A Study of Canadian Literature and Information Services in Chemistry and Chemical Engineering

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1. Preamble

When so many journals that report work in chemistry and chemical engineering are being published*, it is reasonable to ask why there should be

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*During 1965, 10,850 periodicals and serials were monitored by Chemical Abstracts[1]

Canadian journals at all. There are no barriers confronting Canadian authors who wish to publish the results of their research in American, British, French, or other journals. We think there is considerable justification for the publication of Canadian journals on the following grounds:

(i) To maintain scientific self-respect by contributing to the world pool of publications.

(ii) To complete the investment in scientific research and development in Canada.

(iii) To promote a sense of community in the scientific scene in Canada.

(iv) To complete the activities of Canadian scientific societies through publication of proceedings of symposia and conferences.

(v) To help raise and maintain standards of scientific work being done in Canada.

While we subscribe to the thesis that journals ought to be published in Canada, some realities that face primary research journals have to be faced. In a country with a population as small as Canada's not all branches of chemistry or chemical engineering can be represented. At the same time, the sheer bulk of the scientific literature leads a researcher to publish in journals reaching the audience that will be interested in his work. The consequence is some automatic specialization of journals. National journals can participate in this trend to specialization by trying to tie themselves more closely to those lines of research that are being actively pursued in the country. The quality of the material published is also an important parameter. National journals of a low scientific standard do no credit to anyone or to any country as they fail to fulfill the functions of national journals as given above.

Trade journals, house organs, and professional magazines have other objectives: to inform users or prospective customers in a particular narrow area, to carry national advertising, and to act as a unifying force for a professional society. These publications must therefore be judged on a basis different from that used to examine primary research journals.

As with most scientific disciplines, journals and proceedings of conferences, congresses and symposia, constitute the bulk of the publications in the fields of chemistry and chemical engineering. Textbooks and monographs account for approximately 25% of the world's output in these areas, but the percentage in Canada is very much less. Undoubtedly, more scientific books would be published in Canada, if authors and publishers could be assured of a fair return on their time and investment, and a reasonable distribution. There does not, however, appear to be the same justification for the publication of chemistry texts in Canada as for chemistry journals. Prestige and strengthening of the Canadian publishing industry may be sufficient reasons for encouraging Canadian authors to publish in Canada. If so, then the possibility of government subsidization of an appropriate Canadian publisher, for a limited period, might be explored.

This report presents first some facts and figures mainly about Canadian chemical journals and summarizes the present status. It then looks at some shortcomings and possible needs and finally attempts to look further ahead and forecast some trends.

2. Facts and Figures

2.1 Canadian Chemical Journals

The publications listed in Table 1 were taken from the 1966 edition of the Directory of Canadian Scientific and Technical Periodicals[2]. We believe the list contains all of the journals that carry any significant number of chemically-oriented articles. It would be invidious for us to attempt to assess the standards of all of them. We will only remark that the journals vary considerably in size, objectives, and other respects, which will be brought out in subsequent sections.

2.2 Coverage by Abstracting Journals

Table 1 (p. 19) shows the extent to which the various journals are monitored by indexing and abstracting services. All but one of the primary research journals are covered by a minimum of two and a maximum of nine indexing and abstracting services. This one exception, the Canadian Journal of Pharmaceutical Science began publication in 1966 and this omission will undoubtedly be rectified before long. Chemical Abstracts covers all of the primary journals (except for the title noted above) and Biological Abstracts covers all but three of the journals. More important, from the point of view of information retrieval, is the fact that an information searcher will be led to the papers contained in Canada's primary chemistry journals by consulting only three international abstracting services.

The trade journals and professional magazines are not monitored as comprehensively as the primary research journals. However, the situation is better than might be expected, for six of the eleven titles listed in Table 1 are covered by at least one indexing or abstracting service.

2.3 Primary Research Journals

Only three of the journals listed under part (a) of Table 1 are entirely devoted to chemistry and chemical engineering. These are the

Canadian Journal of Chemical Engineering, the Canadian Journal of Chemistry, and the Canadian Journal of Biochemistry. The others contain varying proportions of chemical work and it is therefore difficult to assess them on the same basis as the three given above.

The history of the three journals is depicted in Figure 1 (p. 26) which shows the chronological development of the research journals published by the National Research Council. The Canadian Journal of Chemistry has existed in its present form since 1950. The Canadian Journal of Chemical Engineering developed from the Canadian Journal of Technology which ceased publication in 1957. The Canadian Journal of Biochemistry has its origins in the Canadian Journal of Medical Sciences and was separated from Physiology and Pharmacology in 1963.

The growth of the Canadian Journal of Chemistry and the Canadian Journal of Chemical Engineering over the past ten years is depicted in Figures 2 and 3 (p. 27-28), which are semi-logarithmic plots. (In the absence of contrary evidence, it is reasonable to assume that scientific development is an exponential function of time). Comparable data for the Canadian Journal of Biochemistry is not included because trends for less than an 8-10 year period are not likely to be meaningful. No attempt has been made to assign limits of accuracy to the doubling times derived from the slopes of the lines in the figures. For comparison we quote the following doubling times: (i) an average of 8.5 years for all of the journals published by the National Research Council; (ii) 8.2 years for the world's chemical literature in 1966[1]. It therefore appears that the growth of Canadian primary research journals in chemistry is normal.

The current (1966) sources of contributions to the Can. J. Chem. Eng., Can. J. Chem. and Can. J. Biochem. are set out in Table 2 (p. 22). The numerical results should not be taken too seriously because they vary somewhat from year to year. However, such annual compilations revealed two general points: (i) the small proportion of contributions from industrial laboratories shows no sign of increasing; (ii) after increasing fairly rapidly in the period 1957 to 1963, the proportion of contributions from outside

Canada is tending to flatten off at about 30%. It is difficult to make an estimate of how much of the chemical research done in Canada is reported in foreign literature each year. A "back-of-the-envelope" computation indicates that perhaps a third of it is published by Can. J. Chem. Eng., Can. J. Chem. and Can. J. Biochem. together, i.e. two thirds is published outside of Canada.

2.4 Circulation and Finance of Primary Research Journals

Probably no aspects of publication are more subject to misconception and misstatement of fact than are circulation and finance. Practically any journal published, regardless of its quality, can have a circulation of about 1,000 copies because the world's scientific libraries are a "captive audience"[3]. The attainment of higher circulations depends on a complex of factors: the significance of the work published; the breadth of the field covered; the pricing policy; the philosophy behind the publication (a private endeavour as opposed to an extension of the scientific process, for example); acceptance of advertising; - among others. We will here attempt only to give some facts; a general comment will be made in the summary.

The current circulations of several Canadian journals are listed in Table 3 (p. 23), which also contains circulation figures for some other well-recognized chemistry journals. The data for the three American Chemical Society publications, J. Am. Chem. Soc., J. Org. Chem. and Biochemistry are for 1966[4]. The J. Chem. Soc. circulation figure is for 1963 and 1964 and only one-sixth of the subscriptions were held in the United Kingdom (Table 2 of Ref. 3).

The cost of producing a journal also depends on a number of factors: the size of the publishing unit; the quality of the paper and typography; the number of illustrations, tables, formulae, etc.; the extent of the editing; the circulation. Because of the variability of these factors, anything but the broadest comparison in costs of journal publication would be meaningless. For the same reason, there exists no simple parameter for measuring the efficiency of a publishing operation. Nevertheless, it is useful to have an approximate figure from which the magnitude of the cost of publication can be reckoned. For 1966, the

cost (exclusive of building overhead and cost of minor services) to the National Research Council for publication of eight research journals was roughly $25.00 per page per 1000 impressions. This figure falls in the middle of a broad range of costs given for a number of journals published by governments or professional societies. In other words, the cost of producing journals in Canada seems to be in line with costs elsewhere.

2.5 Trade Journals

We have found no simple basis on which the trade journals and professional magazines can be discussed; they are too heterogeneous. The two, which probably have the greatest influence, are Canadian Chemical Processing and Chemistry in Canada. Since the latter has to serve the entire membership of the Chemical Institute of Canada, it tends to speak with many voices. Chemistry in Canada does seem to fulfill very well its function as a unifying influence for its professional society. It does this primarily through its news items and through a commendable trend to carry articles about national policy and education that are of interest and concern to chemists and chemical engineers. The other trade journals listed in Table 1 carry news items and articles on chemical processes and technology of interest to small groups of chemists and chemical engineers in specific industries. These journals provide a medium of communication for people within a particular industry; their effect on the scientific scene outside of Canada will obviously not be great.

2.6 Secondary Publications

Secondary publications include reviews, monographs, annual progress reports, abstracting and indexing journals. There are no publications of this nature in Canada covering the fields of chemistry and chemical engineering. Chemistry in Canada carries occasional review articles, often based on Award Lectures, but these are seldom comprehensive or extensive in their coverage.

2.7 Library Holdings

The circulation of journals (Table 4, p. 24) has not been broken down by library, society and individual subscriptions. Instead, for each

province, there is shown the number of libraries that subscribe to each of the 20 journals on the list. This information is taken from the 1967 edition of the Union List of Scientific Serials in Canadian Libraries[5], compiled and published by the National Science Library.

This Union List records the titles and holdings of 38,000 journals received by all the major libraries in Canada - university, public, governmental and industrial - 198 in all. The preparation and printing of the Union List is a computerized operation. The bibliographic data are stored on magnetic tapes updated at regular intervals, thus permitting the printing of new editions of the Union List as frequently as is deemed necessary[6].

In reviewing the figures tabulated in Table 4 it should be noted: (i) that although the Union List covers all the major libraries collecting scientific and technical publications, many small libraries (particularly company libraries) do not report their holdings and may be subscribing to one or more of the journals selected for examination; (ii) some of the libraries reporting to the Union List undoubtedly subscribe to more than one copy of some of the journals on our list. Nevertheless, with these limitations in mind and assuming, as we have, that the nine primary research journals in chemistry are essential reading matter for any scientists concerned with chemical research in Canada, Table 4 reveals a startling and shocking state of affairs - namely, these primary journals are not readily available through a vital channel of communication - the libraries of Canada.

A more detailed examination of Table 4 reveals that in considering Canada as a whole, not one of the primary research journals on the list is held by even half of the 198 reporting libraries. From

a provincial point of view, except for the Canadian Journal of Chemistry and the Canadian Journal of Biochemistry, there is no province in which even half the libraries hold any one of the nine journals. To put it another way - the journal subscribed to most frequently is held by only 93 of Canada's 198 major libraries.

The situation as regards library holdings of trade journals and professional magazines is even more discouraging. However, in view of the rather specialized nature of these journals and the poor showing of the primary research journals, this is not surprising. The figures cited in Table 4 speak for themselves and in this case no further analysis is required.

This lack of availability of basic research journals, which has also been pointed out in a survey of the science and technology literature resources in Canada[7], is offset to some extent by the various information services of the National Science Library. The NSL through its Interlibrary Loan and Photocopying section, makes available by loans and through the provision of photocopies, scientific and technical publications not readily available in other Canadian libraries. At present, requests for such services are being received at the rate of approximately 300 per day.

The purpose of this service is to make available those scientific and technical publications, which because of infrequency of use, limited distribution, or high cost are not acquired by other Canadian libraries. It is not intended to relieve other scientific and technical libraries of the responsibility for developing strong working collections to meet the day-to-day needs of their clientele.

2.8 Information Retrieval

The term "information retrieval" is used almost exclusively to mean the retrieval of information using mechanized techniques. Remarkable progress has been made in employing computers to store and retrieve physical and chemical data. Outstanding advances have

also been made in mechanizing the storage and retrieval of publications containing information about a specific subject. However, much experimental work must be done before we have achieved truly mechanized information retrieval - that is, the mechanized locating and retrieving, from the world's output of scientific and technical literature, of a specific bit of information.

As mentioned later in this report, the American Chemical Society has pioneered in developing mechanized techniques for handling chemical information. No comparable work is being done in Canada, but some governmental and private organizations are carrying out limited experiments to meet their own information needs. Two departments of the federal government, for example, have devised semi-mechanized systems for handling information. The Food and Drug Directorate of the Department of National Health and Welfare has combined co-ordinate indexing with the Miracode system to store and retrieve information regarding the toxicity, therapeutic and side effect of drugs. The Department of Agriculture, using somewhat similar techniques, stores and retrieves information concerning the toxicity and effectiveness of insecticides, fungicides and herbicides.

The National Science Library, in keeping with its responsibility for serving as the focal point for a national scientific and technical information network, is continually developing new techniques that are designed to expedite the storage, retrieval and dissemination of information on a national scale. The Library has been particularly successful in developing an SDI (Selective Dissemination of Information) program in chemistry and related fields. This program, using an IBM 360 Model 50 computer, scans the titles of papers appearing in approximately 750 journals, and provides 70 scientists, at two week intervals, with bibliographies covering their specific fields of interest. The NSL is negotiating with Chemical Abstracts Service, the producers of the magnetic tapes, for permission to extend this service to interested scientists in other parts of Canada who do not have access to computer facilities[8].

Because of the very personalized nature of any SDI system, particularly the setting up of interest profiles, there is a limit to which the current awareness program mentioned above can be provided from a central point such as the NSL. Large university libraries and other types of libraries having access to computers should be encouraged to establish their own computer assisted retrieval systems. In such cases, the NSL can provide valuable assistance by reporting the results of its experiments and by making available computer programs that it has developed. The preparation of computer programs is an expensive undertaking and for the SDI system using Chemical Titles on tape the cost of development was approximately $10,000.

The NSL is expanding its SDI program in order to utilize magnetic tapes now being produced to cover other subject fields, e.g. ISI tapes (Institute for Scientific Information), MEDLARS tapes (U.S. National Library of Medicine), and NASA tapes (U.S. National Aeronautics and Space Administration).

It will be many years before these mechanized information retrieval systems can provide national services. Until then, the chemists and chemical engineers of Canada do have access to the extensive information services provided by the NSL. Here a staff of research librarians having science or engineering degrees answers requests for scientific and technical information, compiles bibliographies, carries out literature searches, and identifies and locates obscure references and publications. There is no charge for this service but enquirers are expected to make full use of their local literature resources before submitting their question to the NSL.

In 1964, in co-operation with the Editorial Office of the NRC's Canadian Journals of Research, the Library established a Depository of Unpublished Data. The purpose of this Depository is to enable authors of scientific papers to store extensive tables of data or detailed results of calculations that supplement their papers but are not essential for

most readers of the paper. This supplementary material is made available without charge, upon request. To date 82 items are on file and 111 requests for copies have been received.

3. Assessment of Present Status

The publications listed in Table 1 (p. 19) show, in our opinion, that the chemical community in Canada is well-represented by journal coverage. The journals in this list provide outlets for work done in all the major areas of chemistry that are being actively pursued. With only a few exceptions, as noted in section 2.2, the journals are well-monitored by abstracting and indexing services.

As shown in section 2.3, the growth rate of Canadian primary research journals is keeping pace with the chemical literature as a whole. The circulation figures given in section 2.4 (Table 3, p. 23) are very encouraging when it is considered that the J. Am. Chem. Soc. probably has the greatest circulation of any chemical journal. The Canadian journals have reached or are approaching the circulation figures of such journals as Biochemistry and the Journal of the Chemical Society. In short, the Canadian primary research journals appear to be achieving a competitive position on the international scientific scene.

There are two aspects about the sources of contribution to Canadian journals section 2.3 (Table 3) that deserve comment. The first is the small number of contributions coming from industry - about 4% as compared to 29% for industry in the U.S.A.[9]. Clearly, this reflects the small amount of research done by Canadian chemical industry. The second cause for comment is that some two-thirds of the chemical research done in Canada is published elsewhere. Undoubtedly, one good and valid reason for authors publishing in foreign journals is to put their work in a specialized journal that they know will reach a certain specific audience. The view has been expressed that papers published in Canadian journals are lost or buried as far as the international scientific community is concerned. The facts do

not substantiate this opinion for, as pointed out in section 2.2, Canada's primary chemical research journals are completely monitored by several international abstracting and indexing services (including Chemical Titles on tape). Nevertheless, this view has presented a specific problem to the development of primary research journals in Canada.

If much of the best work done in Canada is published elsewhere, it is difficult to raise the standards of a Canadian journal, to attract good papers, and thereby to obtain the desirable international circulation. A "vicious circle" is thus established and any Canadian journal, particularly a new one, has to make strong efforts to break out of it. A measure of success can be achieved by maintaining high standards and by offering faster publication than competing journals; however, the process takes time. The extent to which existing Canadian journals have overcome this problem is revealed by the circulation figures (Table 3).

Trade journals and professional magazines appear to be fulfilling adequately the function of a medium of communication between specific groups of chemists and chemical engineers at the national level.

4. Shortcomings and Possible Needs

4.1 Feedback

Editorial boards and some individual members of scientific societies were canvassed for their views on chemical publications. As might be expected, a wide spectrum of opinion was encountered. Some pointed to gaps in the coverage of particular fields such as polymer chemistry and theoretical chemistry; this is discussed in section 4.2. A few opinions were based on incorrect information, which ought to be rectified by the facts and figures given in Section 2. Some anomalous things were pointed out. For example, the Department of National Revenue assesses magnetic tapes and microfilm differently from books that contain the same information. Moreover, the Income Tax Act discriminates in favour of self-employed professional people who can claim deductions for scientific books and journals. Several people

expressed concern about the relatively small amount of applied research that is published in Canada but no prescriptions for increasing it were volunteered.

4.2 Possible New Publications

At present, there is no medium for very rapid publication in Canada. New "world" discoveries (e.g. chemical compounds of the rare gases) are therefore first announced in journals published in other countries. Beginning in January 1968, the Canadian Journal of Chemistry is carrying a section for communications that will be published quickly. Such sections may also be developed for some of the other journals published by the National Research Council.

As the amount of material published in primary journals is rapidly increasing there is an ever-growing demand for critical reviews, monographs and such secondary publications. It is possible that Canadian contributions in this direction ought to be considered.

Regret has often been expressed that no Canadian equivalents of Nature, Science, the New Scientist, etc. have existed. It now appears that several general publications are being launched and one or more of them may grow to meet the present need.

The initiation of new primary journals of basic or applied chemistry requires careful thought and preparation. The critical factors involved are high standards and a sufficient number of papers to sustain the journal during its initial growth period. Editorial boards can set and control standards but the number of papers will depend on how many people are working actively in the specialty represented by the journal. To register any impact on the scientific scene a journal would have to be published at least bimonthly. To make an issue of respectable size requires at least ten papers for an annual content of 60 papers. If a normal rejection rate of 25% is assumed, 80 papers will be needed each year to sustain the journal. This means there should be 40 or more researchers actively working in the field.

A few suggestions have been made that Canada should join some other countries in publishing abstracting and indexing services. In our view, it is unrealistic for Canada to consider the publication of abstracting and indexing journals. Instead, we should participate to the fullest extent in the improvement and extension of existing abstracting and indexing services whether issued in printed form or on magnetic tapes. Some direct financial assistance from Canada may be desirable. Even greater aid can be given, however, if Canadian chemists and their journals provide existing abstracting and indexing services with abstracts in both conventional and machine-readable form. Such participation would be extremely valuable to Chemical Abstracts, which is aiming to provide as complete a coverage as possible of the world's chemical literature, and has under way a computerized service. The magnitude of this effort is indicated by its budgetary requirements of 41 million dollars[3].

Canadian publications can further participate in these services by adopting international recommendations for symbols, units and nomenclature[10]. Editors should also keep in mind the increasing extent to which titles of papers are being used in mechanized retrieval systems to index the subject contents of these papers (KWIC Indexes).

5. A Look into the Crystal Ball

If one takes citation of Canadian work in abstract journals as a yardstick, Canada's contribution to the world's chemical literature is in proprotion to her contribution to the world's gross national product[11]. While such a comparison should not be pressed too far, it suggests that the state of health of the pursuit of chemistry in Canada is reasonably good. We have argued from the beginning that chemical publications serve a national purpose. In the future, they should continue to do so. At the same time, they should be properly integrated with international information systems.

The principal cost of publication is encountered at the production stage. Traditionally, scientific editing and reviewing are done on a

voluntary basis. A development that is coming quickly is the automation of typesetting and distribution. For example, the American Chemical Society expects to be producing all of its journals by computerized typesetting by the end of 1968[4]. In order to benefit economically from automation, the production of journals ought to be centralized. It should be possible to do this and, at the same time, to leave the responsibility for the scientific standards and the initiative for new publications in the hands of societies and other reputable scientific bodies.

In all countries the cost of scientific publication is largely borne out of public funds through direct grants, payment of page charges from research grants, etc. At present in Canada, there exists a queer mixture of these mechanisms plus publication of journals by government agencies such as the National Research Council and the Fisheries Research Board. We do not propose that everything should be centralized but, in the interest of sound expenditures of public funds, we think that some rationalization at the production stage ought to be contemplated.

6. Recommendations

1. In spite of the proliferation of scientific journals, Canada should continue and expand its program of publishing journals in the fields of chemistry and chemical engineering.
2. Canadian journals should be integrated with international information systems, and should conform to international standards regarding bibliographies, content and format.
3. Canada should not attempt to publish abstracting or indexing journals covering chemical literature. Instead we should participate to the fullest extent in the improvement and extension of existing services.
4. All major Canadian libraries, particularly those supported directly or indirectly by public funds (university, public

and governmental) should subscribe to all of Canada's primary research journals in chemistry. They should also subscribe to those abstracting and indexing services that cover the majority of the Canadian research journals.

5. Libraries having access to computers and serving a community of scientists should be encouraged to subscribe to magnetic tapes and similar services designed to expedite the retrieval of information.
6. The National Science Library should make generally available the results of its experiments with mechanized information retrieval systems and the programs generated for those systems.
7. The possibility of centralizing the production of research journals should be fully explored.
8. The publication of secondary literature (monographs, etc.) should be encouraged.

References

1. Chemical Literature Expands. (in: Chemical and Engineering News, June 6, 1966. p. 84-8)

2. Directory of Canadian Scientific and Technical Periodicals: a classified guide to currently published titles. 3rd. ed. Ottawa: National Science Library, 1966 (NRC No. 9353)

3. Cahn, R.S.

Survey of Chemical Publications and Report to the Chemical Society. London: The Chemical Society, 1965. 97p.

4. American Chemical Society, Annual Report 1966 (in: Chemical and Engineering News, April 10, 1967).

5. Union List of Scientific Serials in Canadian Libraries. 2nd. ed. Ottawa: National Science Library, 1967. 2 vols. (NRC No. 9520).

6. Wolters, Peter H & R. Arthur Green.

Union List of Scientific Serials in Canadian Libraries, 1967 edition: design, conversion, computer operations. (in: Canadian Library. v. 24, January 1968).

7. Bonn, George S.

Science-Technology Literature Resources in Canada. Report of a survey for the Associate Committee on Scientific Information. Ottawa: National Research Council, 1966. 80pp.

8. National Science Library, Annual Report. 1966-67. Ottawa: National Research Council, 1967. 34pp.

9. Chemistry: Opportunities and Needs. A Report on Basic Research in U.S. Chemistry by the Committee for the Survey of Chemistry. National Academy of Sciences - National Research Council, U.S.A., Washington, D.C. 1965, p. 150.

10. ISO Recommendations (International Organization for Standardization)

R 8 - Layout of periodicals
R 18 - Short contents list of periodicals or other documents
R 77 - Bibliographical references
R 214 - Abstracts and synopses

11. Price, Derek J. de Solla

Nations can Publish or Perish. (in: Science and Technology, October 1967, p. 84-90).

TABLE 1

Canadian Chemical Publications

Title	Number of Pages Published in 1966		
	Scientific Papers	Editorials, Letters News Items, etc.	*Abstracted or Indexed in
(a) Primary Research Journals			
1. Canadian Journal of Biochemistry (National Research Council)	1704	-	c, e, g, j, m
2. Canadian Journal of Chemical Engineering (Chemical Institute of Canada)	360	-	a, b, c, e, g, h, i, l, o
3. Canadian Journal of Chemistry (National Research Council)	3137	-	a, c, e, g, h, m
4. Canadian Journal of Pharmaceutical Sciences (Canadian Pharmaceutical Association)	62	2	-
5. Canadian Journal of Physiology and Pharmacology (National Research Council)	1036	-	c, g, h, j, m
6. Canadian Journal of Plant Science (Agricultural Institute of Canada)	695	-	c, d, e, g, h, m
7. Canadian Metallurgical Quarterly (Canadian Institute of Mining and Metallurgy)	365	-	a, g, h, i, l
8. Canadian Spectroscopy (Canadian Association for Applied Spectroscopy)	98	17	g, h
9. Fisheries Research Board of Canada Journal (Fisheries Research Board)	1981	56	c, g

*See page 21 for key to Abstracting and Indexing services.

(b) Trade Journals and Professional Magazines

10. Alcan News	-	77	-
11. Canadian Chemical Processing (Southam Business Publications Ltd.)	309	368	a, b, g, i
12. Canadian Clay and Ceramics (Canadian Ceramic Society)	148	58	-
13. Canadian Petroleum (Southam Business Publications Ltd.)	404	183	-
14. Canadian Pharmaceutical Journal (Canadian Pharmaceutical Association)	63	357	g, k
15. Canadian Pulp and Paper Industry (Maclean Hunter Publishing Co. Ltd.)	71	426	g, n
16. Chemicals Outlook (Canadian Industries Ltd.)	14	5	-
17. Chemistry in Canada (Chemical Institute of Canada)	101	429	a, g, h
18. CIL Oval (Canadian Industries Ltd.)	0	58	f
19. Journal of Canadian Petroleum Technology (Petroleum Society of Canadian Institute of Mining and Metallurgy)	257	57	-
20. Pulp and Paper Magazine of Canada (National Business Publications of Canada Ltd.)	1639	316	c, e, g, h

a - ASM Review of Metal Literature

b - Applied Science and Technology Index

c - Biological Abstracts

d - Biological and Agricultural Index

e - Bulletin Signalétique

f - Canadian Periodical Index

g - Chemical Abstracts

h - Chemisches Zentralblatt

i - Engineering Index

j - Index Medicus

k - International Pharmaceutical Abstracts

l - Metallurgical Abstracts

m - Nutritional Abstracts and Reviews

n - P.A.I.S. (Public Affairs Information Service)

o - RAPRA (Rubber and Plastics Research Association of Great Britain)

Table 2. - Origin of Contributions to Research Journals in 1966

(numerical values in %)

	Canada			Outside Canada		
	University	Government	Industry	University	Government	Industry
Can. J. Chem. Eng.	40	4	6	38	-	12
Can. J. Chem.	47	20	5	18	6	4
Can. J. Biochem.	43	29	2	21	4	1

TABLE 3

The Circulation of Journals

Number of Copies

Journal	Total	Canada	U.S.	U.K.	Other Countries
Can. J. Biochem. (Aug./67)	2532	1142	599	292	499
Can. J. Chem. Eng. (Aug./67)	3084	2025	583	88	388
Can. J. Chem. (Aug./67)	5213	3059	1083	351	720
Can. J. Phys. Pharm. (July/67)	1516	752	392	149	223
Chem. in Canada (Nov./67)	10,589	9915	464	63	147
J. Am. Chem. Soc. (1966)	18,555	452	12,830	588	4,685
J. Org. Chem. (1966)	10,502	226	7,254	326	2,696
Biochemistry (1966)	5,468	159	3,755	170	1,384
J. Chem. Soc. (1963/64)	5,365				

TABLE 4

Canadian Library Holdings of Canadian Chemical Journals

Province	Alta.	B.C.	Man.	N.B.	Nfld.	N.S.	Ont.	P.E.I.	Que.	Sask.	Total
Number of libraries reporting	8	16	8	4	3	12	91	1	48	7	198
Titles											
(a) Primary Research Journals											
1. Canadian Journal of Biochemistry	3	7	4	3	1	8	31	-	17	2	76
2. Canadian Journal of Chemical Engineering	4	3	1	2	1	5	23	-	7	2	48
3. Canadian Journal of Chemistry	5	9	2	3	1	8	39	-	23	3	93
4. Canadian Journal of Pharmaceutical Sciences	1	1	-	-	-	1	5	-	-	-	8
5. Canadian Journal of Physiology and Pharmacology	1	3	-	1	1	3	12	-	8	1	30
6. Canadian Journal of Plant Science	3	2	2	1	-	2	14	-	3	3	30
7. Canadian Metallurgical Quarterly	2	-	-	-	-	2	11	-	7	2	24
8. Canadian Spectroscopy	-	-	-	-	-	-	3	-	2	-	5
9. Fisheries Research Board of Canada Journal	2	6	1	3	1	8	19	1	10	2	53
(b) Trade Journals and Professional Magazines											
10. Alcan News	1	1	-	-	-	1	9	-	2	1	15
11. Canadian Chemical Processing	4	8	3	3	-	8	42	-	22	3	93
12. Canadian Clay and Ceramics	-	-	-	-	-	1	5	-	2	1	9
13. Canadian Petroleum	4	1	-	1	-	-	10	-	-	1	17
14. Canadian Pharmaceutical Journal	1	1	1	1	-	2	7	-	5	1	19

15. Canadian Pulp and Paper Industry	-	5	-	-	-	-	8	-	4	1	18
16. Chemicals Outlook	-	1	1	-	-	1	4	-	2	-	9
17. Chemistry in Canada	5	6	3	2	1	8	33	-	16	3	77
18. CIL Oval	3	5	2	1	3	5	35	-	14	4	72
19. Journal of Canadian Petroleum Technology	Not listed ULSSCL						1				1
20. Pulp and Paper Magazine of Canada	-	5	-	2	1	4	21	-	12	3	48

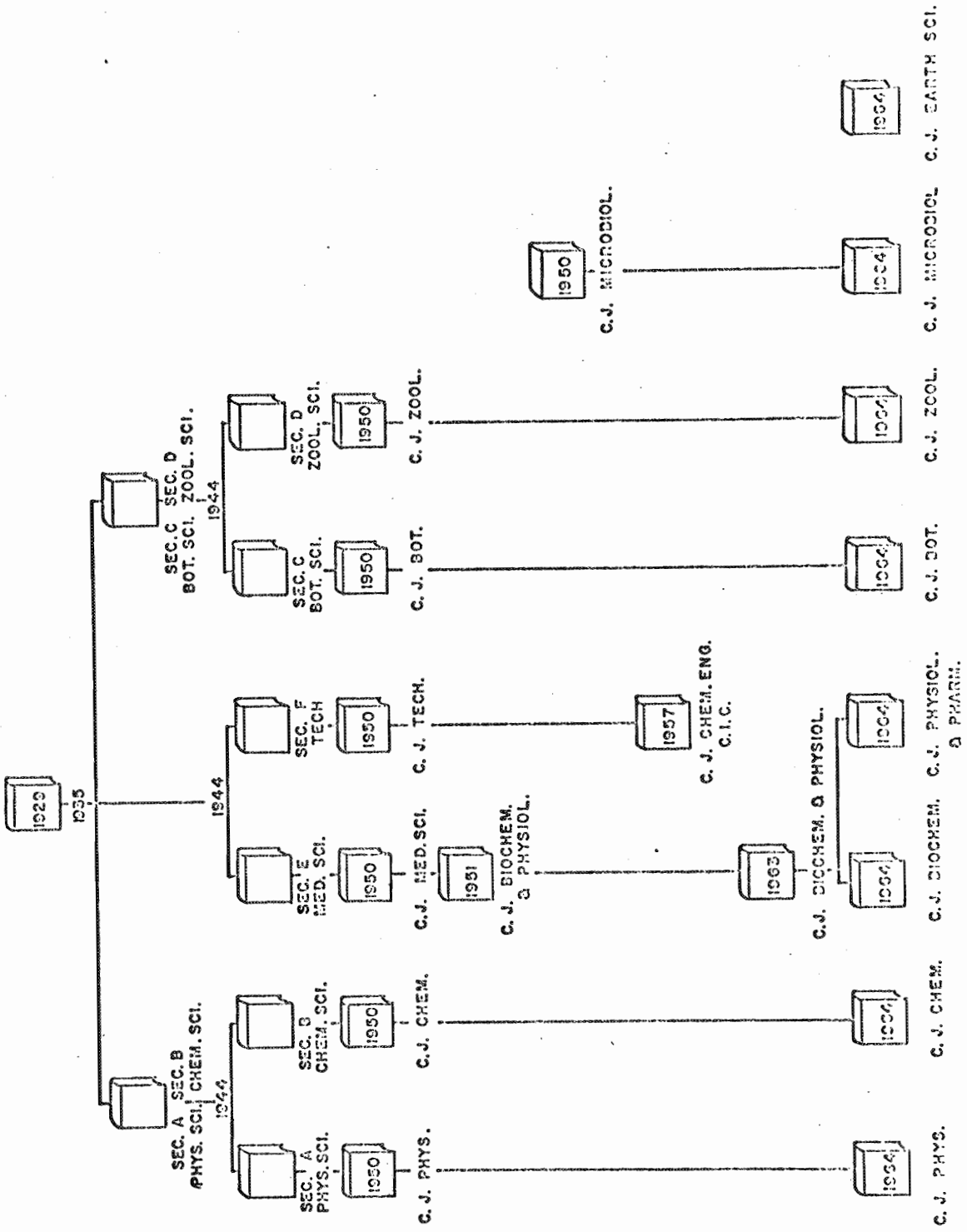
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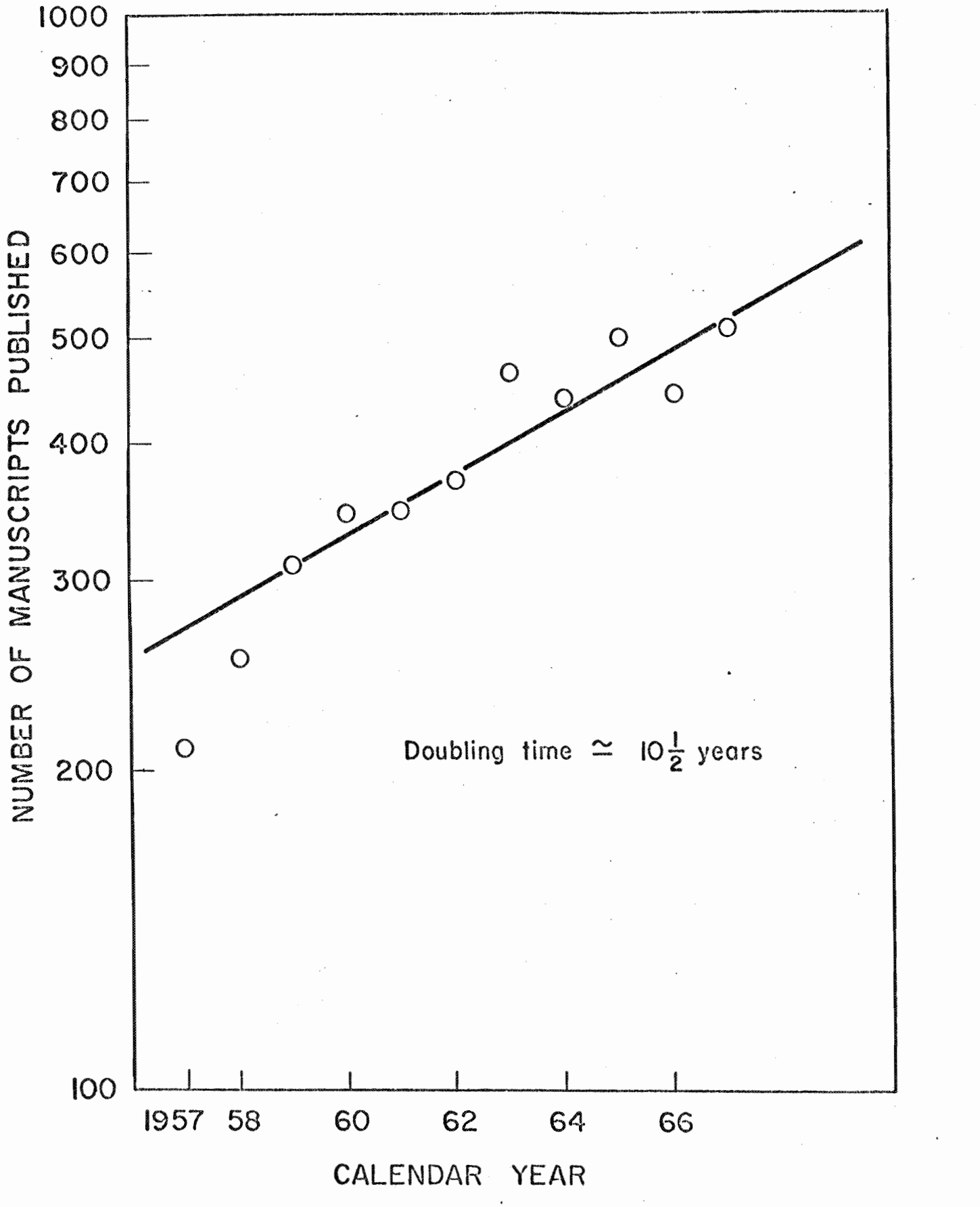
FIGURE 1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62
64
66
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FIGURE 2

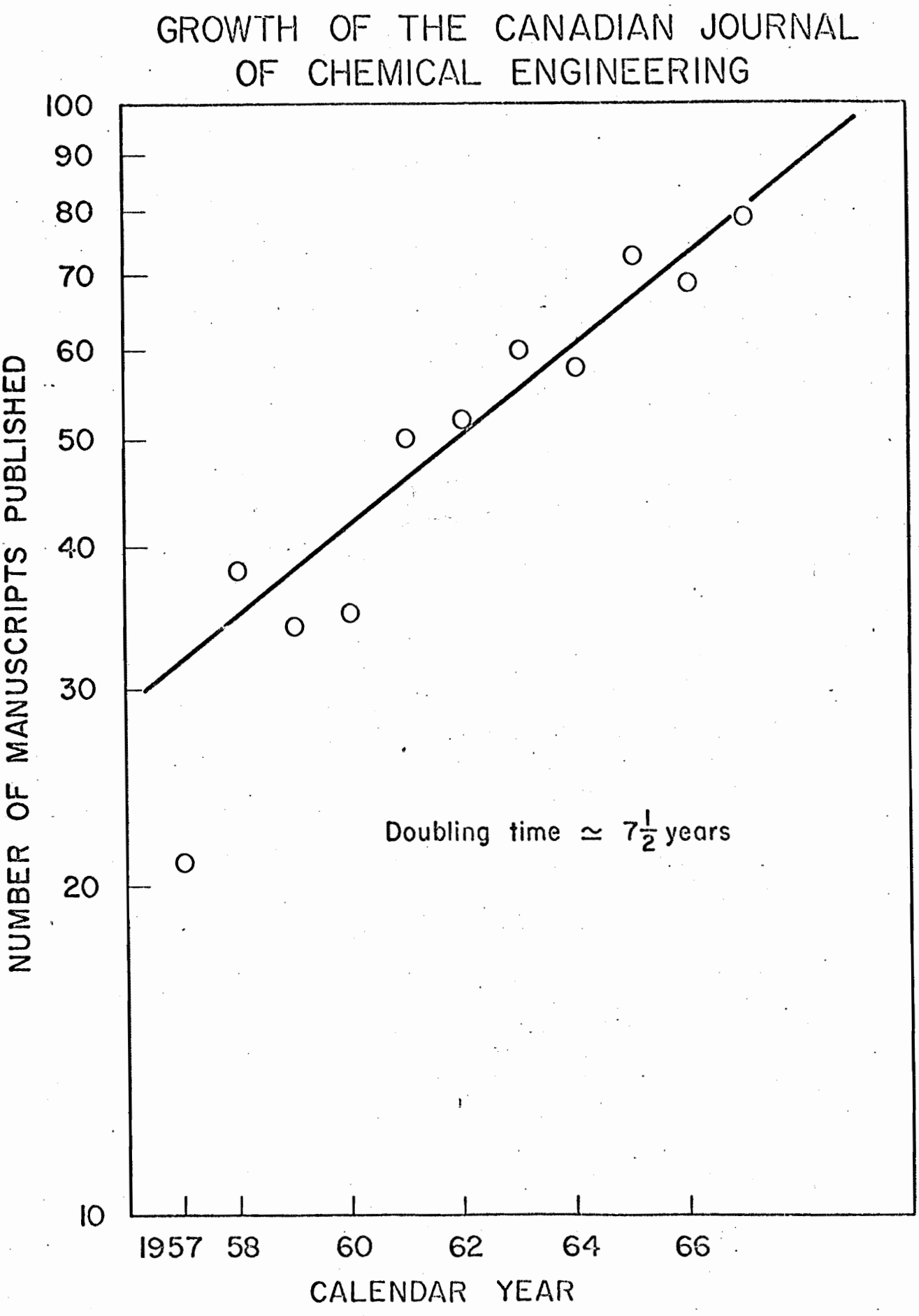
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FIGURE 3