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Ernst Wynder: Citation analysis

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Abstract

Ernst Wynder published nearly 800 papers during his lifetime. I used the ISI Web of Science® to analyze his publications and the subsequent literature citing his work. More than half of his papers were published in just ten journals, including Cancer, Preventive Medicine (which he founded and edited), JNCI, and Cancer Research. The 87 papers in Cancer covered all of the major cancer sites including breast, colon, lung, and prostate, and many others. Twenty-five papers and one book were cited in over 200 publications. His publications included 441 co-authors from a broad range of scientific disciplines.

Keywords: Ernst Wynder; Citation analysis; Publications; Cancer epidemiology; American Health Foundation

One way to appreciate Ernst Wynder's impact on the medical and health sciences is by studying his bibliography and the citations it received over the years. Noreen Sweeney and Joanne Braley, who managed the American Health Foundation library for many years, compiled a bibliography of nearly 800 journal articles, chapters, books, and other technical writings (Hoffmann, 2006). However, the only practical way to study citing papers was to use a commercial, electronically searchable database. I used the ISI Web of Science® to generate a set of Wynder's publications and then used a Cited Reference Search to count the subsequent references to those papers. I made no attempt to eliminate self-citation (i.e., references in Wynder's own papers to his earlier publications), and I did not distinguish original research findings from reviews or invited editorials.

The ISI Web of Science® search identified 642 publications by Wynder appearing in 139 periodicals and one book; of these, 358, or more than half, were published in ten prestigious mainline journals (Table 1). Foremost is *Cancer*, the American Cancer Society's flagship research journal. Wynder published nearly ninety papers in this journal over a period of more than four decades. The dominant themes were lung and breast cancer, but there were also in-depth studies of the epidemiology of cancer of the bladder, larynx, colon and rectum, stomach, ovary, prostate, pancreas, and kidney, as well as numerous experimental studies. Many of these papers were the first or most comprehensive studies ever published, especially the massive 1960 study of the epidemiology of breast cancer co-authored with Irwin Bross and Takeshi Hirayama (Wynder et al., 1960).

Bross and Hirayama were themselves important figures in the development of cancer epidemiology. From 1954 to 1959, Bross was head of research and design at the Sloan-Kettering Institute before its 1960 merger with Memorial Hospital for Cancer and Allied Diseases. He and Wynder (who was then a researcher at Sloan-Kettering and a staff physician at Memorial Hospital) had already co-authored seven epidemiological papers prior to the breast cancer study. By the time that paper appeared in 1960, Bross had become head of the Department of Biostatistics at Roswell Park Memorial Institute of Cancer Research in Buffalo, NY, a position he held until his retirement in 1983. He died in 2004 having published over 300 papers and six books.

Hirayama was director of the Institute of Preventive Oncology at the National Cancer Institute in Tokyo, Japan. He organized the first large-scale prospective study of lifestyle and cancer in that country (Hirayama, 1990) and was one of the first to suggest protective effects of dietary soy against cancer (Hirayama, 1982). He published one of the earliest Japanese studies of lung cancer and cigarette smoking (Hirayama and Hamano, 1955) and his landmark 1981 paper on lung cancer in non-smoking wives of cigarette smokers helped open up the field of research on passive smoking (Hirayama, 1981). He has been called one of the "grandfathers of tobacco control in Asia" (Mackay, 2002). Wynder chose *Cancer* for his updated comparative study of cancer in the United States and Japan, also written with Hirayama (Wynder et al., 1991).

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Table 1
Ten journals in which Wynder published most frequently

Journal	Number of papers	Percent	Years
Cancer	87	13.6	1956–1997
Preventive Medicine	64	10.0	1974–2001
JNCI	54	8.4	1957–1998
Cancer Research	47	7.3	1982–1999
JAMA	28	4.4	1950–2000
American Journal of Epidemiology	27	4.2	1974–1998
New England Journal of Medicine	17	2.6	1952–1992
American Journal of Public Health	12	1.9	1979–1995
Science	12	1.9	1952–1980
International Journal of Epidemiology	10	1.6	1978–1995
All others[a, b]	284	44.2	1950–2005
	642	100.0	

Source: ISI Web of Science®.
[a] Includes abstracts of 17 papers presented at meetings of the American Association for Cancer Research.
[b] Includes a posthumous reprint of his original 1950 lung cancer study. (See Wynder and Graham, 1950).

The second most frequent journal for Wynder's publications is *Preventive Medicine*, which is not surprising since Wynder was its founder and Editor-in-Chief for thirty years. Besides original research reports, his papers in *Preventive Medicine* included editorials and an occasional feature called "A Corner of History" in which he gave thumbnail sketches of important figures such as James Lind (Wynder, 1974a) and Edward Jenner (Wynder, 1974b). It is also noteworthy that Wynder's opus included a dozen papers in *Science* (including our saccharin study; Wynder and Stellman, 1980) and four in *Nature*. Wynder published 28 papers in *JAMA*, including his original study of lung cancer and cigarette smoking (Wynder and Graham, 1950).

Wynder's remaining 284 publications were distributed among 129 journals ranging from *Acta Medica Scandinavica* to *Zentralblatt Für Bakteriologie Mikrobiologie Und Hygiene Serie B-Umwelthygiene Krankenhaushygiene Arbeitshygiene Präventiv Medizin*—literally A to Z. To be sure, a few papers in foreign-language journals were merely translations of papers

Table 2
Publications of Ernst Wynder cited at least 200 times in subsequent publications

Year of publication	No. of citations	
1950	567	Wynder EL, Graham EA. Tobacco Smoking as a Possible Etiologic Factor in Bronchiogenic Carcinoma—A Study of 684 Proved Cases. JAMA 1950;143:329–336.
1974	543	Narisawa T, Magadia NE, Weisburger JH, Wynder EL. Promoting Effect of Bile-Acids on Colon Carcinogenesis After Intrarectal Instillation of *N*-Methyl-*N*′-Nitro-*N*-Nitrosoguanidine in Rats. JNCI 1974;53:1093–1097.
1967	509	Wynder, E. L., and Hoffmann, D. (1967). Tobacco and Tobacco Smoke: Studies in Experimental Carcinogenesis. Academic Press, New York.
1967	495	Wynder EL, Shigematsu T. Environmental Factors of Cancer of Colon and Rectum. Cancer 1967;20:1520–1561.
1986	428	Howson CP, Hiyama T, Wynder EL. The Decline in Gastric-Cancer—Epidemiology of an Unplanned Triumph. Epidemiologic Reviews 1986;8:1–27.
1957	410	Wynder EL, Bross IJ, Feldman RM. A Study of the Etiological Factors in Cancer of the Mouth. Cancer 1957;10:1300–1323.
1977	396	Wynder EL, Gori GB. Contribution of Environment to Cancer Incidence—An Epidemiologic Exercise. JNCI 1977;58:825–832.
1969	375	Wynder EL, Kajitani T, Ishikawa S, Dodo H, Takano A. Environmental Factors of Cancer of the Colon and Rectum. II. Japanese Epidemiological Data. Cancer 1969;23:1210–1220.
1977	370	Reddy BS, Watanabe K, Weisburger JH, Wynder EL. Promoting Effect of Bile-Acids in Colon Carcinogenesis in Germ-free and Conventional F344 Rats. Cancer Research 1977;37:3238–3242.
1961	366	Wynder EL, Bross IJ. A Study of Etiological Factors in Cancer of Esophagus. Cancer 1961;14:389–413.
1973	358	Reddy BS, Wynder EL. Large-Bowel Carcinogenesis-Fecal Constituents of Populations with Diverse Incidence Rates of Colon Cancer. JNCI 1973;50:1437–1442.
1977	331	Reddy BS, Wynder EL. Metabolic Epidemiology of Colon Cancer—Fecal Bile-Acids and Neutral Sterols in Colon Cancer Patients and Patients with Adenomatous Polyps. Cancer 1977;39:2533–2539.
1986	310	Rose DP, Boyar AP, Wynder EL. International Comparisons of Mortality-Rates for Cancer of the Breast, Ovary, Prostate, and Colon, and Per-Capita Food-Consumption. Cancer 1986;58:2363–2371.
1960	289	Wynder EL, Bross IJ, Hirayama T. A Study of the Epidemiology of Cancer of the Breast. Cancer 1960;13:559–601.
1977	273	Wynder EL, Stellman SD. Comparative Epidemiology of Tobacco-Related Cancers. Cancer Research 1977;37:4608–4622.
1971	262	Wynder EL, Mabuchi K, Whitmore WF Jr. The Epidemiology of Cancer of Prostate. Cancer 1971;28:344–360.
1973	246	Wynder EL, Mabuchi K, Maruchi N, Fortner JG. The Epidemiology of Cancer of Pancreas. JNCI 1973;50:645–667.
1978	233	Reddy BS, Hedges AR, Laakso K, Wynder EL. Metabolic Epidemiology of Large Bowel Cancer-Fecal Bulk and Constituents of High-Risk North-American and Low-Risk Finnish Population. Cancer 1978;42:2832–2838.
1963	231	Wynder EL, Mantel N, Onderdonk J. An Epidemiological Investigation of Cancer of Bladder. Cancer 1963;16:1388–1407.
1976	230	Reddy BS, Narasawa T, Weisburger JH, Wynder EL. Promoting Effect of Sodium Deoxycholate on Colon Adenocarcinomas in Germ-free Rats. JNCI 1976;56:441–442.
1953	229	Wynder EL, Graham EA, Croninger AB. Experimental Production of Carcinoma with Cigarette Tar. Cancer Research 1953;13:855–864.
1954	223	Wynder EL, Cornfield J, Schroff PD, Doraiswami KR. A Study of Environmental Factors in Carcinoma of the Cervix. American Journal of Obstetrics and Gynecology 1954;68:1016–1052.
1966	223	Wynder EL, Escher GC, Mantel N. An Epidemiological Investigation of Cancer of the Endometrium. Cancer 1966;19:489–520.
1975	221	Wynder EL. The Epidemiology of Large Bowel Cancer. Cancer Research 1975;35 (11 Pt 2):3388–3394.
1977	220	Wynder EL, Goldsmith R. Epidemiology of Bladder Cancer—A Second Look. Cancer 1977;40:1246–1268.
1996	211	Zang EA, Wynder EL. Differences in lung cancer risk between men and women: Examination of the evidence. JNCI 1996;88:183–192.

Source: ISI Web of Science®.

previously published in English, but this only served to extend Wynder's international audience.

Citation analysis can give only a limited view of the impact of an individual on a field, but in Wynder's case even this view is most remarkable. A total of 25 papers and one book were cited in at least 200 subsequent publications (including self-citations of Wynder himself or other American Health Foundation investigators). These 26 publications, listed in Table 2, were cited a total of 8,549 times.

Wynder is often remembered for his strong personality and the way in which he could dominate a discussion by sheer force of intellect. Nevertheless, he could not have succeeded without an extensive network of collaborators and co-authors. The ISI Web of Science® search yielded an astonishing 441 co-authors. All of the papers in Table 2 have co-authors except one paper in a special issue of *Cancer Research* based on a workshop on nutrition and diet that Wynder helped organize. The papers cover a wide range of disciplines, methods (analytic epidemiology, international comparisons, metabolic studies, reviews, chemistry), and types of cancer (lung, larynx, esophagus, colon, breast, pancreas, bladder).

In the "best-seller" papers of Table 2, Wynder had 36 co-authors, seven of whom are listed in more than one publication. Bandaru Reddy, senior author of seven of those papers, was Chief of the Division of Nutritional Carcinogenesis at the American Health Foundation. For over thirty years, he has done pioneering research in chemoprevention and has published extensively on metabolism of bile acids, fecal mutagens, non-steroidal anti-inflammatory agents, and the effect of dietary fat on the development of colon and other cancers. He is now at the School of Pharmacy, Rutgers University. Other co-authors were John Weisburger (three papers) and Irwin Bross (three papers). Weisburger was head of the National Cancer Institute Bioassay Program from 1961 until 1972, when Wynder recruited him to the American Health Foundation. As vice president and director of research at its laboratories in Valhalla, NY, Weisburger has played a major role in studies of dietary mutagens such as heterocyclic amines, as well as chemopreventive potential of lycopenes and green tea, work he continued at AHF long after his retirement in 1987. He is now at New York Medical College. Two additional papers in the list were co-authored with Nathan Mantel and one with Jerome Cornfield, both "superstar" biostatisticians.

Finally, Wynder's publication list strongly reflects his belief that advancement of public health requires the interplay and cooperation of researchers from many disciplines. Table 3 shows the co-authors with whom Wynder published the greatest number of papers. It is significant that the first three co-authors are not epidemiologists like Wynder but represent a broad range of scientific disciplines. The list is appropriately headed by Wynder's close friend and long-standing colleague Dietrich Hoffmann, who co-authored 81 papers with him between 1959 and 1999. One of the world's leading tobacco chemists, Hoffmann was associate director of the American Health Foundation and Chief of the Division of Environmental Carcinogenesis. He has made numerous contributions to our understanding of the mechanisms of tobacco carcinogenicity, and pioneered the analysis of smokeless tobacco. He is co-author of the only book in the list of Wynder's most frequently cited publications (Wynder and Hoffmann, 1967). Second on the list is Bandaru Reddy (45 papers), followed by Peter Hill (37 papers) whose research interests include the influence of diet and hormones on cancer. Four of the next five co-authors are epidemiologists: myself (32 papers), Joshua Muscat (27 papers), Geoffrey Kabat (24 papers), and Randall Harris (24 papers). Scientific fields represented in the list of frequent co-authors also include biochemistry, biostatistics, oncology, nutrition science, endocrinology, and education, to name only a few.

Table 3
Frequent co-authors of Ernst Wynder, number of publications, and dates

Author	Number of publications	Publication years
Dietrich Hoffmann	81	1959–1999
Bandaru Reddy	45	1973–1997
Peter Hill	37	1972–1988
Steven D. Stellman	32	1977–2001
John H. Weisburger	29	1975–1997
Joshua Muscat	27	1991–2001
Geoffrey Kabat	24	1983–1996
Randall Harris	24	1988–1996
Leonard Cohen	24	1974–1999
David P. Rose	21	1984–1994
Edith Zang	14	1989–2001
Rowan Chlebowski	14	1986–1996
Christine Williams	12	1976–1995
Po Chan	12	1969–1981
James Hebert	12	1987–1992
Evarts Graham	12 [a]	1950–1958
Alfredo Morabia	10	1990–1998
Barbara Winters	10	1995–1999

Source: ISI Web of Science®.
[a] Count includes re-publication of original 1950 paper in 1985 and 2001.

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