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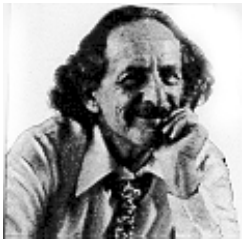

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Journal Citation Studies. 45. Surgery Journals: Another Operation in Citation Analysis

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About five years ago, we discussed how patients should shop for a surgeon.[1] But at the time, it occurred to me that the surgeon might well ask, "How do you shop for a journal?" Since then, we've analyzed journals in many fields—too numerous to list them all here. More recently, we examined nursing journals.[2] But some other medically oriented fields that we have examined through the *Science Citation Index®* (*SCI®*) and *Social Sciences Citation Index®* (*SSCI®*), include neuroscience,[3] dental science,[4] pediatrics,[5] and pathology.[6] Most of these essays have also discussed the most-cited articles from these journals. In the tables that follow, we've provided considerable data for the field of surgery. In addition, we've added several maps showing some of the major research efforts in this branch of biomedicine. These maps will be discussed later.

History of Surgery

The word "surgery" is derived from the Greek words *cheir* meaning "hand" and *ourgos* for "working."[7,8] Today, surgery is defined as that part of medicine that treats injuries, deformities, diseases, and other disorders by manual operations or with instrumental appliances.

In ancient times, surgery was practiced in China, Egypt, Greece, and India.[9] The Hindus (500 BC) practiced many of the basic surgical techniques that surgeons use today. They were also the first to perform plastic and reconstructive surgery. During the time of Hippocrates (460-370 BC), surgeons were skilled in the treatment of fractures and wounds. They knew that patients with broken bones should be kept immobile and that wounds should be cleaned with boiled water or alcohol, and then kept dry. These principles are still considered basic to the practice of the surgery of trauma, which deals with the immediate treatment of acutely injured patients. Unfortunately, the quality of surgery began to gradually decline after the first century AD.[10] By the twelfth century, it had become a menial task performed by craftsmen who knew how to let, or intentionally release, blood from the body.[8,10] Surgery was often practiced by barbers who had been trained to bleed and shave monks.[10]

The earliest surgical guilds were established by the few formally trained surgeons. They wanted to control the quality of the surgery performed by barber-surgeons. The Collège de St. Côme was founded in Paris in 1210.[10] The Company of Barber Surgeons of London was formed in 1540. The latter guild lasted for more than 200 years. In fact, it was the precursor of the present Royal College of Surgeons of England,[9] of which the *Annals* are still published regularly.

"Modern" surgery began in 1846 when ether was used in surgical anesthesia at Massachusetts General Hospital, Bos-

ton. Louis Pasteur's discovery that microorganisms caused infection, and Joseph Lister's realization that antiseptics inhibited the growth of microorganisms in surgical wounds, revolutionized surgical practice, and enhanced its development into a scientific discipline. Other important medical advances that affected surgery include the invention of X rays (1895); the identification of the different blood types (1900); and the use of intravenous infusions to replace body fluids (1930s).[9,10] (Seventeenth-century physicians were actually the first to use intravenous infusions, but it did not become a part of standard practice until the early twentieth century.) The introduction of antibiotics (1940s) and the development of microsurgery (1950s) are two medical breakthroughs made in the latter half of the 1900s.[9]

Today, surgical methods continue to improve with the development of new medical technologies. For example, ultrasound, or sound waves or vibrations of a frequency higher than the human ear can detect, can be used as a diagnostic tool before surgery to detect abnormalities in tissues or organs. These high-pitched waves create characteristic echoes when they are reflected off tissue boundaries of varying densities.[9,11] The echoes then are transformed into an electronic picture that is displayed on a video monitor. Ultrasonic vibrations are also used to fragment or break apart tumors during surgery.[12] Figure 1 is a cluster map of research fronts that we have identified for ultrasonography and computed tomography (CT). I'll have more to say about tomography later in this essay.

Laser surgery, another new technique, uses single-wavelength beams of light energy to destroy tissue or cauterize bleeding vessels during surgery. Lasers are highly accurate and intrinsically sterile. And, since laser beams coagulate blood, laser surgery is nearly bloodless.[13] Ultrasonography and laser surgery are but two of the dozens of topics covered under the umbrella of biomedical engineering. I discussed this field in the Alza Lecture that I gave on April 24, in Anaheim, California. This lecture is sponsored each year by the Biomedical Engineering Society at the annual meeting of the Federation of American Societies for Experimental Biology (FASEB).[14]

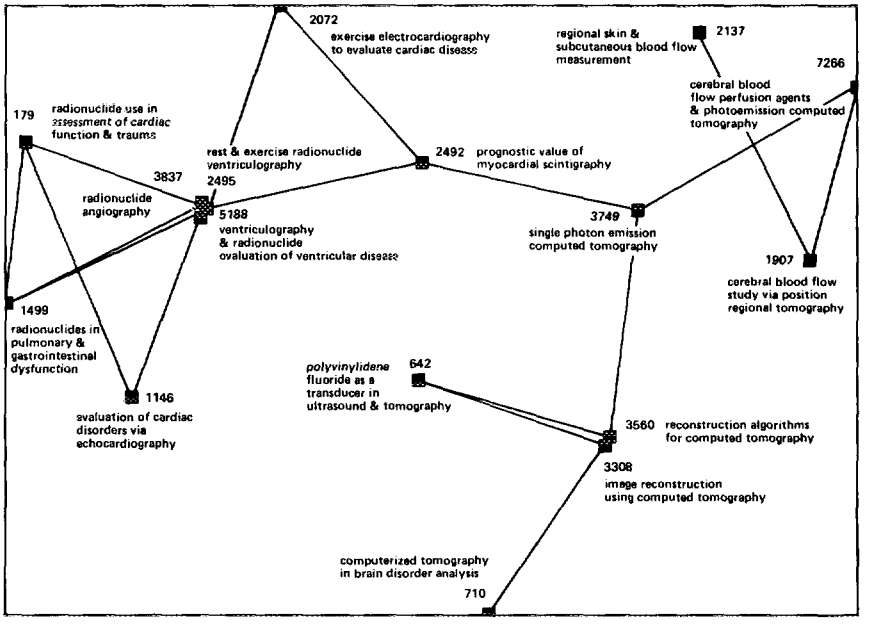
In the United States, there are now 10 surgical specialty areas within the 31 recognized medical specialties. These 10 surgical areas are plastic, orthopedic, obstetric and gynecologic, ophthamalic, colon and rectal, urologic, otolaryngologic, neurologic, thoracic, and general. Within these specialties, there are many smaller, more specific subspecialties.[9]

Surgery Journals

Many of the 10 areas of surgery listed above are covered by the 27 "core" journals listed in Table 1. Subspecialties, such as trauma and pediatric surgery, are also represented. Of course, this list does not include every surgery journal published today. We selected the surgery core used in this study after carefully examining the citations received and references given out by surgery journals indexed in the *Journal Citation Reports®* (*JCR*™), volumes 15 and 16 of the 1983 *SCI*.

The oldest journal in Table 1 is *Acta Chirurgica Scandinavica*, which was first published in 1869. Originally titled *Nordiskt Medicinskt Archiv*, it changed to its current title in 1919. However, there was no break in the sequence of its volume numbers. Several additional journals in Table 1 also had changes that were in title only. And other journals were started as new publications after superseding older journals that had ceased publishing. *Acta Chirurgica Scandinavica* is one of three surgery

Figure 1: Higher-level, multidimensional scaling map for "Ultrasonography and computed tomography."



journals in the list that began publishing in the 19th century. The other two are the *Annals of Surgery* (1885) and the *American Journal of Surgery* (1891). These latter two journals are published in the US, while *Acta Chirurgica Scandinavica* is published in Sweden. US publishers, incidentally, account for 20 of the journals in this study, although several of these journals are considered international publications. Three journals are published in the UK. Austria, Canada, France, and Sweden each account for one.

Twenty-four of the core journals are published exclusively in English, while one, *Neuro-Chirurgie*, is published in French. The *Canadian Journal of Surgery* is bilingual (French and English), while *Acta Neurochirurgica* accepts papers in English, French, and German.

In this study, we treat the group of 27 "core" surgery journals as if they were a single "Macro Journal of Surgery." This

Table 1: Core surgery journals indexed in the *SCI*® and the year that each began publication.

Acta Chirurgica Scandinavica—1869
Acta Neurochirurgica—1950
American Journal of Surgery—1891
American Surgeon—1935
Annals of Plastic Surgery—1978
Annals of Surgery—1885
Annals of the Royal College of Surgeons of England—1947
Annals of Thoracic Surgery—1965
Archives of Surgery—1920
British Journal of Plastic Surgery—1948
British Journal of Surgery—1913
Canadian Journal of Surgery—1957
Clinics in Plastic Surgery—1974
Diseases of the Colon and Rectum—1958
Journal of Neurosurgery—1944
Journal of Pediatric Surgery—1966
Journal of Surgical Research—1961
Journal of Thoracic and Cardiovascular Surgery—1931
Journal of Trauma—1961
Neuro-Chirurgie—1955
Neurosurgery—1977
Plastic and Reconstructive Surgery—1946
Surgery—1937
Surgery, Gynecology & Obstetrics—1905
Surgical Clinics of North America—1920
Surgical Neurology—1973
World Journal of Surgery—1977

is a convention that we have used in previous analyses. We have determined and ranked the journals cited by this macro journal, as well as the journals that cite it.

Journal Statistics

In 1983, the 27 "core" surgery journals published 4,900 articles. This represents slightly over 1 percent of the 451,000 research articles covered in the 1983 *JCR*. These 27 journals included over 94,500 references in 1983, about 1 percent of the 8,000,000 references processed to create the *JCR* that year. In other words, the average 1983 surgical article cited approximately 20 references, a few more than the 18 for the average *JCR* article.

Articles from the 27 surgery journals received 91,000 citations in 1983. This is also 1 percent of the total *JCR* citations. Six journals account for 55 percent—*Annals of Surgery* (11,300); *Surgery* (8,500); *Journal of Neurosurgery* (7,650); *Journal of Thoracic and Cardiovascular Surgery* (7,600); *Surgery, Gynecology & Obstetrics* (7,600); and the *American Journal of Surgery* (7,300). These data and the data for 44 other journals are provided in Table 2. They are ranked by the number of citations that they received from the core that year. The table also provides total citations; self-citations; 1983 impact factor and immediacy index (explained later); and number of 1983 source items for the 50 journals.

The journals in Table 2 received over 53,000 citations from the 27 core journals. This accounts for 56 percent of the references given out by the core in 1983. Twenty-two of the 50 journals are themselves core surgery journals. They are indicated in the table by asterisks. Thirty-eight percent of the citations received by these 22 core journals were from other core surgery journals. However, the figure for *Plastic and Reconstructive Surgery* is over 50 percent.

Annals of Surgery is the most-cited core journal. But it is also highest in impact (2.9). However, the *Journal of Thoracic and Cardiovascular Surgery* ranks fifth in citations, but second in impact (2.4). *Surgery* ranks third (2.3) in impact and citations. And the *Journal of Neurosurgery* ranks fourth in impact (1.8) but second in cites. *Archives of Surgery* ranks fifth in impact (1.7), while the median impact for core surgery journals is 1.0. (The median is calculated by ranking the journals by impact factor and then determining which value is in the middle of the list, with an equal number of values both above and below it.) The median impact for the 27 surgery journals in this list is slightly higher than the median for all *SCI* journals in 1983—0.6. Part of this can be attributed to the higher number of references in the average surgery paper.

In Table 3, we provide data for the 10 highest impact surgery journals. In the 1983 *JCR*, impact is calculated by dividing the number of 1983 citations to 1981 and 1982 articles by the number of articles published by that journal in 1981 and 1982. But in Table 3, we have also calculated 1983 impact factors using five different two-year bases for each journal. This illustrates the time lag in the literature of some disciplines. In surgery, unlike the "hotter" fields of biomedical research, citations peak a little later. The highest impact occurs when 1980-1981 is used as the base period. And *Surgery* and *Annals of Surgery* peak in impact in the 1979-1980 period. *Annals of Thoracic Surgery* and the *Journal of Neurosurgery* peak in 1978-1979.

Table 4 lists the 50 journals that most frequently cited the macro journal of surgery in 1983. Although they represent just 4 percent of the 1,300 journals that cited the core, these 50 journals account for 52 percent of the citations received by the core. Twenty-six of these journals (indicated by asterisks in Table 4) are

Table 2: The 50 journals most cited by core surgery journals in 1983. An asterisk indicates a core journal. A=citations from core journals. B=citations from 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-cited rate, C/B). F=percent of core journal citations that are self-citations (C/A). G=1983 impact factor. H=1983 immediacy index. I=1983 source items.

	A	B	C	D	E	F	G	H	I
*Ann. Surg.	3986	11,303	504	35.3	4.5	12.6	2.90	.31	214
*J. Neurosurg.	3467	7640	1518	45.4	19.9	43.8	1.80	.29	332
*Surgery	3175	8510	531	37.3	6.2	16.7	2.28	.23	292
*Arch. Surg.	2673	7290	274	36.7	3.8	10.3	1.65	.20	225
*J. Thorac. Cardiovasc. Surg.	2579	7615	1087	33.9	14.3	42.2	2.41	.34	255
*Amer. J. Surg.	2571	7336	406	35.1	5.5	15.8	1.29	.17	352
*Surg. Gynecol. Obstet.	2377	7578	204	31.4	2.7	8.6	1.48	.10	232
*Plast. Reconstr. Surg.	2256	4062	930	55.5	22.9	41.2	1.27	.22	219
*Brit. J. Surg.	2074	5816	517	35.7	8.9	24.9	1.58	.40	214
N. Engl. J. Med.	1732	56,841	---	3.1	---	---	16.47	4.49	392
Lancet	1605	59,422	---	2.7	---	---	12.25	4.54	523
Cancer	1509	29,509	---	5.1	---	---	2.65	.28	813
Circulation	1492	33,632	---	4.4	---	---	6.90	.73	431
*Ann. Thorac. Surg.	1295	3250	473	39.9	14.6	36.5	1.38	.16	206
JAMA—J. Am. Med. Assn.	1229	24,239	---	5.1	---	---	3.38	1.16	554
Gastroenterology	1112	19,642	---	5.7	---	---	5.56	1.03	339
Brit. Med. J.	1015	30,782	---	3.3	---	---	2.77	2.24	969
Radiology	1005	16,109	---	6.2	---	---	2.73	.50	668
*J. Trauma	978	2236	379	43.7	17.0	38.8	.85	.11	175
Amer. J. Roentgenol.	753	10,577	---	7.1	---	---	2.34	.28	502
*Surg. Neurol.	703	1412	191	49.8	13.5	27.2	.79	.06	178
Amer. J. Cardiol.	686	19,969	---	3.4	---	---	5.56	.37	652
*J. Pediat. Surg.	679	2061	317	33.0	15.4	46.7	.62	.06	192
*Acta Chir. Scand.	656	2493	201	26.3	8.1	30.6	.46	.17	151
Amer. J. Physiol.	637	34,956	---	1.8	---	---	3.02	.52	1206
*Neurosurgery	637	1335	254	47.7	19.0	39.9	1.09	.09	255
*Surg. Clin. N. Amer.	616	1795	45	34.3	2.5	7.3	1.19	.06	91
*J. Surg. Res.	569	1886	110	30.2	5.8	19.3	.95	.19	145
*Dis. Colon Rectum	566	1337	275	42.3	20.6	48.6	.83	.07	181
Surg. Forum	516	1404	---	36.8	---	---	.36	.01	283
J. Bone Joint Surg.—Amer. Vol.	512	6313	---	8.1	---	---	1.25	.09	208
Ann. Intern. Med.	489	21,128	---	2.3	---	---	7.00	2.33	284
*Brit. J. Plast. Surg.	477	950	117	50.2	12.3	24.5	.54	.15	108
Gut	472	6861	---	6.9	---	---	3.56	.69	176
J. Neurol. Neurosurg. Psychiat.	465	4775	---	9.7	---	---	1.43	.27	194
*Acta Neurochir.	452	939	99	48.1	10.5	21.9	.52	.10	73
Stroke	447	3081	---	14.5	---	---	2.57	.47	155
J. Clin. Invest.	434	38,580	---	1.1	---	---	7.00	.78	441
J. Urol.	405	11,572	---	3.5	---	---	1.32	.13	666
Neurology	402	8359	---	4.8	---	---	2.20	.19	323
Circ. Res.	398	17,487	---	2.3	---	---	4.70	.52	184
Amer. J. Med.	387	17,351	---	2.2	---	---	4.90	.33	476
*Amer. Surg.	374	993	47	37.7	4.7	12.6	.35	.04	150
Arch. Neurol.	362	6702	---	5.4	---	---	1.60	.19	232
*World J. Surgery	346	845	55	41.0	6.5	15.9	1.40	.13	135
Amer. Heart J.	315	10,098	---	3.1	---	---	3.24	.36	412
Cancer Res.	310	31,754	---	1.0	---	---	3.79	.72	983
J. Pediat.	303	14,563	---	2.1	---	---	2.67	.37	432
Chest	282	6204	---	4.6	---	---	1.65	.23	439
Anesthesiology	279	7357	---	3.8	---	---	3.59	.47	221

Table 3: The 1983 impact factors of selected core journals using different two-year bases. Journals are listed in alphabetic order. A=1981-1982. B=1980-1981. C=1979-1980. D=1978-1979. E=1977-1978.

	A	B	C	D	E
Amer. J. Surg.	1.29	1.71	1.71	1.66	1.44
Ann. Surg.	2.90	3.71	3.78	3.29	3.16
Ann. Thorac. Surg.	1.38	1.78	1.75	1.92	1.83
Arch. Surg.	1.65	1.98	1.98	1.84	1.70
Brit. J. Surg.	1.58	1.83	1.77	1.72	1.62
J. Neurosurg.	1.80	1.93	1.99	2.19	2.11
J. Thorac. Cardiovasc. Surg.	2.41	3.20	2.97	2.54	2.28
Surg. Gynecol. Obstet.	1.48	1.70	1.62	1.55	1.37
Surgery	2.28	2.81	3.23	2.10	2.39
World J. Surgery	1.40	2.23	----	----	----

core surgery journals. Only *Neuro-Chirurgie* does not appear. Had we extended the table, it would have ranked 61st, with 348 citations to the core.

The 26 core journals in Table 4 provided over 93,000 references in 1983. Only 37 percent of these were to core journals. The remainder were to journals such as the *New England Journal of Medicine*, *Lancet*, *Cancer*, *Circulation*, the *Journal of the American Medical Association*, and the *British Journal of Medicine*. This is clearly seen in Table 2, where these journals rank higher than most surgery journals. The percentages in column D of Table 4 are sometimes referred to as specialty factors. For example, the *American Surgeon* cites the core literature 49 percent of the time, thereby having the highest citing specialty rate.

Just as the age of citations affects impact, we can learn a lot by looking at a journal's half-life. This is the median age of its cit*ed* and cit*ing* literature. Table 5 lists the cit*ed* and cit*ing* half-lives for 26 of the 27 core surgery journals. (*Annals of Plastic Surgery* is not included because we only began to cover it in the *SCI* recently.) Cit*ed* half-life is the median age of the articles from each journal that were cited in 1983. The average cit*ed* half-life for surgery journals is 7.3 years. That is, on the average, half of the 1983 citations to core surgery journals were to articles they published over the past seven years. This number is higher than that in other fields that we have studied. For example, anthropology has an average cit*ed* half-life of 3.1, while nursing has a half-life of 4.6, and astrosciences, 5.4 years. *Neurosurgery* has the shortest cit*ed* half-life—3.3 years, while the number for several journals is greater than 10 years. For *Acta Chirurgica Scandinavica*, more than 50 percent of the 1983 citations it received were to articles it published prior to 1973.

Cit*ing* half-life is the median age of the literature cited by a journal. It gives us an idea of the age of the literature that each journal cites. In 1983, the average cit*ing* half-life for a core surgery journal was 7.7 years. The *Journal of Thoracic and Cardiovascular Surgery* had the shortest cit*ing* half-life—6.2 years. Half of the references it gave out in 1983 were to articles published from 1978 to 1983.

The immediacy index of a journal measures how often its articles were cited in the same year that they were published. In 1983, *Annals of the Royal College of Surgeons of England* ranked first among the 27 core surgery journals in immediacy—0.44. Not surprisingly, this journal publishes a significant number of letters in each issue, as does the *British Journal of Surgery* (0.40), which is ranked second in immediacy. They are followed by the *Journal of Thoracic and Cardiovascular Surgery* (0.34); *Annals of Surgery* (0.31); and *Journal of Neurosurgery* (0.29). Three of these (*Journal of Thoracic and Cardiovascular Surgery*, *Annals of Surgery*, and *Journal of Neurosurgery*) are also among the top five journals when ranked by impact fac-

Table 4: The 50 journals that most frequently cited core surgery journals in 1983. 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 core journal citations that are self-citations (C/A). G=1983 impact factor. H=1983 immediacy index. I=1983 source items.

	A	B	C	D	E	F	G	H	I
*Amer. J. Surg.	2492	5685	406	34.8	7.1	16.3	1.29	.17	352
*J. Neurosurg.	2358	8170	1518	28.9	18.6	64.4	1.80	.29	332
*Surgery	2265	6177	531	36.7	8.6	23.4	2.28	.23	292
*J. Thorac. Cardiovasc. Surg.	2083	5301	1087	39.3	20.5	52.2	2.41	.34	255
*Ann. Surg.	1999	4985	504	40.1	10.1	25.2	2.90	.31	214
*Arch. Surg.	1880	4446	274	42.3	6.2	13.6	1.65	.20	225
*Ann. Thorac. Surg.	1758	4279	473	41.1	11.1	26.9	1.38	.16	206
*Neurosurgery	1719	5999	254	28.7	4.2	14.8	1.09	.09	255
*Brit. J. Surg.	1590	4254	517	37.4	12.2	32.5	1.58	.40	214
*Plast. Reconstr. Surg.	1558	3890	930	40.1	23.9	59.7	1.27	.22	219
*Surg. Gynecol. Obstet.	1450	3982	204	36.4	5.1	14.1	1.48	.10	232
*Surg. Clin. N. Amer.	1299	3473	45	37.4	1.3	3.5	1.19	.06	91
*J. Trauma	1265	3278	379	38.6	11.6	30.0	.85	.11	175
Cancer	1233	18945	---	6.5	---	---	2.65	.28	813
*Amer. Surgeon	1119	2290	47	48.9	2.1	4.2	.35	.04	150
*Dis. Colon Rectum	1113	2575	275	43.2	10.7	24.7	.83	.07	181
*Surg. Neurol.	1071	3423	191	31.3	5.6	17.8	.79	.06	178
*Acta Chir. Scand.	1004	2926	201	34.3	6.9	20.0	.46	.17	151
*J. Pediat. Surg.	974	2740	317	35.6	11.6	32.6	.62	.06	192
*World J. Surgery	917	2678	55	34.2	2.1	6.0	1.40	.13	135
*Ann. Plastic Surg.	831	1941	78	42.8	4.0	9.4	---	---	163
Radiology	762	10041	---	7.6	---	---	2.73	.50	668
*J. Surg. Res.	719	3427	110	21.0	3.2	15.3	.95	.19	145
*Can. J. Surg.	709	2056	51	34.5	2.5	7.2	.37	.11	123
N. Engl. J. Med.	635	18619	---	3.4	---	---	16.47	4.49	392
Clin. Orthop. Related Res.	621	9325	---	6.7	---	---	.57	.12	412
Amer. J. Roentgenol.	580	7138	---	8.1	---	---	2.34	.28	502
Gastroenterology	565	11470	---	4.9	---	---	5.56	1.03	339
J. Urol.	564	10074	---	5.6	---	---	1.32	.13	666
Circulation	563	12293	---	4.6	---	---	6.90	.73	431
J. Chir.—Paris	558	1825	---	30.6	---	---	.32	.02	96
Southern Med. J.	555	6724	---	8.3	---	---	.28	.06	464
Langenbecks Arch. Chir.	552	2174	---	25.4	---	---	.35	.04	199
*Clin. Plast. Surg.	547	1337	38	40.9	2.8	7.0	.42	.03	60
*Ann. Roy. Coll. Surg. Engl.	540	1587	94	34.0	5.9	17.4	.61	.44	118
Thorac. Cardiovasc. Surg.	535	1625	---	32.9	---	---	.48	.16	103
*Acta Neurochir.	527	1491	99	35.4	6.6	18.8	.52	.10	73
Chirurgie	498	2258	---	22.1	---	---	.43	.10	156
Brit. Med. J.	476	17496	---	2.7	---	---	2.77	2.24	969
J. Surg. Oncol.	474	3150	---	15.1	---	---	.46	.09	196
Chest	445	8582	---	5.2	---	---	1.65	.23	439
Stroke	440	4322	---	10.2	---	---	2.57	.47	155
Amer. J. Cardiol.	433	15237	---	2.8	---	---	5.56	.37	652
Lancet	433	22883	---	1.9	---	---	12.25	4.54	523
Transplant. Proc.	430	8640	---	5.0	---	---	2.16	.79	717
Sem. Hop. Paris	419	9221	---	4.5	---	---	.15	.03	539
Amer. J. Gastroenterol.	405	3006	---	13.5	---	---	.68	.02	175
*Brit. J. Plast. Surg.	400	893	117	44.8	13.1	29.3	.54	.15	108
Crit. Care Med.	400	3621	---	11.1	---	---	1.77	.26	203
Schweiz. Med. Wochenschr.	399	7791	---	5.1	---	---	.56	.16	368

Table 5: The 1983 *SCI*® cited and citing half-lives of core surgery journals listed in alphabetic order. Journals with no listing either received or gave out less than 100 citations in 1983. A = cited half-life. B = citing half-life.

A	B	
>10.0	8.2	Acta Chir. Scand.
5.3	8.1	Acta Neurochir.
8.4	7.0	Amer. J. Surg.
8.8	8.6	Amer. Surg.
---	---	Ann. Plastic Surg.
7.8	8.2	Ann. Roy. Coll. Surg. Engl.
9.0	7.0	Ann. Surg.
5.9	7.2	Ann. Thorac. Surg.
9.8	6.7	Arch. Surg.
>10.0	9.6	Brit. J. Plast. Surg.
8.4	7.2	Brit. J. Surg.
5.8	7.2	Can. J. Surg.
5.1	7.5	Clin. Plast. Surg.
6.3	8.6	Dis. Colon Rectum
8.4	7.8	J. Neurosurg.
7.4	8.8	J. Pediat. Surg.
6.2	7.1	J. Surg. Res.
6.6	6.2	J. Thorac. Cardiovasc. Surg.
7.0	7.8	J. Trauma
9.0	9.4	Neuro-Chirurgie
3.3	7.7	Neurosurgery
7.2	7.9	Plast. Reconstr. Surg.
8.1	6.9	Surg. Clin. N. Amer.
>10.0	7.8	Surg. Gynecol. Obstet.
5.0	9.1	Surg. Neurol.
7.7	6.7	Surgery
3.7	6.9	World J. Surgery

tor. The median 1983 immediacy index for the macro journal of surgery is 0.13, compared to 0.18 for all *SCI* journals included in the 1983 *JCR*.

Recently, we referred to an article-by-article analysis that we conducted for certain journals.[15] In these audits, we examine the year-by-year performance of each article over six or more years. We are also able to examine the variations in different types of published items. Not all "articles" are equal. In Table 6, we have provided data for the two most-cited surgery journals—*Annals of Surgery* and *Surgery*. We used 1978 as the base year. Using six years of the *SCI* file (1978-1983), we identified 240 items for *Annals of Surgery*. Of these, 168 were research articles. Sixty-seven items were classified as "proceedings." Many of these items are actually the full texts of articles presented at conferences, annual meetings, and so on, in contrast to meetings abstracts, which would be coded as such. Only five items were editorials, reviews, and other miscellaneous works. The 1978 articles from *Annals of Surgery* received over 50 percent of the journal's 1978-1983 citations—2,003. Proceedings papers received 1,491.

The most important data are the six-year impact values (columns E and F). While all items in *Annals of Surgery* and *Surgery* are cited an average of 14.6 and 12.3 times, respectively, there seems to be a much higher average for proceedings papers (22.3 and 15.3). This demonstrates the wide variability within journals for the many different types of items published. In some cases, the averaging may work to the advantage or disadvantage of a particular journal. The large letters columns in some medical journals like the *New England Journal of Medi-*

Table 6: Article-by-article analysis of 1978 source items published by *Annals of Surgery* and *Surgery*. A = number published in 1978. B = number cited from 1978-1983. C = percent citedness (B/A). D = number of 1978-1983 citations. E = cited impact (D/B). F = total impact (D/A).

Annals of Surgery

	A	B	C	D	E	F
Articles	168	151	89.9	2003	13.3	11.9
Editorials	1	0	0.0	0	0.0	0.0
Letters	0	0	0.0	0	0.0	0.0
Notes	0	0	0.0	0	0.0	0.0
Reviews	3	1	33.3	9	9.0	3.0
Proceedings	67	64	95.5	1491	23.3	22.3
All Others	1	0	0.0	0	0.0	0.0
TOTAL	240	216	90.0	3503	16.2	14.6

Surgery

	A	B	C	D	E	F
Articles	103	99	96.1	1251	12.6	12.1
Editorials	11	8	72.7	36	4.5	3.3
Letters	18	4	22.2	7	1.8	0.4
Notes	9	9	100.0	41	4.6	4.6
Reviews	5	5	100.0	140	28.0	28.0
Proceedings	115	115	100.0	1764	15.3	15.3
All Others	2	0	0.0	0	0.0	0.0
TOTAL	263	240	91.3	3239	13.5	12.3

Table 7. The most-cited article from each core surgery journal cited at least 50 times in the *SCI®*, 1955-1983, in alphabetic order by first author. A = 1955-1983 citations. The 1984 citations appear in parentheses. B = bibliographic data. C = total number of papers from that journal cited at least 50 times. An asterisk (*) before a paper indicates that it was the subject of a *Citation Classic*™ commentary. The issue, year, and edition of *Current Contents®* in which the commentary appeared follow the bibliographic reference.

A		B	C
375	(4)	**Allison P R.** Reflux esophagitis, sliding hiatal hernia, and the anatomy of repair. *Surg. Gynecol. Obstet.* 92:419-31, 1951.	413
58	(9)	**Andersen D, Hostrup H & Amdrup E.** The Aarhus county vagotomy trial. II. An interim report on reduction in acid secretion and ulcer recurrence rate following parietal cell vagotomy and selective gastric vagotomy. *World J. Surgery* 2:91-100, 1978.	1
294	(10)	*__Ashbaugh D G, Petty T L, Bigelow D B & Harris T M.__ Continuous positive-pressure breathing (CPPB) in adult respiratory distress syndrome. *J. Thorac. Cardiovasc. Surg.* 57:31-41, 1969. (44/79/CP)	309
243	(23)	**Bakamjian V Y.** A two-stage method for pharyngoesophageal reconstruction with a primary pectoral skin flap. *Plast. Reconstr. Surg.* 36:173-84, 1965.	53
143	(7)	*__Barlow B, Santulli T V, Heird W C, Pitt J, Blanc W A & Schullinger J N.__ An experimental study of acute neonatal enterocolitis—the importance of breast milk. *J. Pediat. Surg.* 9:587-95, 1974. (52/81/CP)	34
229	(10)	**Botterell E H, Lougheed W M, Scott J W & Vandewater S L.** Hypothermia, and interruption of carotid, or carotid and vertebral circulation, in the surgical management of intracranial aneurysms. *J. Neurosurg.* 13:1-42, 1956.	291
320	(17)	**Bricker E M.** Bladder substitution after pelvic evisceration. *Surg. Clin. N. Amer.* 30:1511-21, 1950.	23
140	(5)	**Capper W M.** Factors in the pathogenesis of gastric ulcer. *Ann. Roy. Coll. Surg. Engl.* 40:21-35, 1967.	27
548	(24)	**Dudrick S J, Wilmore D W, Vars H M & Rhoads J E.** Long-term total parenteral nutrition with growth, development, and positive nitrogen balance. *Surgery* 64:134-42, 1968.	398
187	(7)	*__Favaloro R G.__ Saphenous vein autograft replacement of severe segmental coronary artery occlusion. Operative technique. *Ann. Thorac. Surg.* 5:334-9, 1968. (32/81/CP)	45
444	(7)	**Flanc C, Kakkar V V & Clarke M B.** The detection of venous thrombosis of the legs using ^{125}I-labelled fibrinogen. *Brit. J. Surg.* 55:742-7, 1968.	168
103	(14)	**French B N & Dublin A B.** The value of computerized tomography in the management of 1000 consecutive head injuries. *Surg. Neurol.* 7:171-83, 1977.	3
239	(0)	**Kakkar V.** The diagnosis of deep vein thrombosis using the ^{125}I fibrinogen test. *Arch. Surg.* 104:152-9, 1972.	286
96	(5)	**Lind J F, Warrlan W G & Wankling W J.** Responses of the gastroesophageal junctional zone to increases in abdominal pressure. *Can. J. Surg.* 9:32-8, 1966.	5
128	(1)	**Lindberg R B, Moncrief J A, Switzer W E, Order S E & Mills W.** The successful control of burn wound sepsis. *J. Trauma* 5:601-16, 1965.	33
66	(1)	**Ludecke D, Kautzky R, Saeger W & Schrader D.** Selective removal of hypersecreting pituitary adenomas? *Acta Neurochir.* 35:27-42, 1976.	3
88	(3)	**Moretz W H, Rhode C M & Shepherd M H.** Prevention of pulmonary emboli by partial occlusion of the inferior vena cava. *Amer. Surg.* 25:617-26, 1959.	9
303	(8)	*__Nilsson I M & Olow B.__ Fibrinolysis induced by streptokinase in man. *Acta Chir. Scand.* 123:247-66, 1962. (5/80/CP)	46
309	(15)	*__Payne J H & DeWind L T.__ Surgical treatment of obesity. *Amer. J. Surg.* 118:141-7, 1969. (48/81/CP)	188
142	(1)	**Petersen N C, Bodenham D C & Lloyd O C.** Malignant melanomas of the skin. Part I. *Brit. J. Plast. Surg.* 15:49-94, 1962.	17
85	(19)	**Racine R.** Kindling: the first decade. *Neurosurgery* 3:234-52, 1978.	1
201	(43)	**Staub N C, Bland R D, Brigham K L, Demling R, Erdmann A J & Woolverton W C.** Preparation of chronic lung lymph fistulas in sheep. *J. Surg. Res.* 19:315-20, 1975.	26
132	(14)	**Turcot J, Despres J-P & St. Pierre F.** Malignant tumors of the central nervous system associated with familial polyposis of the colon. *Dis. Colon Rectum* 2:465-8, 1959.	10
701	(26)	*__Zollinger R M & Ellison E H.__ Primary peptic ulcerations of the jejunum associated with islet cell tumors of the pancreas. *Ann. Surg.* 142:709-28, 1955. (4/80/CP)	701

cine and *Lancet* can significantly affect the impact calculations.

Surgery, in contrast, published slightly more proceedings articles in 1978 (115), than "regular" articles not previously presented elsewhere (103). And these proceedings papers received the greatest number of the 1978-1983 cita-

Table 8: Core surgery journals (in chronologic order) and the number of articles they published that were cited at least 50 times in the *SCI*®, 1955-1983. A = core journal. B = year. C = number of articles published.

A	B	C
Acta Chir. Scand.	1869	46
Ann. Surg.	1885	701
Amer. J. Surg.	1891	188
Surg. Gynecol. Obstet.	1905	413
Brit. J. Surg.	1913	168
Arch. Surg.	1920	286
Surg. Clin. N. Amer.	1920	23
J. Thorac. Cardiovasc. Surg.	1931	309
Amer. Surg.	1935	9
Surgery	1937	398
J. Neurosurg.	1944	291
Plast. Reconstr. Surg.	1946	53
Ann. Roy. Coll. Surg. Engl.	1947	27
Brit. J. Plast. Surg.	1948	17
Acta Neurochir.	1950	3
Neuro-Chirurgie	1955	0
Can. J. Surg.	1957	5
Dis. Colon Rectum	1958	10
J. Surg. Res.	1961	26
J. Trauma	1961	33
Ann. Thorac. Surg.	1965	45
J. Pediat. Surg.	1966	34
Surg. Neurol.	1973	3
Clin. Plast. Surg.	1974	0
Neurosurgery	1977	1
World J. Surgery	1977	1
Ann. Plastic Surg.	1978	0

tions (1,764) given to *Surgery* that year. Articles were a close second with 1,251 cites. Many of the other journals in this study also publish proceedings papers.

Most-Cited Papers and Research Fronts

In these analyses, we also examine the individual papers published in each of the core journals. Table 7 lists the most-cited article from each core surgery journal for the period 1955-1983. Six of these papers have already been the subject of *Citation Classic*™ commentaries. *Annals of Plastic Surgery*, *Clinics in Plastic Surgery*, and *Neuro-Chirurgie* are not represented in the table because none of their articles met our selection criterion of a minimum of 50 citations. This often occurs in small fields. The figures in column C provide the total number of papers each journal published that were cited at least 50 times. These numbers often reflect the age and size of a journal. So, for the journals in this study, we have also listed these data in Table 8. For the most part, surgery journals that began publishing more than 40 years ago have the greatest number of published items cited at least 50 times in the *SCI* from 1955 to 1983.

The most-cited paper was published in the *Annals of Surgery* in 1955 by Robert M. Zollinger and Edwin H. Ellison, Ohio State University College of Medicine, Columbus. The paper discusses the possible relationship between pancreatic lesions and hypersecretion of gastric acid, one of the causes of peptic ulcer.[16] This relationship has since been identified as the clinical ulcerogenic Z-E syndrome (gastrinoma). Zollinger and Ellison's paper was cited 700 times from 1955 to 1983, and 26 times in 1984 alone. Zollinger stated that after its publication, "...our hypothesis was accepted by many and challenged by many during the next five years. But within ten years, a thousand or more case reports established the clinical ulcerogenic Z-E syndrome (gastrinoma).... Recently, the syndrome has been extensively cited because of the introduction of H_2 blockers, which for the first time permit drug control of the excessive gastric hypersecretion.... Peptic ulcer remains a common and disabling disorder. While the original paper was concerned only with the management of patients with the rare...(pancreatic tumor) syndrome, its thrust has been to challenge the research and clinical imaginations of many disciplines to solve the enigma of the gastrointestinal tract."[17]

The second most-cited paper describes an issue of indirect but great importance to surgery—the use of intravenous infusions. Stanley J. Dudrick and colleagues, then at the School of Medicine, University of Pennsylvania, Philadelphia, discussed whether "tissue main-

tenance and synthesis and growth could be achieved exclusively by intravenous infusion of basic nutrients for prolonged periods of time."[18] Their 1968 paper was published in *Surgery* and received 548 citations from 1968 to 1983. It received an additional 24 citations in 1984. Dudrick has published two other papers on this subject.[19,20] He also appeared in our study of the 1,000 contemporary scientists most cited from 1965 to 1978.[21] Dudrick is now at St. Luke's Episcopal Hospital, Houston, Texas, and is one of the coauthors of another paper identified later in Table 10.

C. Flanc, V.V. Kakkar, and M.B. Clarke, King's College Hospital Medical School, London, authored the third most-cited paper, "The detection of venous thrombosis of the legs using ^{125}I-labelled fibrinogen," published in the *British Journal of Surgery* in 1968. The authors felt that "...the early detection of venous thrombosis of the legs is of the utmost importance if the treatment of this condition...is to be improved.... The diagnosis of silent venous thrombosis in the legs depends on more sensitive methods of detection, and the most promising of these seems to be the radioactive fibrinogen technique."[22] The paper has been cited more than 450 times. Kakkar also authored an article in Table 7 that discusses the diagnosis of deep vein thrombosis using ^{125}I fibrinogen. It was published in *Archives of Surgery* in 1972, and has since been cited about 250 times.

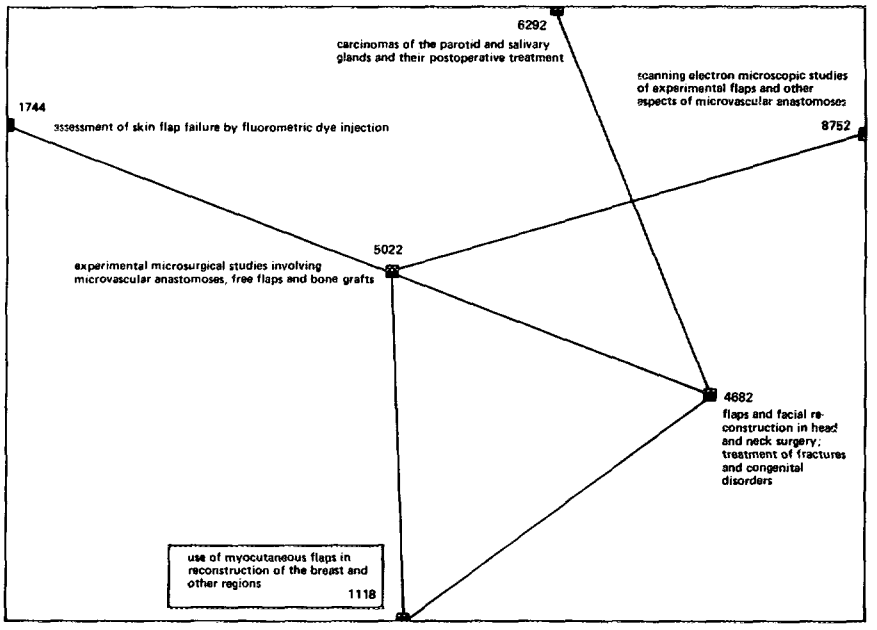
In Table 9, we list the 1983 *SCI* research fronts that include cit*ing* articles from core surgery journals. These papers were published in 1983 and cited the articles that are core papers in the research fronts listed in Table 9. Only those research fronts that had at least 50 cit*ing* documents from the 27 surgery journals are included here. As the list indicates, surgery is indeed a multidisciplinary field. Several fronts on the treatment and analysis of different types of cancer appear in the list. And it also includes fronts on coronary, liver, and pancreatic disorders, as well as head injuries and platelet function.

Two papers from the list of most-cited articles are core documents in research fronts in Table 9. V.Y. Bakamjian's 1965 paper from *Plastic and Reconstructive Surgery* discusses a two-stage method for pharyngoesophageal reconstruction with a primary pectoral skin flap. It was cited 243 times from 1955 to 1983, and 23 times in 1984 alone. And it is core to research front #83-1118, "Use of myocuta-

Table 9: The 1983 *SCI*® research front specialties that contain citing documents published in core surgery journals. A=research front number. B=title. C=number of core surgery journals which cite the research front/number of 1983 citations from these core journals.

A	B	C
83-0004	Survival analysis and prognostic factors in cancer	12/73
83-0077	Diagnosis and treatment of intracranial hematomas and other head injuries	14/110
83-0136	Diagnosis and treatment of liver disorders including carcinomas	15/62
83-0157	Gastrointestinal function, absorption characteristics and disorders	12/60
83-0239	Environmental effects on and surgical treatment of coronary disorders	9/50
83-0425	Echocardiographic evaluation of endocarditis, valvular stenosis and pancreatic disorders	13/74
83-0465	Parenteral nutrition and associated bacterial infections especially by staphylococci	13/71
83-0481	Myocutaneous flaps in reconstructive surgery; clinical studies and evaluations	18/167
83-0526	Diagnosis and treatment of colorectal cancer	11/78
83-0527	Prostaglandins, thromboxanes and other substances in platelet activation and function	17/92
83-0902	Management of vascularization, infection and other problems of aortic reconstructive surgery	15/192
83-1032	Chemical aspects of peripheral artery, intracranial and cerebral aneurysms	5/60

Figure 2: Higher-level, multidimensional scaling map for research front #83-0481, "Myocutaneous flaps in reconstructive surgery; clinical studies and evaluations."



neous flaps in reconstruction of the breast and other regions." This topic is subtended by the higher-level cluster map of research fronts named "Myocutaneous flaps in reconstructive surgery; clinical studies and evaluations" (#83-0481). As shown in Figure 2, #83-1118 is linked to #83-4682, "Flaps and facial reconstruction in head and neck surgery; treatment of fractures and congenital disorders," and #83-5022, "Experimental microsurgical studies involving microvascular anastomoses, free flaps and bone grafts."

The French-Dublin 1977 paper from Table 7 discusses the value of CT, an X-ray scanning technique that eliminates distracting shadows and clarifies specific areas on X rays, in managing head injuries. This paper is core to research front #83-0077, "Diagnosis and treatment of intracranial hematomas and other head injuries." CT is an area of biomedicine that has proliferated widely. While many of its branches show up on the map in Figure 1, this particular research topic is subtended by yet another part of the hierarchy. It is a point on an even higher-level map, cluster #83-0033, "Treatment of cardiac arrest and head injuries including intracranial hematomas." And this is a point on a map of yet another level of the hierarchy, "Clinical aspects of medicine" (#83-0005).

As you can see, we would have to publish an entire *Atlas of Surgical Research* to cover all the relevant areas. As another example, we have also provided a map for research front #83-0902, "Management of vascularization, infection and other problems of aortic reconstructive surgery" (see Figure 3). Currently this is a relatively hot area of research.

In Figure 4, coronary surgery is shown in a map at the next level of clustering.

Figure 3: Higher-level, multidimensional scaling map for research front #83-0902, "Management of vascularization, infection and other problems of aortic reconstructive surgery."

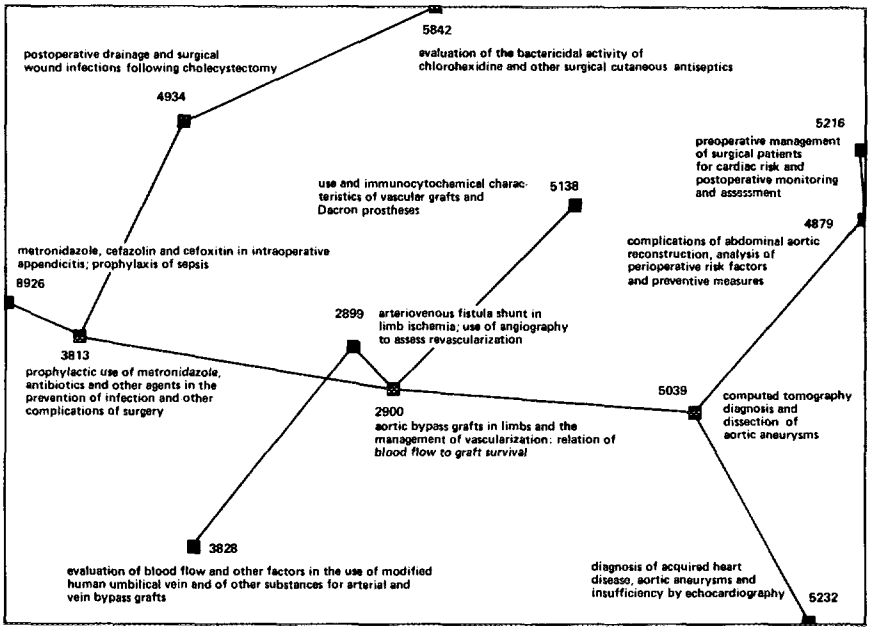


Figure 4: Multidimensional scaling map for "Characteristics, treatment and prevention of arrhythmias, myocardial ischemia and other coronary disorders."

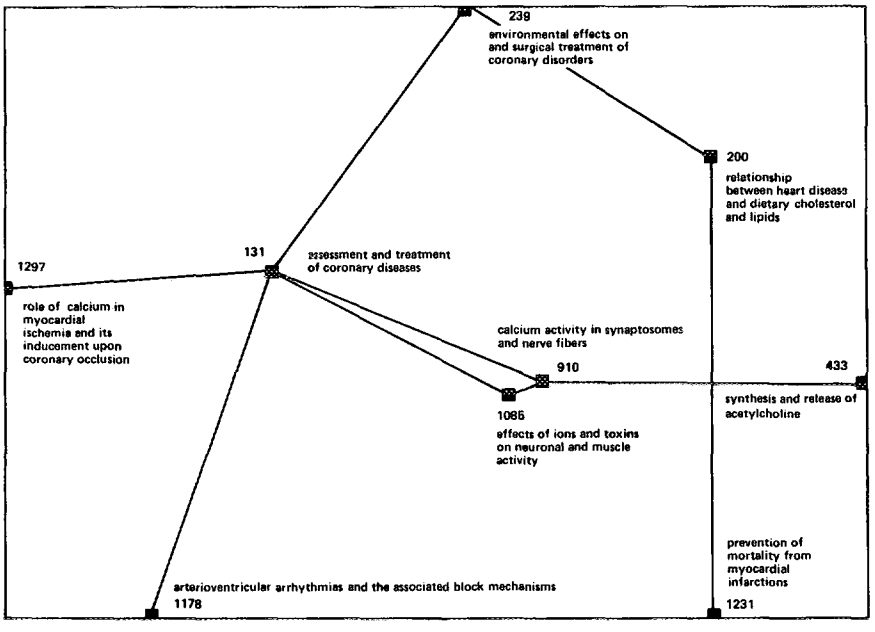


Table 10: Papers published in non-core journals listed in alphabetic order by first author. These articles were cited at least 10 times by core surgery journals in 1983. A = 1983 citations from core surgery journals. B = total 1955-1984 *SCI*® citations. C = bibliographic data. An (*) asterisk indicates that the paper was the subject of a *Citation Classic*™ commentary. The issue, year, and edition of *Current Contents*® in which the commentary appeared follow the bibliographic reference.

A	B	C
19	1440	**Cox D R.** Regression models and life-tables. *J. Roy. Statist. Soc. Ser. B. Meth.* 34:187-202, 1972.
14	255	**Dukes C E.** The classification of cancer of the rectum. *J. Pathol. Bacteriol.* 35:323-32, 1932.
22	1141	***Gehan E A.** A generalized Wilcoxon test for comparing arbitrarily singly-censored samples. *Biometrika* 52:203-23, 1965. (39/79/LS)
14	98	**Gerzof S G, Robbins A H, Johnson W C, Birkett D H & Nabseth D C.** Percutaneous catheter drainage of abdominal abscesses. *N. Engl. J. Med.* 305:653-7, 1981.
12	138	**Goldman L, Caldera D L, Nussbaum S R, Southwick F S, Krogstad D, Murray B, Burke D S, O'Malley T A, Goroll A H, Caplan C H, Nolan J, Carabello B & Slater E E.** Multifactorial index of cardiac risk in noncardiac surgical procedures. *N. Engl. J. Med.* 297:845-50, 1977.
11	128	**Goldring J, McNaught W, Scott A & Gillespie G.** Prophylactic oral antimicrobial agents in elective colonic surgery. *Lancet* 2:997-1000, 1975.
10	582	**Heymann M A, Payne B D, Hoffman J I E & Rudolph A M.** Blood flow measurements with radionuclide-labeled particles. *Prog. Cardiovasc. Dis.* 20:55-79, 1977.
24	237	**Jennett B & Bond M.** Assessment of outcome after severe brain damage. *Lancet* 1:480-4, 1975.
10	111	**Jennett B, Teasdale G, Braakman R, Minderhoud J & Knill-Jones R.** Predicting outcome in individual patients after severe head injury. *Lancet* 1:1031-4, 1976.
12	118	**Jennett B, Teasdale G, Galbraith S, Pickard J, Grant H, Braakman R, Avezaat C, Maas A, Minderhoud J, Vecht C J, Heiden J, Small R, Caton W & Kurze T.** Severe head injuries in three countries. *J. Neurol. Neurosurg. Psychiat.* 40:291-8, 1977.
38	2052	***Kaplan E L & Meier P.** Nonparametric estimation from incomplete observations. *J. Amer. Statist. Assn.* 53:457-81, 1958. (24/83/LS)
10	283	**Law D K, Dudrick S J & Abdou N I.** Immunocompetence of patients with protein-calorie malnutrition. *Ann. Intern. Med.* 79:545-50, 1973.
19	111,601	***Lowry O H, Rosebrough N J, Farr A L & Randall R J.** Protein measurement with the Folin phenol reagent. *J. Biol. Chem.* 193:265-75, 1951. (1/77)
18	1410	**Peto R, Pike M C, Armitage P, Breslow N E, Cox D R, Howard S V, Mantel N, McPherson K, Peto J & Smith P G.** Design and analysis of randomized clinical trials requiring prolonged observation of each patient. II. Analysis and examples. *Brit. J. Cancer* 35:1-39, 1977.
12	22	**Robbins T H.** Rectus abdominis myocutaneous flap for breast reconstruction. *Aust. NZ J. Surg.* 49:527-30, 1979.
11	42	**Seelig J M, Becker D P, Miller J D, Greenberg R P, Ward J D & Choi S C.** Traumatic acute subdural hematoma. *N. Engl. J. Med.* 304:1511-8, 1981.
12	65	**Sundt T M, Sharbrough F W, Piepgras D G, Kearns T P, Messick J M & O'Fallon W M.** Correlation of cerebral blood flow and electroencephalographic changes during carotid endarterectomy. *Mayo Clin. Proc.* 56:533-43, 1981.
30	300	**Teasdale G & Jennett B.** Assessment of coma and impaired consciousness. *Lancet* 2:81-4, 1974.

The "Environmental effects on and surgical treatment of coronary disorders" is represented by cluster #239. It is linked to two other large clusters on the "Relationship between heart disease and dietary cholesterol and lipids"(#200), and "Assessment and treatment of coronary diseases" (#131). This is not a typical classification system for medicine or for any other subject. But scientists do not publish and do research based on *a priori* Aristotelian, Dewey, or WHO methods of classification.

Another interesting way of examining core surgery journals is by looking at the articles that they cited in 1983 that were published in *non*-core journals. We selected the articles for this study by the following method. First we processed all the references cited in the 1983 editions of the 27 surgery journals. We created a "mini citation index" of the papers cited. We then ranked these cited papers by frequency. For Table 10, we included only those papers that were cited at least 10 times by the core surgery journals in

1983. Only 85 papers fell into this group out of 70,000 cited items. Of these, less than 20 were published in non-core journals.

It is not surprising that the *New England Journal of Medicine* and *Lancet* are well represented in this table. But statistical journals (*Journal of the Royal Statistical Society Series B—Methodological*; *Biometrika*; and *Journal of the American Statistical Association*) also account for several papers. B. Jennett, University of Glasgow, Scotland, and colleagues, published three of the papers. These concern severe head injuries and brain damage.

It may surprise some readers to learn that the Lowry method for protein determination also turns up on this list of "surgical" papers. Equally noteworthy, the 1932 paper by C.E. Dukes on cancer of the rectum was still well cited in 1983 surgical papers. The Peto paper was discussed in some detail in our recent analysis of *Citation Classics*.[23] From this type of analysis, we have been able to identify many such *Citation Classics* for the field of surgery. It is also significant that among the 65 articles from the core, 13 were published in the *Journal of Plastic and Reconstructive Surgery*, perhaps indicating how rapidly new developments are taking place in that field. A complete list of these papers is available on request. Please contact Abigail Grissom, Editorial Services, ISI®.

Summary

When we compare the data for the core journals in Tables 2 and 4, we find that eight core surgery journals (*American Journal of Surgery*; *Annals of Surgery*; *Archives of Surgery*; *British Journal of Surgery*; *Journal of Neurosurgery*; *Journal of Thoracic and Cardiovascular Surgery*; *Plastic and Reconstructive Surgery*; and *Surgery*) appear among the top 10 journals in both tables. These journals rank highest in terms of their references *to* the core and the number of citations received *from* the core in 1983. Seven of these journals, excluding *Plastic and Reconstructive Surgery*, rank in the top 10 journals when ranked by impact. And seven of the journals, excluding the *American Journal of Surgery*, are in the top 10 journals when ranked by immediacy. Clearly, then, these eight core journals are the surgery journals that are most influential to surgeons and surgical research. Like all other specialists, they also rely heavily on multidisciplinary journals such as the *New England Journal of Medicine*, *Lancet*, *Annals of Internal Medicine*, *Circulation*, *Cancer*, and so on. This concludes our current analysis of core surgery journals.

* * * * *

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