

## College & Research Libraries: Its First Forty Years

*College & Research Libraries began publication in December 1939. This study examines the changes that occurred in its publication and citation patterns during the forty years from 1939 through 1979. Data are generally described in terms of eight five-year periods, and the findings of this study are compared with the results of similar studies of various subject literatures. An overall trend toward greater adherence to the norms of scholarly publication in other disciplines was observed.*

**C**OLLEGE & RESEARCH LIBRARIES (*C&RL*) marked its fortieth year of continuous publication in December 1979. Widely recognized as a leader in the field, *C&RL* has ranked for many years among the top ten library periodicals in circulation. Its success is primarily due to the fact that throughout the years it has not strayed from its originally stated purposes, which were to:

- (1) serve as the official medium of communication between the association and its subsections and their members;
- (2) make available selected articles presented at conventions at which college and research librarians gather, and publish other professionally significant articles;
- (3) serve as a clearing house for educational, research, and library news of interest to college, university, and reference librarians;
- (4) seek to bridge the gap between these librarians and the faculties, college administrators, and research workers whom they serve;
- (5) integrate efforts of college, university, and reference librarians with those of kindred groups such as educational and research agencies and learned societies;
- (6) review and abstract such books, pamphlets, and current periodical literature as would be of interest to the personnel of the A.C.R.L.;

- (7) seek to stimulate research and experimentation for the improvement of the service and publish the results; and
- (8) help to develop the A.C.R.L. into a strong and mature professional organization.<sup>1</sup>

Certainly most, if not all, of these purposes have been adequately served by *C&RL*. Katz attested to its high quality by stating, "In many ways the best of the American Library Association publications, this is professionally edited and contains articles and features not only of interest to college and university libraries, but to anyone dealing with the problem of bibliography, cataloging, acquisitions, and the whole range of professional librarianship."<sup>2</sup>

During its first forty years, seven men served as editors of *C&RL*:

- A. F. Kuhlman, 1939-41
- Carl M. White, 1941-48
- Maurice F. Tauber, 1948-62
- Richard B. Harwell, 1962-63
- David Kaser, 1963-69
- Richard M. Dougherty, 1969-74
- Richard D. Johnson, 1974-80

Changes, of course, occurred in its publication practices. For example, during the first six years of publication, *C&RL* dated its volumes with combined years, e.g., volume one was dated 1939-40. Then issued as a quarterly, each volume contained the December, March, June, and September issues. In 1945,

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however, no December issue was published, and from volume seven, 1946, to date, the volumes have adhered to a calendar year. *C&RL* continued as a quarterly publication until 1956, at which time it changed to bi-monthly. In March 1966 it gave birth to *ACRL News*, later renamed *College & Research Libraries News*. The *News* was to publish "... News from the Field, Personnel profiles and notes, classified advertising, and other matters of a timely nature. . .,"<sup>3</sup> thereby providing rapid news dissemination to the academic library profession and freeing *C&RL* to publish scholarly papers.

Because *C&RL* has gained a national reputation as a leading library periodical, it is a likely target for retrospective analysis. One wonders what it has accomplished in its long history. What topics did it cover? Whom did it publish? How did it change? The purpose of this study is to answer these and other questions by: (1) describing the literature both published and cited in *C&RL*, 1939 through 1979; (2) identifying interesting and significant changes or trends in publication patterns; (3) comparing the findings of this study with the results of similar studies of various subject disciplines, especially landmark studies of scientific literature; and (4) reaching conclusions concerning the scholarlyness of *C&RL* from the ascertained trends and comparisons.

#### DATA AND METHODOLOGY

Data of two types were collected from volumes one through forty of *C&RL*: those concerned with the source documents and those concerned with the cited documents. The study was limited in a number of ways, including:

1. No issues of *C&RL News* were analyzed;
2. Editorials, news items, programs for meetings or conferences, and the like were excluded;
3. Review articles were excluded;
4. Only bona fide articles, recognizable because of known authorship, were included in the study whether or not they listed references;
5. References added by the editors were excluded;
6. All references listed as "Ibid." or "Op. cit." were included;

7. Where multiple references were listed in a single footnote, all were included; and

8. References given in the text of the articles, but not listed as footnotes, were included.

Altogether, the completed database consisted of 1,775 source documents (i.e., the articles published in *C&RL*, volumes one through forty) and 11,658 cited documents (i.e., items cited in the articles published in *C&RL*). Data items for both sources and cited documents included much that was identical: principal author, sex of principal author, coauthor(s), title, and date. For source documents, additional information that was gathered included author's institutional affiliation, number of pages, number of references, subject classification, and number of author and journal self-citations. For cited documents, the additional information included a single letter from the LC classification scheme to indicate the subject, country of publication, language, publisher for monographs or journal title for articles, and form of the document.

Because the database is large and extends over a long period of time, this study is divided into two parts: analysis of the source documents and analysis of the cited documents. The data are tested in many ways utilizing frequency distributions and cross-tabulations, as well as means, percentages, etc., where meaningful. When possible, comparisons of the results are made with literature from other subject areas.

#### PART ONE: SOURCE DOCUMENTS

There were 1,775 articles published in *C&RL* from December 1939 through November 1979. Characteristics of these articles are identified in two areas: of the articles themselves and of the authors who published them. To ascertain changes and trends in the literature and to smooth out anomalies from year to year, data are usually presented in eight five-year spans.

#### *Number and Length of Articles*

Three questions concerning trends in the publishing habits of *C&RL* will probably be of some interest to its readers. First, How many articles did *C&RL* publish during each five-year period of this study? Second, What

was the average number of articles per issue? And third, What was the average number of pages per article? Table 1 summarizes the findings for each of these questions.

The number of articles published in any journal is, of course, controlled by the editors and board of the journal itself. The years 1945-49 were the most productive in terms of articles published (297). This could be accounted for in some measure by the fact that *C&RL* published its third issue in two parts in 1944-45 (a combined year), 1947, and 1949. Each extra issue was dedicated to a single theme: communication and cooperation, essays in honor of Charles Harvey Brown, and rare books in the university library. Even if the articles appearing in these special issues (37) were subtracted from the overall total for 1945-49, the results would remain essentially the same, with that time span producing both the greatest number of articles and, the highest average number of articles per issue. (*C&RL* was, at this time, a quarterly publication.) Twenty years later, in 1965-69, the next greatest number of articles appeared in *C&RL*, 263 (the journal was then bimonthly), which surprisingly was followed in 1970-74 by a record low of 163. Whether the increase to 194 in 1975-79 indicates a restabilization of production remains to be seen.

An obvious trend toward fewer but longer articles per issue can be identified in the table. The trend is most apparent in the average number of pages per article which increased steadily from 4.79 in 1945-49 to 8.08 in 1975-79. In 1963, Garfield and Sher published the results of a study of scientific litera-

ture in which they found that 17.3 articles per issue was the norm, while the average number of pages per article was 5.4.<sup>4</sup> Although *C&RL* did not publish as many articles per issue as scientific journals, its average number of pages per article, in the 1960-64 time span, was identical to that given for scientific journals, 5.4.

#### *Unreferenced Articles and Average Number of References Per Article*

Of greater importance as measures of the scholarliness of a journal are two characteristics for which standards have been established for scientific literature: (1) the incidence of unreferenced articles and (2) the average number of references per article. *C&RL* experienced increased adherence to these standards in both areas for 1939 through 1979. Table 2 presents supporting data that contrast the steady decrease in unreferenced articles with the steady increase in the average number of references per article.

The percentage of articles in *C&RL* having no references whatever was excessively high (more than 40 percent) during the early years of the study and remained well above the average for scientific literature (10 percent)<sup>5</sup> throughout the first thirty years. It is encouraging to note, however, that the percentage of unreferenced articles steadily decreased after 1945-49, and in the last decade of the study either approached or fell below 10 percent, the standard for scientific literature. As the percentage of unreferenced articles decreased, the average number of references per article increased correspondingly. In 1970 Price found the norm for the average number of references per source article (defined as *AR*) for scientific literature to be in the range of 10 to 22.<sup>6</sup> Ten years later, in

TABLE 1

PUBLICATION CHANGES IN *C&RL*

Time Period	No. of Articles Published	Avg. No. of Articles/ Issue	Avg. No. of Pages/ Article
1939-44	207	10.35	5.76
1945-49	297*	14.85	4.79
1950-54	230†	11.50	4.93
1955-59	206‡	7.22	5.19
1960-64	215	7.17	5.37
1965-69	263	8.77	6.30
1970-74	163	5.43	7.66
1975-79	194	6.47	8.08

\*Three issues appeared in two parts.

†One issue appeared in two parts.

‡Number of issues/volume increased from four to six in 1956.

TABLE 2

REFERENCING CHARACTERISTICS OF *C&RL*

Time Period	% of Unreferenced Articles	Avg. No. of References/ Article
1939-44	45	2.89
1945-49	47	3.23
1950-54	41	3.61
1955-59	39	4.09
1960-64	33	5.88
1965-69	25	9.16
1970-74	13	10.56
1975-79	9	15.46

TABLE 3  
JOURNAL SELF-CITATIONS, 1939-79

Time Period	Self-Citing Rate	% of Source Documents Containing Journal Self-Citations
1939-44	7.64	12.56
1945-49	8.95	14.82
1950-54	12.41	23.04
1955-59	10.74	22.82
1960-64	6.26	18.14
1965-69	6.54	26.24
1970-74	5.85	34.97
1975-79	11.17	52.06

1980, *AR* for all literature indexed in the *Science Citation Index* was found to be 15.9.<sup>7</sup> However, when *AR* was calculated for articles only, excluding meetings, notes, editorials, etc., it was found to be 24.2.<sup>8</sup> For the entire forty-year span of this study, *AR* was computed to be 6.57 (i.e., 11,658 cited documents divided by 1,775 source documents), a figure well below even the low norm of 10 for scientific literature. It was also well below Barnard's finding of 16 for library literature.<sup>9</sup> Barnard's study, however, analyzed the citations in seven library periodicals, not one; covered two years, not forty; and omitted all articles having no references, unlike the current study which included them. The reader should note that *AR* increased steadily through the years, and in the last fifteen years of the study, either approached or fell into the norm of 10 to 22 for scientific literature.

#### Journal Self-Citations

In 1979 Garfield reported that self-citations were contained in about 20 percent of a journal's references.<sup>10</sup> In the same paper, he explained the difference between two kinds of journal self-citation rates:

There are *two* self-citation rates, the self-citing and self-cited rates. The self-citing rate relates a journal's self-citations to its total references. The self-cited rate relates a journal's self-citations to the number of times it is cited by all journals including itself. For example, journal X made reference to 10000 items, including 2000 items it itself had published. Its self-citing rate is 2/10 or 20%. On the other hand, journal X was cited 15000 times in the references of all journals, including its own. Its self-cited rate is 2/15 or 13.5%.

In this study it was possible to examine two phenomena of journal self-citations in *C&RL*: (1) the self-citing rate (the data for this study did not provide a means for analyzing the self-cited rate), and (2) the percentage of source documents containing journal self-citations. Table 3 presents the changes that occurred in both over the years.

As an example of how the percentages in table 3 were calculated, in 1975-79, *C&RL* made reference to 2,999 items, including 335 items it itself had published; thus its self-citing rate was 11.17 percent. In the same time span, 194 source documents appeared in *C&RL*, 101 (52.06 percent) of which in-

cluded one or more references to items it had published. Note that the self-citing rate fluctuated a great deal and never approached the 20 percent that Garfield reported. Although the percentage of documents containing journal self-citations had increased consistently and rapidly from 1939 to 1979, the total number of journal self-citations was minimal with respect to the total number of citations (1,001 out of 11,658).

#### Activities Discussed in *C&RL*

In order to determine the activities discussed in *C&RL* during its first forty years, each article was scanned by the writer who then used a somewhat modified version of a classification scheme developed by Saracevic and Perk to categorize the source documents according to the subjects they covered.<sup>11</sup> The scheme is outlined in appendix A.

Table 4 illustrates the distribution of source documents according to the activity discussed in each time span and overall for 1939 through 1979. Organization and administration was the major topic most often discussed in *C&RL* throughout the forty years of this study, and comprised, overall, 33.6 percent of all activities. It was followed by general topics (18.7 percent), resources (14.3 percent), public services (13.7 percent), and technical services (12.6 percent). Combined, the activities of automation and information retrieval (4.1. percent), library instruction (2.1 percent), and photoreproduction (.9 percent) were discussed less than 10 percent of the time.

Few trends in the activities discussed could be identified because the changes in relative frequency from one time period to another were inconsistent. Until 1975-79, there ap-

TABLE 4  
ACTIVITIES DISCUSSED IN C&RL BY FIVE-YEAR PERIOD, 1939-79

Activity	Time Period (in Percent)									
	1939-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	1939-79	
General	22.7	22.9	11.7	21.4	18.6	16.0	15.3	20.1	18.7	18.7
Organization and Administration	35.7	25.3	37.4	35.9	34.9	34.2	36.8	31.4	33.6	33.6
Resources	14.5	18.2	23.5	15.5	11.6	9.1	9.2	10.8	14.3	14.3
Public services	10.1	14.1	10.9	8.3	11.2	15.2	22.7	19.1	13.7	13.7
Technical services	16.9	15.2	13.9	9.2	12.6	12.9	6.7	10.3	12.6	12.6
Automation and information retrieval	0.0	1.0	1.3	3.9	5.6	9.1	6.7	6.2	4.1	4.1
Library instruction	0.0	2.0	0.9	3.9	3.3	2.7	2.5	2.1	2.1	2.1
Photoreproduction	0.0	1.3	0.4	1.9	2.3	0.8	0.0	0.0	0.9	0.9

peared to be a slight trend toward less emphasis upon general topics. However, with the publication in 1976 of a large number of historical studies, this trend seemed to terminate. A very slight increase in emphasis upon public services and a slight decrease of interest in automation and library instruction were also noted in the latter years of the study.

Six of the eight major activities were divided into subtopics. Table 5 presents the data on subtopics for 1939-79.

Several areas represented by the subtopics are noteworthy. First, general administration received the most emphasis because it included topics of continuing interest to librarians, i.e., finance, personnel, salaries, etc. Second, special types of materials were the resources most often discussed. These included government publications, rare books, indexes, and abstracts. Third, not surprisingly, library cooperation was the area of public services that received the most attention. And last, as one might expect, catalog-

TABLE 5  
SUBCLASSIFICATION OF ACTIVITIES  
DISCUSSED IN C&RL, 1939-79\*

Subclassification	No.	%
<i>Organization and administration</i>		
General administration	447	31.8
Professional education	56	4.0
Architecture and equipment	92	6.6
<i>Resources</i>		
Book	30	2.1
Serial publications	25	1.8
Special types of materials	99	7.1
Subject literatures	59	4.2
Audiovisual materials	41	2.9
<i>Public services</i>		
Circulation	50	3.6
Reference	46	3.3
Library cooperation	96	6.8
Use and user studies	45	3.2
Reader services	7	0.5
<i>Technical services</i>		
Acquisitions and selection	95	6.8
Cataloging and classification	103	7.3
General activities	25	1.8
<i>Automation and information retrieval</i>		
Automation of library processes	46	3.3
Information retrieval and documentation	26	1.9
<i>Photoproduction and microfilming</i>		
Copyright law	7	0.5
Microfilming techniques and equipment	9	0.6

\*The activities classified as "General" and "Library Instruction" had no subactivities.

ing and classification received the most emphasis among the subtopics of technical services.

### Source Author Productivity

A total of 1,240 principal authors contributed 1,775 articles to *C&RL*, 1939 through 1979. This averages to 1.43 articles per author over the forty-year span of this study. Figure 1 illustrates the wide range in author productivity. In 1977 Watson, reporting on the publication output of librarians at ten large university libraries, found the median productivity to be two publications in five years, one of which was a book review.<sup>12</sup>

In his landmark study of 1926, Lotka de-

scribed the productivity of scientific authors.<sup>13</sup> He found: (1) that the proportion of all persons making a single contribution to chemistry and physics journals was about 60 percent, and (2) that the number of persons making  $n$  contributions was about  $1/n^2$  of those making only one contribution. In the current study, 80 percent of the principal authors made a single contribution to *C&RL*. It was obvious then that librarians were not as productive as scientific authors, a conclusion that was in agreement with Schorr's findings for library literature.<sup>14</sup> A discussion of Lotka's law and a detailed statistical analysis of the data from *C&RL* appear in appendix B.

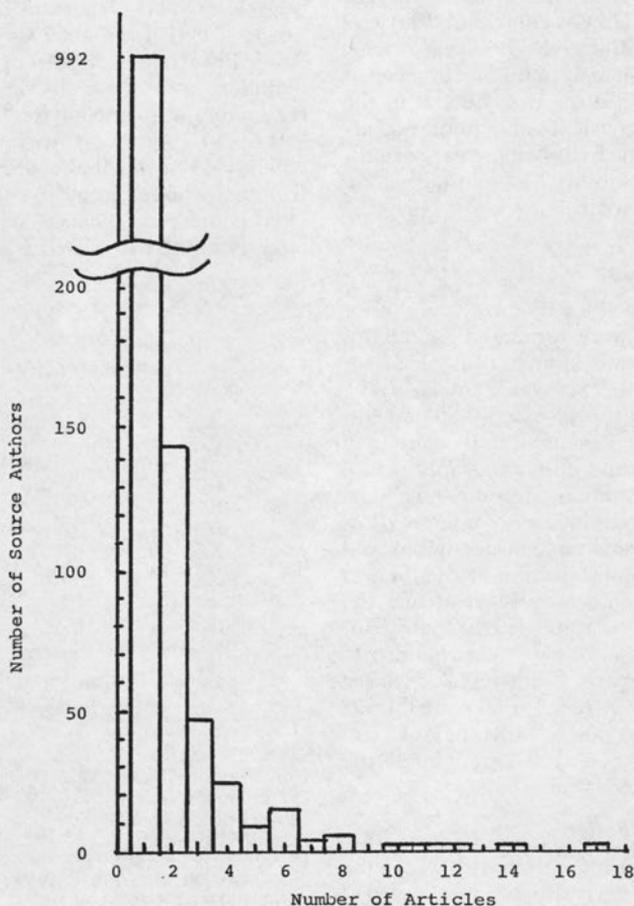


Fig. 1  
Number of Articles Contributed by Source Authors

### Leading Authors

A very weak core of productive authors was identified. Only six authors contributed ten or more articles to *C&RL* during the forty years of this study. They were:

Author	Number of Articles
Downs, Robert B.	24
Metcalf, Keyes D.	17
Muller, Robert Hans	14
Ellsworth, Ralph E.	12
Shaw, Ralph R.	11
Tauber, Maurice F.	10

These six authors, representing 0.48 percent of all source authors, contributed about 5 percent of the articles appearing in *C&RL*. Only Robert B. Downs contributed articles during each of the eight five-year spans, while Keyes D. Metcalf published in seven of the time periods (in the first six and in the eighth) and Maurice F. Tauber published articles in each of the first six five-year periods. These authors obviously had unusually long and productive careers.

### Sex of Authors

Sex was recorded for the principal author only, and data were tabulated for all instances when sex was known, rather than for each unique author. Sex was known in 1,768 of 1,775 cases. For seven cases (0.39 percent) sex was unknown because initials were used for given names and no photograph or biographical information accompanied the source article. The incidence of unknown authorship was considered to be negligible, and thus it was felt that omission of the data in the discussion would not distort or bias the results in any way. From 1939 through 1979, principal authors were overwhelmingly males (78.85 percent), with females constituting only 21.15 percent of all contributors to *C&RL*. Surprisingly, this balance remained almost constant throughout the years, as illustrated in table 6.

### Institutional Affiliation

The name of the institution with which the principal author was affiliated was recorded in every instance where the information was available. Over the forty-year span of this study, only 66 of 1,775 cases were unknown.

The top ten institutions are listed in table 7.

Although it seemed obvious that the majority of contributors to *C&RL* would be associated with academic libraries, it was necessary to categorize institutions according to type to see if this assumption proved to be true. Nine categories were used: academic libraries, special libraries, library associations, government libraries, public libraries, library schools, other (nonlibrary institutions), foreign institutions, and unknown. The frequency of distribution for institutional affiliation (by type) of source authors for 1939 through 1979 is given in table 8 in descending order. As anticipated, almost 60 percent of the contributors did come from academic libraries. Kim and Kim found that between 57 and 61 percent of the contributors to *C&RL* from 1957 to 1976 were academic librarians.<sup>15</sup> As seen in table 8, the remainder of the distribution seemed reasonable also, except for the category of "other." However, it was understandable when one realizes that the majority of contributors who fell into this category were invited conference speakers whose texts were later published in *C&RL*. Additional con-

TABLE 6  
SEX OF SOURCE AUTHORS

Time Period	Male Sex (in Percent)
1939-44	78
1945-49	77
1950-54	78
1955-59	87
1960-64	85
1965-69	77
1970-74	80
1975-79	79

TABLE 7  
INSTITUTIONAL AFFILIATION  
OF SOURCE AUTHORS

Institution	No. of Articles	No. of Authors
University of Illinois	73	44
Columbia University	58	40
Library of Congress	53	41
Harvard University	47	26
University of Chicago	37	27
University of California, Berkeley	34	28
Stanford University	30	20
University of Wisconsin	23	13
American Library Association	19	14
Purdue University	19	15

TABLE 8  
TYPES OF INSTITUTIONS OF  
SOURCE AUTHORS, 1939-79

Type of Institution	No.	%
Academic libraries	1,042	58.70
Other (nonlibraries)	200	11.27
Library schools	152	8.56
Government libraries	111	6.25
Unknown	66	3.72
Foreign	63	3.55
Special libraries	60	3.38
Public libraries	56	3.16
Library associations	25	1.41
Total	1,775	100.00

tributors within this category were often either retired or unemployed librarians. Library school faculty provided a good many of the articles published in *C&RL*, as did government library employees. Contributors from foreign countries, as well as from special and public libraries, were few in number, as might be expected. The smallest percentage of contributors were those affiliated with library associations.

#### Collaborative Authorship

Collaborative authorship was recorded for each of the 1,775 source documents published from 1939 through 1979. From the figures presented in table 9, one can see that the vast majority of the articles had no coauthors. However, a trend toward increased collaborative authorship was easily identified by tracing the decrease in the percentage of articles having no coauthors through each of the eight five-year periods as seen in table 10.

For twenty-five years there was no break in the extent of collaborative authorship. In 1965-69, however, the rate of articles having no coauthors dropped over 8 percent, and was followed by two additional consecutive

TABLE 9  
NUMBER OF COAUTHORS CONTRIBUTING TO  
ARTICLES IN *C&RL*, 1939-79

No. of Coauthors	No. of Articles	%
None	1,586	89.35
1	165	9.29
2	17	.96
3	4	.23
4 or more	3	.17
Total	1,775	100.00

decreases of over 6 percent. The trend toward increased collaborative authorship seemed to parallel a similar increase in the sciences. In 1963, for example Garfield and Sher reported an average of 2.1 authors per source document,<sup>16</sup> a figure that had increased to 2.56 by 1980.<sup>17</sup> For *C&RL*, the average number of source authors per article had increased from 1.04 in 1939-44 to 1.36 in 1975-79, still far below the average for scientific literature.

#### Author Self-Citations

The practice of author self-citation has received little attention in the literature. Garfield and Sher reported, "In this index [*Science Citation Index*], 8% of all citations are first-author self-citations."<sup>18</sup> Table 11 presents the data for two facets of author self-citations in *C&RL*.

The findings for author self-citations paralleled those discussed earlier for journal self-citations. The author self-citing rate fluctuated a good deal and never reached the 8 percent Garfield mentioned for scientific literature, indicating that the total number of author self-citations (414 out of 11,658 total citations for 1939-79) were minimal. It was

TABLE 10  
EXTENT OF COLLABORATIVE AUTHORSHIP

Time Period	Articles Having No Coauthors (in %)
1939-44	95.65
1945-49	95.62
1950-54	93.48
1955-59	92.72
1960-64	93.95
1965-69	85.93
1970-74	79.14
1975-79	72.68

TABLE 11  
AUTHOR SELF-CITATIONS, 1939-79

Time Period	Self-Citing Rate	% of Source Documents Containing Author Self-Citations
1939-44	5.09	9.7
1945-49	4.16	7.1
1950-54	5.45	10.0
1955-59	2.65	8.7
1960-64	2.30	10.7
1965-69	2.55	12.9
1970-74	4.93	22.7
1975-79	3.30	29.9

interesting to note that although author self-citing rates were small, there was a marked increase in the percentage of contributors to *C&RL* who cited themselves, from 9.7 percent in 1939-44 to 29.9 percent in 1975-79.

PART TWO:  
CITED DOCUMENTS

Variables investigated in this part of the study include: (1) growth rate of cited documents; (2) authorship of cited documents, including the identification of leading authors, sex of authors, and the extent of collaborative authorship; (3) bibliographic form, with emphasis upon the most-cited periodicals and monographs; (4) language/geographic/subject distributions; and (5) time span of cited documents.

Documents totaling 11,658 were cited in *C&RL* during the forty-year span of this study. Some of these documents had authors but no titles (for example, correspondence); conversely, some were anonymous, having titles but no authors. Other variables such as publisher and date of publication were also sometimes missing from the data; this situation usually occurred when they were omitted from the author's reference and could not be readily ascertained. Therefore, the number of cases analyzed for each of these variables will vary.

#### *Growth Rate of Cited Documents*

It has been widely accepted for years that world literature has grown at an exponential rate.<sup>19</sup> While Danton<sup>20</sup> and others have discussed the proliferation of library literature, they have not shown whether it too has increased exponentially. Table 12 provides the frequencies for documents cited in *C&RL* during 1939 through 1979.

Note in the table that the number of citations per five-year period was averaged in order to reduce the "noise" that would have resulted in wide yearly fluctuations in the citation patterns. By plotting these eight five-year averages on linear graph paper, a curve was obtained that illustrates in part an exponential rise in citations. Observe in figure 2 that four of the eight points on the curve lie on what resembles an exponential curve; four points form peaks above the exponential portion. The initial aberration occurring in the curve during the 1945-49 period resulted

TABLE 12  
FREQUENCY OF DOCUMENTS  
CITED IN *C&RL*

Time Period	No.	Yearly Average
1939-44	589	118
1945-49	961	192
1950-54	862	172
1955-59	829	166
1960-64	1262	252
1965-69	2430	486
1970-74	1726	345
1975-79	2999	600

primarily from *C&RL* having published one issue in two parts during three of the five years, thereby increasing the total number of citations by 131 (or 26 when averaged). If these were subtracted from the 1945-49 total, the curve would have approached a true exponential in its early part (see the dashed curve).

An explanation for the second peak in 1965-69 is more difficult to formulate. If the figures for 1965-69 and 1970-74 were reversed, there would be little need for an explanation. A plausible reason for the unprecedented growth in citations in 1965-69 (which really began in 1960-64) is that the 1960s were years of great expansion in libraries. Funds were available from the federal government to support research and experimentation in such ventures as automation, as well as collection development and buildings.<sup>21</sup> As a consequence, the literature undoubtedly expanded to report the results of research in the field. In the early 1970s, however, funding slowed<sup>22</sup> and the number of citations decreased markedly as if to reflect a slowdown in library research activity. In the mid-1970s, the citations seemed to resume their earlier rate of growth. Whether or not the overall rate for 1939 to 1979 was truly exponential, it did indicate that the archive of available literature in library science had expanded enormously during those forty years.

#### *Authorship of Cited Documents*

A total of 4,072 individual authors was cited from 1939 to 1979. Of the 11,658 cited documents, 1,158 (9.93 percent) were anonymous, a rate considerably lower than Brace found in his study of the citations in library science dissertations (25 percent).<sup>23</sup> Over 60

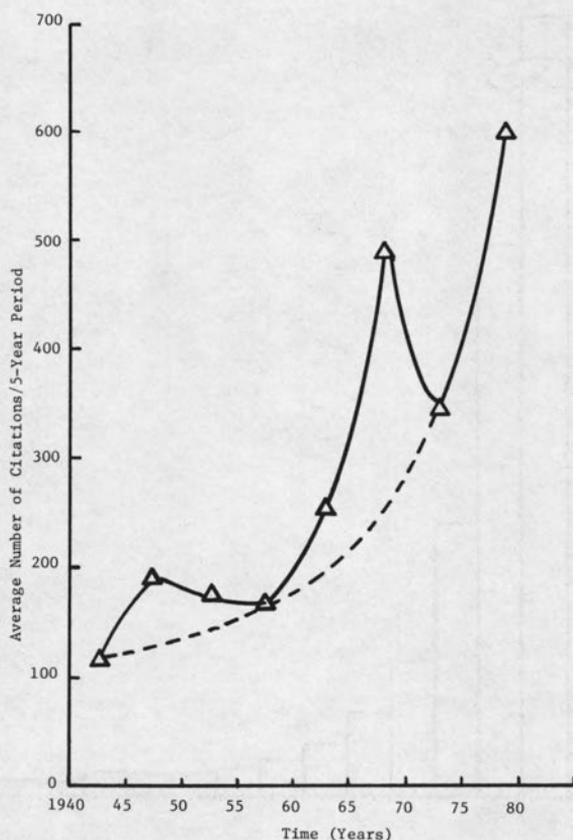


Fig. 2  
Average Number of Citations per Five-Year Period  
in *C&RL*, 1939-79

percent (2,531) of the cited authors were cited only once, and almost 98 percent (3,985) were cited fewer than fifteen times each during 1939 through 1979. Figure 3 illustrates the frequency of authors cited one to fourteen times. Table 13 provides the actual data for figure 3.

#### Leading Authors

The writer arbitrarily decided to include among the core of leading authors only those who had been cited, on the average, once a year for the entire forty-year span of this study. Thus, to be included, an author had to be cited forty or more times. Only 17 (0.42 percent) of the 4,072 authors cited in *C&RL* qualified as leading authors. Table 14 lists

the leaders in rank order. Three of these 17 authors were among the 6 leading contributors to *C&RL*: Robert B. Downs, first with twenty-four contributions; Keyes D. Metcalf, second with seventeen contributions; and Ralph E. Ellsworth, fourth with twelve contributions.

#### Sex of Cited Authors

Sex was recorded for principal author only; data were not gathered for coauthors. Four categories of sex were established: (1) male, (2) female, (3) corporate, and (4) unknown (for personal authors whose sex could not be determined because initials were used for given names in the citations). Sex was tabulated in all instances when it was known

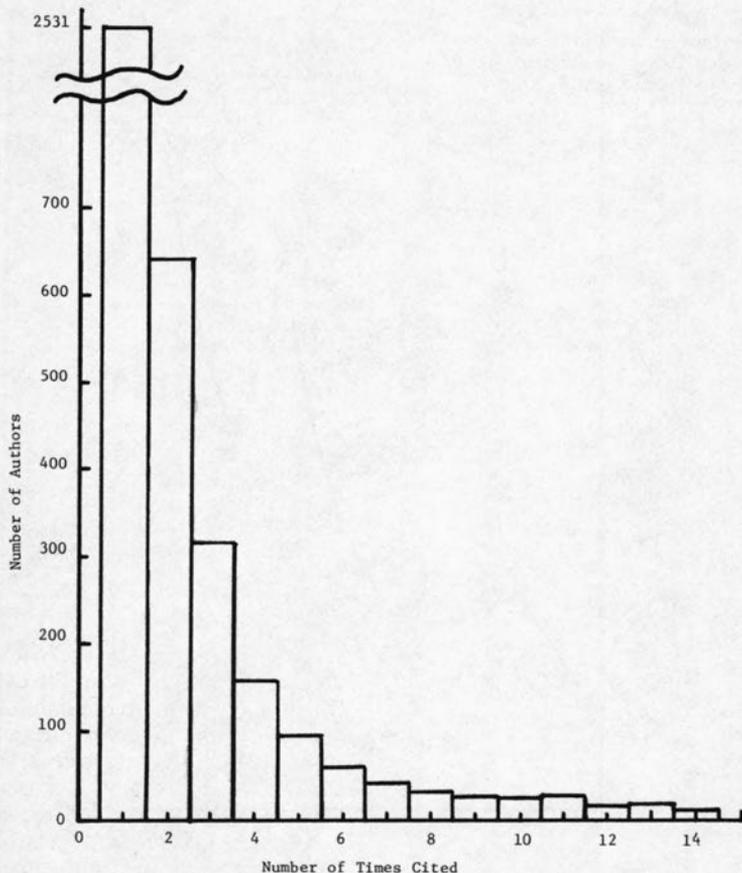


Fig. 3  
Frequency of Author Citations (Less than Fifteen  
Times per Author), 1939-79

(10,500 cases) rather than for each unique author. Overall, males were cited more than six times as often as females, i.e., 72.75 percent to 11.29 percent. Corporate authors constituted 9.39 percent of the total, while 6.57 percent were personal authors whose sex was unknown. Table 15 analyzes the data on sex by five-year periods. Few strong trends or changes in the sex of cited authors were readily apparent. There was an increase of almost 7 percent in females cited during the years from 1955-59 (6.31 percent) to 1975-79 (13.03 percent). During the same twenty-five-year span, there was a decrease in the citations of corporate authors from 15.03 percent in 1955-59 to 6.50 percent in 1975-79. The use of initials-only for personal authors

hovered around the 4 to 6 percent mark in six of the eight time periods, with a high of over 11 percent reached in 1975-79.

#### *Extent of Collaborative Authorship*

The majority of authors (88.06 percent) cited in *C&RL* over the forty-year span of this study did not collaborate with others in writing their papers. It was often difficult to determine the exact number of coauthors, because the citing authors frequently used *et al.* to indicate two or more coauthors rather than their listing each by name. However, the writer recorded individual names for up to three coauthors and then used *et al.* to indicate four or more coauthors. Because of

TABLE 13

NUMBER OF CITED AUTHORS  
CROSS-TABULATED BY THE  
NUMBER OF TIMES EACH WAS CITED

No. of Times Cited	No. of Authors
1	2,531
2	637
3	315
4	157
5	96
6	60
7	40
8	31
9	27
10	24
11	25
12	16
13	17
14	9
15	10
16	7
17	9
18	4
19	6
20	4
21	5
22	3
24	3
25	2
26	4
27	3
28	1
29	3
30	1
34	3
36	1
39	1
41	2
43	1
44	1
46	1
49	1
51	1
52	2
54	2
55	1
62	1
66	1
73	1
82	1
111	1

these variations in citing patterns, the data may be somewhat inaccurate. However, it was thought that these inaccuracies would not greatly affect the results. Table 16 provides an overall picture of the changes in collaborative authorship during 1939 to 1979.

There was a definite trend toward greater collaboration among cited authors, increasing from a low of 4.3 percent in 1955-59 to 15.7 percent in 1975-79. This trend paral-

TABLE 14

LEADING AUTHORS CITED IN  
C&RL, 1939-79

Name	No. of Times Cited
Downs, Robert B.	111
American Library Association	82
Wilson, Louis R.	73
U.S. Office of Education	66
Metcalf, Keyes D.	62
Branscomb, Harvie	55
Lyle, Guy R.	54
Rider, Fremont	54
Ellsworth, Ralph E.	52
Library of Congress	52
Randall, William M.	51
McAnally, Arthur	49
Knapp, Patricia B.	46
Fussler, Herman H.	44
U.S. Congress	43
Danton, J. Periam	41
Williams, Edwin E.	41

leled a similar increase noted in table 10 for collaboration among source authors.

#### *Bibliographic Form of Cited Documents*

At the beginning of the data-gathering phase of this study, eighteen categories of bibliographic form were established for the cited documents. It turned out that only one form, patents, was not used at all. Periodicals (44.65 percent) and monographs (36.41 percent) together provided the bulk of all cited documents. Table 17 presents an overview of the forms of documents cited from 1939 through 1979. Table 18 presents the same data in five-year spans and shows that there were only small fluctuations in the citing patterns. A slight trend toward increased use of periodical literature and decreased use of monographs was evident.

Table 19 provides a comparison of the bibliographic forms cited in various subject fields. The difference in citation patterns between sciences such as chemistry and physics and disciplines such as speech and library science was striking. The sciences cited serial literature more than 85 percent of the time, while the social sciences divided their citations almost equally between serials and monographs.

#### *Bibliographic Form: Periodicals*

*Leading Titles.* Periodicals comprised the bibliographic form cited most frequently in C&RL. From 1939 through 1979, 642 differ-

TABLE 15  
SEX OF CITED AUTHORS (IN PERCENT)

Time Period	Male	Female	Corporate	Unknown
1939-79*	72.75	11.29	9.39	6.57
1939-44	77.44	13.78	8.75	5.03
1945-49	68.73	13.95	13.39	3.93
1950-54	72.60	10.65	12.60	4.15
1955-59	76.38	6.31	15.03	2.28
1960-64	74.54	8.55	12.87	4.04
1965-69	75.32	10.33	8.26	6.09
1970-74	75.28	11.68	7.44	5.60
1975-79	67.06	13.03	6.50	11.41

\*Overall percentage totals for 1939-79.

ent periodicals were cited. Table 20 lists the core of ten (1.6 percent) that provided almost 55 percent of the total number of periodical citations. *C&RL* led with almost 20 percent of the periodical citations. It was followed by *Library Journal*, *Library Quarterly*, *American Libraries*, and other leaders in the field. Only one of the top ten periodicals was not a library periodical in the strictest sense, *American Archivist*, although its relevance to libraries was readily apparent.

*Periodical Title Dispersion.* Stevens defined title dispersion as "... the degree to which the useful literature of a given subject area is scattered through a number of different books and journals. If there is much scattering, the title dispersion is high; if a large portion of the literature is contained in a few journals, the title dispersion is low."<sup>24</sup> Table 21 contrasts the title dispersion of the literature of several subject disciplines.

In the two studies of library science literature listed in table 21, only two titles were required to produce 25 percent of the references. At that point, it was not possible to differentiate the literature of library science from the literature of the sciences, chemistry and physics. Nor was the distinction readily apparent at the next level, where seven journals included 50 percent of the cited literature. The higher title dispersion for library science became obvious at the level where 75 percent of the literature was contained in a much greater number of journals than was true for chemistry or physics. While the title dispersion of library science literature was not as low as it was for the sciences, it was not as high as that of United States history. It seemed instead more comparable to the title dispersion of biochemistry.

### *Bibliographic Form: Monographs*

Monographs comprised over 36 percent of the total documents cited. This figure was comparable to the 36.9 percent that Brace found in his study of library and information science dissertations. Eight-hundred eight (808) publishers supplied the monographs cited. These publishers were widely scattered and, altogether, the ten leaders listed in table 22 provided only about 34 percent of monographic citations. Most of the leaders were predictable: the American Library Association, the official voice for the library profession; the University of Chicago Press and Columbia University Press, leaders by virtue of the fact that they nurture two of the best library schools in the country; and the Association of College and Research Libraries, an important division of the American Library Association.

If the same criteria were applied to the cited monographs as were applied to the cited authors in order to determine a core of leading titles (i.e., each must be cited forty or more times) only two titles would be included. The first, *Teaching with Books: A Study of College Libraries*, by Harvie Branscomb, received fifty-two citations. It was cited most heavily (twenty-one times) from 1940 through 1945. However, its importance to librarianship was demonstrated by the fact that it continued to be cited through 1975-79. The second document cited more than forty times was *Administration of the College Library* by Guy R. Lyle, three editions of which were cited forty-three times in *C&RL* from 1947 through 1979. Although they were not cited forty or more times, two additional titles were cited heavily enough to

TABLE 16  
COLLABORATIVE AUTHORSHIP

No. of Coauthors	Time Period (in Percent)								
	1939-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	1939-79
None	90.6	90.8	92.6	95.7	90.9	88.8	83.2	84.3	87.0
1	6.8	7.8	5.6	3.5	6.8	9.1	12.0	12.3	10.0
2	0.9	1.3	0.7	0.4	1.3	1.1	1.9	1.8	1.5
3	0.2	0.0	0.0	0.1	0.2	0.1	0.4	0.2	0.2
4 or more	1.5	0.1	1.2	0.4	0.7	0.8	2.5	1.4	1.3

TABLE 17  
BIBLIOGRAPHIC FORM OF DOCUMENTS  
CITED IN C&RL, 1939-79

Form	No. Times Cited	%
Periodicals	5,205	44.65
Monographs	4,245	36.41
U.S. govt. publications	464	3.98
Proceedings	299	2.57
Theses and dissertations	226	1.94
Correspondence	200	1.72
Annual continuations	194	1.66
Unpublished materials	153	1.31
Annual reports	137	1.18
Reports	117	1.00
State govt. publications	64	0.55
Newspapers	60	0.52
Laws and statutes	32	0.28
Audiovisual materials	13	0.11
Archival materials	12	0.10
Legal cases	4	0.03
Miscellaneous	227	1.95
Unknown	6	0.05
Total	11,658	100.01

deserve recognition: *The Scholar and the Future of the Research Library: A Problem and the Solution* by Fremont Rider, and *The University Library: Its Organization, Administration and Functions* by Louis Round Wilson. *The Scholar* was cited thirty-six times from 1944 through 1979, and two editions of *The University Library* were cited thirty-two times between 1946 and 1979.

#### Language/Geographic/Subject Distributions

Stevens defined language distribution as "the extent to which the research worker will find useful articles in languages other than his own."<sup>25</sup> In this study, documents in sixteen different languages were cited from 1939 through 1979. English language documents were cited overwhelmingly (97.4 percent). This strong preference for English language materials contrasted sharply with that of the sciences as illustrated in table 23. It should be noted, however, that some of these studies of scientific literature were old and had not been updated. The 1981 *Science Citation Index Guide* did not indicate the percentage of cited documents that was in foreign languages. However, there was some reason to believe that English had become more important to the sciences than appeared to be the case in the data presented here. Garfield found, for example, that al-

TABLE 18  
BIBLIOGRAPHIC FORM OF DOCUMENTS CITED IN *C&RL*  
BY FIVE YEAR PERIOD, 1939-79

Form	Time Period* (in Percent)							
	1	2	3	4	5	6	7	8
Periodicals	40.0	45.1	45.8	46.4	39.4	41.1	46.2	48.8
Monographs	42.9	32.9	31.3	38.7	35.7	39.4	36.4	35.0
Proceedings	1.2	3.3	4.5	1.6	1.8	3.3	1.3	2.8
Reports	0.0	0.2	0.6	0.2	1.0	1.1	2.1	1.1
Annual reports	1.0	1.0	1.3	1.4	2.1	1.2	0.3	1.2
U.S. govt. publications	3.4	6.1	2.9	3.4	4.6	3.7	2.8	4.6
State govt. pubs.	2.2	0.3	0.5	0.2	0.2	0.3	1.1	0.4
Annual continuations	4.4	1.8	1.3	1.6	1.3	1.3	1.7	1.6
Theses and dissertations	1.7	2.1	1.7	0.7	1.7	1.6	2.3	2.5
Correspondence	0.7	3.1	4.2	2.4	4.3	0.8	1.4	0.4
Archival materials	0.0	0.1	0.0	0.2	0.0	0.1	0.3	0.1
Laws and statutes	0.5	2.0	0.1	0.0	0.1	0.1	0.2	0.1
Audiovisual materials	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.1
Legal cases	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0
Newspapers	0.0	0.2	0.5	0.7	0.8	0.6	0.9	0.3
Unpublished materials	1.0	0.9	4.3	0.7	2.5	1.1	1.5	0.4
Miscellaneous	1.0	0.8	0.9	0.9	4.2	4.5	0.9	0.6
Unknown	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0

\*1 = 1939-44; 2 = 1945-49; 3 = 1950-54; 4 = 1955-59; 5 = 1960-64; 6 = 1965-69; 7 = 1970-74; 8 = 1975-79.

TABLE 19  
PERCENT OF SERIALS AND MONOGRAPHS  
CITED IN VARIOUS SUBJECT FIELDS\*

Author and Subject	Serials	Bibliographic Form (in %)	
		Monographs	Others
Fussler - Chemistry, 1948	92.7	5.2	2.1
Fussler - Physics, 1948	91.8	7.7	0.5
Garfield - Science, 1980	86.5†	—	—
Broadus - Speech, 1953	45.7	47.9	6.4
McAnally - U.S. History, 1951	9.2	45.6	45.2
Popovich - Business/Mgt., 1978	58.6	31.9	9.5
Stewart - Politics, 1970	23.0	66.0	11.0
Barnard - Library Science, 1957	51.8	37.7	10.5
Brace - Library Science, 1975	33.0	38.9	28.1
Cline - Library Science, 1980	50.1‡	36.4	13.5

\*Table adapted from Barnard, p. 16.

†Includes journal items only.

‡Includes periodicals, proceedings, annual continuations, and annual reports.

though 56 of the 100 most cited papers in the physical sciences had been published outside the United States, all 100 were published in English.<sup>26</sup>

**Geographic Distribution.** Four categories of geographic distribution were established: (1) United States; (2) English-speaking foreign countries, including the British Isles, Canada, Australia, New Zealand, and other British colonies; (3) other foreign countries; and (4) unknown. Table 24 presents the geographic distribution of documents cited throughout the years 1939 through 1979. Note that over 90 percent were published in the United States.

**Subject Distribution.** Subject distribution

was defined as the extent to which writers in a particular discipline draw on sources outside that discipline. Low subject dispersion indicated that the cited literature belonged to a well-defined field that drew little from outside sources. High subject dispersion existed when the literature was largely composed of materials from outside the subject area to which the literature rightly belonged. In order to determine the subject dispersion of cited documents, they were assigned a single letter of the Library of Congress classification scheme. Table 25 presents the findings for 1939 through 1979. Almost 65 percent of all cited documents fell into the Z class, the special subject of library science.

TABLE 20  
TEN PERIODICALS CITED MOST FREQUENTLY  
IN *C&RL*, 1939-79

Periodical	No. of Times Cited	Percent	Cum. Percent
<i>College &amp; Research Libraries</i>	1,001	19.23	19.23
<i>Library Journal</i>	550	10.57	29.80
<i>Library Quarterly</i>	379	7.28	37.08
<i>American Libraries</i> (incl. <i>ALA Bulletin</i> )	205	3.94	41.02
<i>Library Trends</i>	183	3.52	44.54
<i>Library Resources and Technical Services</i>	117	2.25	46.79
<i>ASIS Journal</i> (incl. <i>American Documentation</i> )	114	2.19	48.98
<i>Special Libraries</i>	110	2.11	51.09
<i>American Archivist</i>	108	2.08	53.17
<i>Wilson Library Bulletin</i>	81	1.56	54.73
Others (632 periodicals)	2,357	45.28	100.01

TABLE 21  
NUMBER OF PERIODICALS CONTAINING THE RESEARCH LITERATURE  
OF DIFFERENT SUBJECT FIELDS

Author and Study	No. of References	No. of Periodicals Containing Various Percentages of References			
		25%	50%	75%	100%
Gross and Gross—Chemistry, 1927	3,633	2	7	24	247
Fussler—Chemistry, 1948	1,085	1	5	19	131
Fussler—Physics, 1948	1,279	1	3	17	134
Henkle—Biochemistry, 1938	17,198	3	12	56	851
McAnally—U.S. History, 1951	452	14	54	149	259
Barnard—Library Science, 1957	863	2	7	36	183
Cline—Library Science, 1980	5,205	2	8	52	642

TABLE 22  
LEADING PUBLISHERS OF MONOGRAPHS, 1939-79

Publisher	No. of Citations	Percent	Cumulative Percent
American Library Association	428	10.08	10.08
University of Chicago Press	182	4.29	14.37
Columbia University Press	163	3.84	18.21
McGraw-Hill	112	2.64	20.85
Wiley	104	2.45	23.30
Wilson	102	2.40	25.70
Scarecrow	100	2.36	28.06
American Council on Education	81	1.91	29.97
Harper	80	1.89	31.86
Association of College & Research Libraries	75	1.77	33.63

TABLE 23  
LANGUAGE DISTRIBUTION OF SUBJECT LITERATURES\*

Author and Subject	English	German	French	Other	Total Non-English
Fussler—Chemistry, 1948	64.5	25.0	3.0	7.5	35.5
Wood—Chemistry, 1967	50.3	6.4	7.3	36.0	49.7
Fussler—Physics, 1948	66.6	22.1	2.9	8.4	33.4
Wood—Physics, 1967	73.0	4.0	4.0	19.0	27.0
Wood—Biology, 1967	75.0	3.0	3.0	19.0	25.0
Stewart—Politics, 1970	82.1	—	—	—	17.9
McAnally—U.S. History, 1951	96.4	—	—	—	3.6
Barnard—Library Science, 1957	94.5	1.2	1.9	2.4	5.5
Cline—Library Science, 1980	97.4	1.0	0.5	1.1	2.6

\*Table was adapted from Stevens, p.17.

TABLE 24  
GEOGRAPHIC DISTRIBUTION OF  
CITED DOCUMENTS, 1939-79

Country	Number	Percent
United States	10,573	90.69
English-speaking foreign	664	5.70
Other foreign	415	3.56
Unknown	6	0.05
Total	11,658	99.90

Table 26 analyzes the subject dispersion by five-year period. The highest dispersion occurred in the fifteen years between 1960 and 1975 when the percentages of documents classified as Z were the lowest at 53, 54, and 62 percent. In all other time periods, the percentage of documents in the Z's hovered at or above 70 percent.

Few trends were discernible in the subject distribution of cited documents. In 1960-64, when subject dispersion was at its greatest, education documents (L's) were cited more frequently than any classification other than Z. From that time period to 1975-79, however, the use of education materials decreased 8.4 percent and the use of social science items (H's) increased 7.0 percent. Only the H's and L's provided a substantial percentage of documents outside the Z's, the special subject of library science.

Subject dispersion of the cited literature is compared with that of other disciplines in Table 27. This study adopted Barnard's definition of subjects closely related to library science and considers them to be: history (D, E, F), sociology (H), education (L), literature (P), and technology (T). The two studies of library science literature showed a surprisingly low subject dispersion, Barnard's being lower than that which Fussler found for chemistry, while the subject dispersion of this study was comparable to that of physics.

#### *Time Span of Cited Documents*

Studies of the time span between the publication of a document and its use (i.e., citation) have produced some interesting observations. For example, upon finding that chemists used chemical literature for a longer time than physicists used chemical literature, Fussler said, "It is reasonable to suppose that this is a natural phenomenon in which specialists in a field use the literature of the field over a longer time span than do non-

TABLE 25  
SUBJECT DISPERSION OF  
CITED DOCUMENTS, 1939-79

LC Classification	Number	Percent
A	197	1.69
B	162	1.39
C	142	1.22
D	49	0.42
E	52	0.45
F	16	0.14
G	16	0.14
H	962	8.25
J	176	1.51
K	68	0.58
L	1,113	9.55
M	104	0.89
N	34	0.29
P	106	0.91
Q	358	3.07
R	33	0.28
S	4	0.03
T	102	0.88
U	11	0.09
V	1	0.01
Z	7,534	64.63
None	418	3.59
Total	11,658	100.01

specialists. . . . It may well be that the literature of 'outside' fields is used only so long as it is new and fresh."<sup>27</sup>

In 1970, Price examined data from the *Science Citation Index* and found that for each year from 1964 through 1968 more than 50 percent of the citations were to the last five years.<sup>28</sup> The data for 1965 provided a high mark of 55.3 percent. For that same year, the percentage of citations dated in the previous five years for selected social science journals was lower: *American Sociological Review*, 35.2 percent; *Psychological Bulletin*, 37.8 percent; and *Journal of Abnormal and Social Psychology*, 39.2 percent. *American Documentation* (now *Journal of the American Society for Information Science*) was the only social science journal that had a higher percentage (at 59.8 percent) than that of the *Science Citation Index* journals (55.3 percent).

Table 28 presents the time span of various subject literatures from studies completed over a thirty-year span. The highest percentages of citations dated in the previous five years were: 69.4 percent for physics; 56.4 percent and 52.0 percent for library science; and 51.3 percent for chemistry. There is reason to believe that Fussler's data may no longer hold true. In 1980, Garfield reported that:

... the references [in biochemistry articles] are to a higher proportion of older material than was the case previously. . . . In 1969, 54.5 percent of [the references in *Acta Biochim. Biophys.*] were more than five years old. This steadily increased to 71.7% in 1977. . . . A similar increase has also taken place in mathematics and botany.<sup>29</sup>

It is difficult to explain the high percentage of citations to the last five years in documents cited in *C&RL*. It cannot be, as Fussler suggested, that new and fresh material was cited from outside fields. Recall that subject dispersion was low for the documents cited in *C&RL* throughout this entire study, indicating that librarians had not drawn frequently from outside sources. A reasonable explanation was that only current materials

were of importance to librarians because they discussed current topics—e.g., what the current inflation was doing to budgets, what technological changes had occurred, etc.

#### SUMMARY AND CONCLUSIONS

*College & Research Libraries* has been one of the leading publications in the field of library science since its inception in 1939. Published by the ACRL, it has served many purposes, chief among which was to be the avenue of communication between the association and its members. When *C&RL News* originated in 1966, it assumed that important responsibility, publishing news items, personnel profiles, and other notes, in the process freeing *C&RL* to publish more schol-

TABLE 26  
RELATIVE FREQUENCY OF DOCUMENTS CITED IN *C&RL*  
CROSS-TABULATED BY LC CLASSIFICATION

Classification	Time Period (in Percent)							
	39-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79
A	0.9	1.1	1.7	2.8	3.9	1.6	2.0	0.7
B	1.0	1.3	0.8	0.6	0.9	3.6	1.3	0.4
C	0.3	0.0	1.3	0.4	0.1	2.7	0.5	1.7
D	0.2	0.0	0.9	0.4	0.4	0.2	0.6	0.6
E	0.9	0.4	0.6	0.2	0.5	0.2	1.2	0.2
F	0.3	0.3	0.5	0.1	0.0	0.2	0.1	0.0
G	0.0	0.5	0.0	0.5	0.1	0.2	0.1	0.0
H	4.1	1.1	3.8	2.9	4.7	7.3	16.5	11.7
J	0.3	1.3	0.5	0.7	6.5	1.1	1.6	0.6
K	0.2	2.0	0.1	0.2	0.8	0.6	0.3	0.5
L	14.3	11.3	10.8	10.3	14.8	9.6	7.6	6.4
M	0.2	0.0	0.1	0.1	0.0	4.0	0.1	0.1
N	0.3	0.0	0.2	0.1	0.7	0.2	0.7	0.1
P	1.2	1.1	2.4	1.7	1.5	1.2	0.1	0.2
Q	1.2	2.5	2.1	1.0	3.5	6.2	2.5	2.1
R	0.0	0.2	0.0	0.2	1.0	0.2	0.3	0.2
S	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0
T	0.3	0.6	0.6	1.3	0.8	0.9	1.4	0.7
U	1.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0
V	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Z	71.6	71.7	68.4	71.0	53.1	54.3	61.6	73.0
None	1.7	4.4	5.0	5.4	6.7	5.7	1.4	1.0

TABLE 27  
SUBJECT DISPERSION OF SPECIAL LITERATURES\*

Author and Subject	Special Subject (%)	Closely Related Subject (%)	Other (%)
Fussler—Chemistry, 1948	71	19	10
Fussler—Physics, 1948	63	25	12
Sengupta—Biochemistry, 1973	55	—	—
McAnally—U.S. History, 1951	31	7	62
Voigt—Metallurgical Engineering, 1947	61	16	23
Voigt—Mechanical Engineering, 1947	27	60	13
Barnard—Library Science, 1957	78	14	8
Cline—Library Science, 1980	65	20	15

\*Table adapted from Stevens, p.15.

TABLE 28  
TIME SPAN OF VARIOUS SUBJECT LITERATURES\*

Author and Subject	0-5	0-10	Age of Cited Documents (in %)			
			0-15	0-20	0-50	0-100
Fussler — Physics, 1948	69.4	88.2	93.9	—	—	—
Fussler — Chemistry, 1948	51.3	71.3	78.7	—	—	—
Garfield — Science, 1980	45.6	70.1	82.5	88.8	—	—
Broadus — Speech, 1953	27.4	43.4	—	62.3	79.9	92.0
McAnally — U.S. History, 1951	10.4	21.6	28.3	33.8	62.1	89.7
Popovich — Business & Mgt., 1978	41.1	70.3	84.7	91.3	—	—
Barnard — Library Science, 1957	52.0	67.3	74.5	81.9	91.6	96.9
Cline — Library Science, 1980	56.4	73.7	81.8	86.3	94.3	98.0

\*Table adapted from Barnard, p. 30.

arly papers. The purpose of this study was threefold: (1) to describe the literature both published and cited in *C&RL* from 1939 through 1979; (2) to identify significant changes and trends in its publication patterns; and (3) to compare the findings of this study with the results of similar studies of various subject disciplines, especially landmark studies of scientific literature. The underlying goal in pursuing the final purpose was to determine how *C&RL*, as a leading library journal, compared with scholarly journals in other fields.

In this study, the characteristics of both source and cited documents were examined in detail, revealing many changes that had occurred from 1939 to 1979. The vast majority of changes boded well for the journal, indicating higher standards and increased scholarliness. This summary will briefly enumerate the changes and draw some conclusions concerning the present status of *C&RL*.

From its beginning in 1939 until the mid-1950s, *C&RL* published many short, newsy articles. After 1954, however, it began to publish fewer but longer articles. The practice of referencing earlier works was sadly neglected by the contributors to *C&RL* until the 1970s, when the percentage of unreferenced articles dropped to 13 percent in 1970-74 and 9 percent in 1975-79, figures in line with the average of 10 percent for scientific literature. As a natural consequence of increased referencing, the average number of references per article also increased, from 2.89 in 1939-44 to 15.46 in 1975-79. This latter figure compared favorably with the norm of 10 to 22 references per article for scientific literature. There were many possible reasons for librarians to have neglected the practice of referencing for so long. For exam-

ple, in the earlier years of the study, the body of library literature was not very large and access to it probably was limited for many librarians. Price, however, pointed to the most plausible explanation for this phenomenon:

Trivially and quite typically, such unreferenced papers occur when an experienced scientist or librarian makes an *ex cathedra* pronouncement out of his innate knowledge of what should be or what is.<sup>30</sup>

Both journal and author self-citing rates in *C&RL* consistently fell below the average percentages for scientific literature (20 percent and 8 percent, respectively). This was simply because the total number of journal and author self-citations were minimal with respect to the total number of citations. However, despite the consistently low self-citing rates, the practice of self-citation increased steadily and substantially from 1939 to 1979 for both the source journal and source authors. These self-citations indicated the existence of increased numbers of related materials in *C&RL* as well as the existence of further documents produced by its contributors.

Throughout the forty years of this study, one library activity was discussed more frequently than any other, organization and administration (about 34 percent). One reason for the heavy emphasis on this topic was supplied by Kim and Kim, who looked at the authorship of articles published in *C&RL* in terms of library position.<sup>31</sup> They found that library administrators contributed a very large percentage of the articles (65.7 percent in 1957-66 and 47.2 percent in 1967-76). It was only natural then that administrators should write about administration. Unfortunately, few significant trends in the topics

discussed were discernible, because the relative frequencies for each generally varied by less than 5 percent from one time span to another. The slight decline of interest in automation and information retrieval, a topic of importance to most librarians, could be attributed to the publication of new, specialized periodicals such as the *Journal of Library Automation*.

Source authors were characterized by sex, institutional affiliation, and extent of collaborative authorship. Further, an effort was made to identify a core of productive authors, and Lotka's law was applied to the empirical data to ascertain whether the contributors to *C&RL* were as productive as scientific authors. An overwhelming majority (about 80 percent) of principal authors were males, and that rate remained relatively constant over the years. The Olsgaards pointed out that females had failed to publish up to the normal level, which should have been 84 percent for the general library population or 61.5 percent for academic librarians.<sup>32</sup> As expected, the majority of authors (about 60 percent) were librarians affiliated with academic institutions. Collaborative authorship increased from less than 5 percent in 1939-44 to over 20 percent in 1975-79. Price indicated that collaborative authorship was useful as a means of analyzing invisible colleges and in-groups, but added that collaboration arises more from economic rather than intellectual dependence.<sup>33</sup> While it was not the purpose of this paper to investigate the existence of invisible colleges or economic dependence among contributors to *C&RL*, it seemed likely that both were reasons for the observed increase in collaborative authorship. A very weak core of productive authors was identified, consisting of only six authors who contributed ten or more articles through the forty years of this study: Robert D. Downs, Keyes D. Metcalf, Robert H. Muller, Ralph E. Ellsworth, Ralph R. Shaw, and Maurice F. Tauber. When Lotka's law was applied to the source author data, the results proved that, overall, the contributors to *C&RL* were not as productive as scientific authors. Whereas Lotka reported that 60 percent of scientific authors published only one article in a given period of time, this study found a much higher rate, 80 percent for contributors to *C&RL*.

The documents cited in *C&RL* grew at a rate that appeared in part to be exponential from 1939 to 1979. However, a true exponential curve was disrupted by an unusually high growth rate during the decade of the 1960s. This undoubtedly resulted from increased funding of research during those years.

Many of the characteristics of the cited authors paralleled those of the source authors. For example, an overwhelming majority of both source (80 percent) and cited (73 percent) authors were males. A trend toward increased collaboration among source authors was also observed for cited authors, although at a somewhat reduced rate. Just as the source authors were widely scattered (about 80 percent contributed only one article), so were the cited authors, over 60 percent of whom were cited only once throughout the forty years of this study. Thus it was inevitable that out of more than 4,000 individual authors, only 17 were cited often enough to be identified as a core. Three of these 17 authors were among the 6 leading contributors to *C&RL*: Robert B. Downs, first among both source and cited authors; Keyes D. Metcalf, second among the source authors, fifth among the cited authors; and Ralph E. Ellsworth, fourth among the source authors and ninth among the cited authors.

One of the significant characteristics of any subject literature is the form in which most of its material is published. Periodical literature is unquestionably the most important bibliographic form for science. Both Price<sup>34</sup> and Garfield and Sher<sup>35</sup> reported that 80 percent or more of all references in scientific papers were to periodical articles. For *C&RL*, only about 45 percent of the cited documents were periodicals. However, a slight trend toward increased use of periodical literature was observed. The periodicals cited in *C&RL* were widely scattered, a characteristic typical of the social sciences but in contrast to that of the sciences, where much of the literature on a topic was contained in a few journals.

Language and geographic distributions were low for the documents cited in *C&RL*, with over 97 percent of them appearing in the English language and about 91 percent published in the United States. Several probable reasons for these low distributions pre-

sented themselves. First, accessibility of the documents was probably limited to the large libraries and library school libraries. Second, indexing of foreign language material in library science was also restricted, with the only widely available index, *Library Literature*, including only a limited number of non-English language materials. And last, it was probable that very little library research of importance was completed outside the English-speaking countries.

Subject distribution is another characteristic widely examined for various disciplines. Scientific literature generally has low subject distribution, i.e., the majority of documents fall into the special subject with little drawn from outside sources. The documents cited in *C&RL* were classified with a single letter of the Library of Congress classification scheme, with Z designated to be the special subject of library science. Over the forty-year span of this study, about 65 percent of all cited documents fell into the Z's. This low distribution, characteristic of scientific literature, seemed to indicate a well-defined field. It should be pointed out, however, that some researchers feel that this great concentration of cited documents in the special subject of library science is a weakness rather

than a strength. Saracevic and Perk<sup>36</sup> felt that the nature of librarianship was too restrictive, too self-contained, and that interaction with other disciplines was needed to broaden the subject.

The final characteristic examined for cited documents was their time span. For this study, over 56 percent were cited within five years of their publication. This was a larger proportion than was reported in 1980 for literature indexed in the *Science Citation Index*, 45.6 percent.<sup>37</sup> Librarians thus seemed to require current, up-to-date information as much or more so than did scientists.

In 1939, when it commenced publication, *C&RL* filled a definite need for academic and research librarians. It immediately became a leader in circulation among library periodicals. However, in scholarliness, it did not initially adhere to the norms observed for other disciplines, especially the sciences. From 1939 through 1979, positive changes occurred in the documents both published and cited in *C&RL*, pointing to both an awareness of the need for higher standards and a greater adherence to those standards. If the trends ascertained in this study continue, the future of *C&RL* as a truly scholarly library journal seems assured.

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APPENDIX A  
SUBJECT CLASSIFICATION OF ACTIVITIES DISCUSSED  
IN SOURCE DOCUMENTS IN C&RL

1. *General*: Includes background studies, historical studies, biography, philosophy, censorship, ethics, intellectual freedom, etc.
2. *Organization and Administration*  
*General Administration*: Includes finance, personnel, unions, salaries, etc.  
*Professional Education*: Includes institutes, in-service education, etc.  
*Architecture and Equipment*: Includes buildings, furniture, equipment, supplies, etc.
3. *Resources*  
*Book*: Includes printing, illustration, book trade, etc.  
*Serial Publications*: Includes periodicals, journals, newspapers, etc.  
*Special Types of Materials*: Includes government publications, rare books, indexes and abstracts, etc.  
*Subject Literatures*: Includes, e.g., music, folklore, black literature, etc.  
*Audio-Visual Materials*: Includes recordings, films, television, picture collections, etc.
4. *Public Services*  
*Circulation*: Includes access to shelves, fines, inventories, etc.  
*Reference and Research Services*: Includes reference interview, telephone information service, bibliographic searching, etc.  
*Library Cooperation*: Includes interlibrary loan, union catalogs, networking, etc.  
*Use and User Studies*  
*Reader Services*: Includes special services for such groups as the handicapped, cultural programs, etc.
5. *Technical Services*  
*Acquisitions and Selection*: Includes ordering, cooperative purchasing, gifts, etc.  
*Cataloging and Classification*: Includes cataloging, classification, indexing, etc.  
*General Activities*
6. *Automation and Information Retrieval*  
*Automation of Library Processes*: Includes application of the computer, punched cards, etc.  
*Information Retrieval and Documentation*: Includes coordinate indexing, selective dissemination of information, etc.
7. *Library Instruction*: Includes methods of instruction, slide/tape productions, etc.
8. *Photoreproduction and Microfilming*  
*Copyright Law and Fair Use Doctrine*  
*Techniques, Methods, and Equipment*

APPENDIX B  
APPLICATION OF LOTKA'S LAW

Lotka's law has been widely recognized as a measure of the productivity of scientific authors. In 1926 Alfred Lotka analyzed the number of publications of chemists listed in *Chemical Abstracts*, 1907-1916 (actually he considered only 6,891 names beginning with the letters A and B) and those of physicists listed in Auerbach's *Geschichtstafeln der Physik*. He found: (1) that the number of persons making  $n$  contributions was about  $1/n^2$  of those making only one contribution, and (2) that the proportion of all persons making a single contribution was about 60 percent. These findings can be generally stated as:

$$y = c/x^n = cx^{-n}$$

where  $y$  = percent of authors  
 $x$  = number of articles  
 $c$  = constant  
 $-n$  = slope of the log-log  
 plot of the above  
 equation

When  $y$ , the percent of authors, is plotted on log-log paper versus  $x$ , the number of articles, an essentially straight line results. The slope of the line,  $-n$ , can be calculated using a least-squares approach. Lotka found that for  $n = 2.0$ , the constant,  $c$ , equaled .6079 or 60.79 percent; thus,

$$y = \frac{60.79}{x^{2.0}} \% = 60.79x^{-2.0} \%$$

Lotka also found that a least-squares analysis of Auerbach's data yielded  $n = 2.0$ , which resulted in the percent of authors given by the above equation. However, for the *Chemical Abstracts* data, the least-squares analysis yielded a fractional exponent,  $n = 1.888$ , which was found (from mathematical tables) to correspond to  $c = 56.69$  percent. Thus, in this case, Lotka's law becomes:

$$y = \frac{56.69}{x^{1.888}} \% = 56.69x^{-1.888} \%$$

Coile discussed several instances in which Lotka's law had been misinterpreted by the author's having assumed a value of  $n = 2.0$  regardless of the slope of the log-log plot.<sup>1</sup> He stressed that whatever the data—humanistic or scientific—the manner in which they are collected must be consistent with Lotka's data for statistical tests of goodness-of-fit. Coile stated that the data must include senior authors only, thus eliminating all coauthors. He also found that the chi-square test was not an appropriate goodness-of-fit test for this type of data. Instead, he recommended the use of the Kolmogorov-Smirnov test.

The first four columns of table 1 represent the empirical data concerning the number of articles per source author. They can be read as follows: 992 source authors (80.02 percent) contributed one article to *C&RL* during 1939–79; 142 (11.44 percent) contributed two articles; through 1 source author (0.08 percent) having contributed twenty-four articles. Column 4 represents the observed cumulative distribution function,  $S_N(x)$ , for the percentages of column 3.

A curve fitting linear regression analysis<sup>2</sup> of the data of columns 1 and 3 yielded  $n = 2.44$  and  $c = 51.29$  percent. See figure 1 for a plot of these data. Using these values in the above equation for Lotka's law, an estimated percent of authors,  $\hat{y}$  (column 5), was calculated for each corresponding value of  $x$  (column 1). From these values of  $\hat{y}$ , the calculated cumulative distribution,  $F_o(x)$ , was obtained (column 6).

Coile showed that the Kolmogorov-Smirnov test for goodness-of-fit was appropriate for this type of data.<sup>3</sup> The maximum deviation ( $D_{\max}$ ) between the theoretical and observed cumulative distribution functions is given by:

$$D_{\max} = |S_N(x) - F_o(x)|_{\max}$$

which is obtained from column 7. This value is compared with the value found at the .01 level of significance ( $\alpha_{.01} = 1.63/\sqrt{N}$ ) with  $N = 1,240$ . Since  $D_{\max} = .3147$ , which exceeds  $\alpha_{.01} = .0466$ , one must conclude that the empirical data do not adhere to Lotka's law.

TABLE 1  
FREQUENCY OF OBSERVED NUMBER OF SOURCE AUTHORS  
IN *C&RL*, 1939–79\*

No. of Articles/ Author $x$	Total No. of Source Authors	% of Authors $y$	$S_N(x)$	% of Authors $\hat{y}$	$F_o(x)$	$D$
1	992	80.02	.8002	51.29	.5129	.2873
2	142	11.44	.9146	9.42	.6071	.3075
3	46	3.71	.9517	3.50	.6421	.3096
4	26	2.10	.9727	1.73	.6594	.3133
5	9	0.73	.9800	1.00	.6694	.3106
6	13	1.05	.9905	0.64	.6758	.3147
7	2	0.16	.9921	0.44	.6802	.3119
8	4	0.32	.9953	0.32	.6834	.3119
10	1	0.08	.9961	0.18	.6852	.3109
11	1	0.08	.9969	0.15	.6867	.3102
12	1	0.08	.9977	0.12	.6879	.3098
14	1	0.08	.9985	0.08	.6887	.3098
17	1	0.08	.9993	0.05	.6892	.3101
24	1	0.08	1.0001	0.02	.6894	.3107

\* $\hat{y}$  was calculated using Lotka's law with  $n = 2.44$ ,  $c = 59.29$ , and  $N = 1240$ .

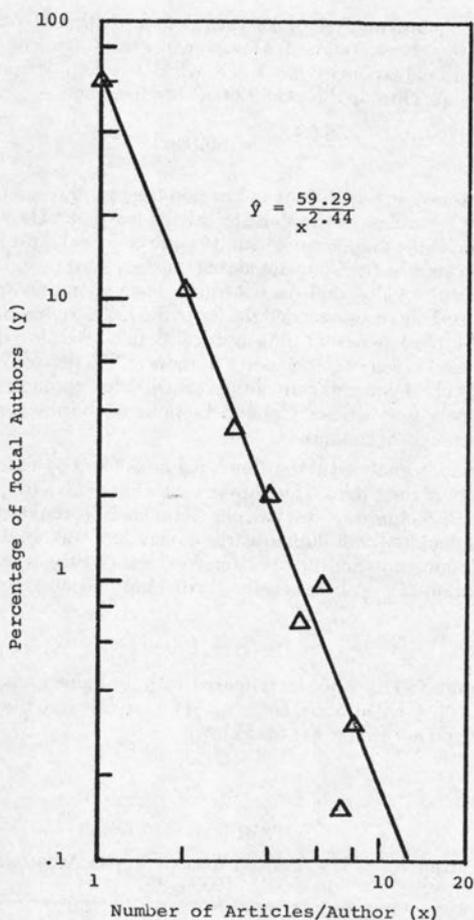


Fig. 1  
Number of Articles/Author as a Percentage  
of Total Authors in *C&RL*, 1939-79

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