticide residues in foods by paper chromatography. *J. Assn. Offic. Agr. Chem.* 42:734-40, 1959.
231		**Mills P A, Onley J H & Gaither R A.** Rapid method for chlorinated pesticide residues in nonfatty foods. *J. Assn. Offic. Agr. Chem.* 46:186-91, 1963.
81	(7)	**Mitchell L C.** Separation and identification of chlorinated organic pesticides by paper chromatography. XI. A study of 114 pesticide chemicals: technical grades produced in 1957 and reference standards. *J. Assn. Offic. Agr. Chem.* 41:781-816, 1958.
159		**Olson O E.** Plants. Fluorometric analysis of selenium in plants. *J. Assn. Offic. Anal. Chem.* 52:627-34, 1969.
160		**Pons W A, Cucullu A F, Lee L S, Robertson J A, Franz A O & Goldblatt L. A.** Aflatoxins. Determination of aflatoxins in agricultural products: use of aqueous acetone for extraction. *J. Assn. Offic. Anal. Chem.* 49:554-62, 1966.
118		**Stoloff L, Nesheim S, Yin L, Rodricks J V, Stack M & Campbell A D.** A multimycotoxin detection method for aflatoxins, ochratoxins, zearalenone, sterigmatocystin, and patulin. *J. Assn. Offic. Anal. Chem.* 54:91-7, 1971.
116		**Van Soest P J.** Feeds. Use of detergents in the analysis of fibrous feeds. I. Preparation of fiber residues of low nitrogen content. *J. Assn. Offic. Agr. Chem.* 46:825-9, 1963.
650		**Van Soest P J.** Use of detergents in the analysis of fibrous feeds. II. A rapid method for the determination of fiber and lignin. *J. Assn. Offic. Agr. Chem.* 46:829-35, 1963.
83		**Van Soest P J.** Use of detergents in the analysis of fibrous feeds. III. Study of effects of heating and drying on yield of fiber and lignin in forages. *J. Assn. Offic. Agr. Chem.* 48:785-90, 1965.
476		**Van Soest P J & Wine R H.** Use of detergents in the analysis of fibrous feeds. IV. Determination of plant cell-wall constituents. *J. Assn. Offic. Anal. Chem.* 50:50-5, 1967.
127		**Van Soest P J & Wine R H.** Determination of lignin and cellulose in acid-detergent fiber with permanganate. *J. Assn. Offic. Anal. Chem.* 51:780-5, 1968.
133		**Verrett M J, Marliac J-P & McLaughlin J.** Use of the chicken embryo in the assay of aflatoxin toxicity. *J. Assn. Offic. Agr. Chem.* 47:1003-6, 1964.
113		**Walker K C & Beroza M.** Thin-layer chromatography for insecticide analysis. *J. Assn. Offic. Agr. Chem.* 46:250-61, 1963.

tistry, New York, entitled "Microdetermination of phosphorus," was cited 3,850 times from 1956 through 1982. Chen gave his personal views on the development of this paper, and suggested why it is highly cited, in a *Citation Classic*™ commentary published in *Current Contents*® (*CC*®).[10] Authors of twelve other papers in Table 5 also contributed *Citation Classic* commentaries.[11-22]

Editors should keep in mind that complete lists of the most-cited articles from any journal can be obtained through the ISI Search Service. In honor of AOAC's centennial celebration, we've prepared a list of highly cited articles originally published in the *Journal of the Association of Official Analytical Chemists*. Table 6 lists 26 articles cited 80 or more times. This journal also published 14 articles cited between 70 and 79 times, eight cited from 60 to 69 times, and 14 cited 50 to 59 times.

The most-cited article in Table 6 is by P.J. Van Soest, US Department of Agriculture, Beltsville, Maryland. It is the second part of a four-part paper entitled "Use of detergents in the analysis of fibrous feeds." Parts one and two were published in 1963, part three in 1965, and part four in 1967. Taken together, this four-part article was cited more than 1,300 times. Van Soest commented on this article in a *Citation Classic* in 1979.[20]

Comparing Tables 2 and 4, we see that 19 core analytical chemistry journals appear in both tables. Seven journals are among the top ten on both lists. They are: *Analyst*, *Analytica Chimica Acta*, *Analytical Chemistry*, *Fresenius Zeitschrift für Analytische Chemie*, *Journal of Chromatography*, *Journal of Electroanalytical Chemistry and Interfacial Electrochemistry*, and *Talanta*. These seven journals rank highest in terms of their references *to* the core group, and the number of citations received *from* the core. With one exception, these same journals ranked among the top ten core journals in impact *and* immediacy. *Fresenius Zeitschrift für Analytische Chemie* ranked twelfth on impact at 1.2.

Interested readers should refer to the excellent studies of the analytical chemistry literature by Tibor Braun and Erno Bujdosó, Hungarian Academy of Sciences.[23-25] Braun is also managing editor of *Scientometrics* as well as editor of *Journal of Radioanalytical Chemistry*. One study occupied an entire issue of *CRC Critical Reviews in Analytical Chemistry*.[23] It is a comprehensive report on the volume and growth of the literature, its distribution with respect to countries and languages of publication, the exchange of information between analytical chemistry and other fields of science, etc. The authors also analyzed the 100 articles most cited from 1961 through 1972 that ISI identified in 1974.[26,27] Although that list was independent of discipline, they found that 47 percent of the papers were on the subject of analytical chemistry. They concluded that there was no "better proof for the...viability and importance of this subject field."[23] However, it is important to note that, while this may be true for a tiny percentage of the *super*-cited papers, the percentage of such "method" papers would be much smaller in a longer list of highly cited articles.

In conclusion, we extend congratulations to the AOAC on its 100th anniversary. Its 700 volunteer members around the world do much to verify industrial compliance with international regulations and standards. They also help ensure the reliability of analytical data reported in the research literature. We would also like to thank the many journal editors who refereed this study of analytical chemistry. In the near future, we'll report on journals in physical chemistry.

* * * * *

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