1972–1976. The publication rate for 1975 and 1976 appears to be approximately 10700 papers per year. For 1972 through 1974, the rate was 9620 papers per year. The average for the five years is 10050 (±800) papers per year.

CONCLUSION

The leading journals publishing papers in electrochemistry have been identified. Electrochemistry is a mature field generating papers at a nearly constant annual rate. Its core of heavily used journals is larger than that for semiconductors, which is a younger and more rapidly growing discipline. The distribution of papers over the 149 journals follows Bradford's law.

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Searching the Literature for Concepts

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Chemical Abstracts was searched during a 3-month period for papers involving Correlation Analysis to determine the incidence of citation of pertinent material in the Keyword Index. Results indicate that the index is not a reliable tool for searching if conceptual material is sought, particularly in those areas of research which are not bound to a particular class of compounds or reaction types.

Is a controlled vocabulary necessary? It could be, for the excellent abstract reporting evident in *Chemical Abstracts* (CA) for compounds and skeletal systems is unfortunately not replicated when concepts or methods are the access points. If one looks for a generic approach to a problem, finding all references is quite difficult. It is well known that casting a net for all references is bound to pull in enormous amounts of extraneous material. It also promotes a reasonable question—how does one know that it is truly all? In some areas, such as legal, patent, pharmaceutical, and such, finding every single reference is often necessary, whatever the cost. One is prepared to cope with excess material in return for completeness. However, can one depend upon an index and be sure of completeness?

To test this we examined CA for a test period of 3 months of 1975. During this time we searched one field. The area studied was one in which we have done work and have a "chemical insider's" advantage in terms of familiarity with both vocabulary and authors. It also crosses a number of disciplines and has been applied to a variety of research and development projects. The field, Correlation Analysis, involves application of linear free energy relationships or structure–activity relationships to physical properties, e.g., spectral phenomena, chemical reactivities such as rate and equilibrium constants, and biological activities.[1,2]

Since this field can treat many types of data and a large group of subject compounds, pertinent papers appear in more than one section of CA and under a fairly extensive collection of keywords. We have compiled the lists shown in Table I for entry in the Keyword Index. There are two lists since some terms do not appear in both large divisions of CA: Physical-Polymer-Analytical and Organic-Biochemical.

Table I. Search Terms Developed by Users

Organic sections	Physical sections
Hammett	Hammett
Taft	Taft
Hansch	Price-Alfrey
Structure-activity	*Q* and *e* constants
Substituent effect	Dissociation constant
Substituent constant	Reactivity ratio
Substituent dipole	Ionization constant
Reactivity	Substituent effect
Kinetics	
Free energy	
Steric effect	
Dissociation constant	
Ionization constant	
Drug design	

METHOD

Each CA issue was searched for the terms indicated. All appropriate abstract numbers were listed, and then the sections in which likely papers would be found were paged through by hand. The Physical sections were easiest to do since relevant material appears in relatively few sections: High Polymers, Kinetics, Thermodynamics, Equilibria, Spectra, Electro-

Table II. Papers Which Were Significant–Hand and Index Search

CA Vol. 83, No.	Index-listed papers: Significant	Index-listed papers: Irrelevant	Index-listed papers: Insufficient data[a]	Unlisted significant papers
17	14	10	8	19
18	2	7	1	1
19	8	12	2	9
20	4	6	2	4
21	21	22	3	9
22	2	5		1
23	14	35	3	21
24	2	5		
Totals	All citations using Index	186	Relevant papers found	
	Relevant papers	67	by hand only	64
	Irrelevant papers	102		

[a] Designates either a dissertation (title only) or a foreign paper where only the title is translated. In either case, the title does not contain appropriate keywords indicating a positive find.

chemistry, and Electric Phenomena.

DISCUSSION

Since the terms were chosen to be all-inclusive, we expected to find many titles picked up which were not of interest. Our search was confined to those papers where some correlation of structure–activity was attempted involving chemical, physical, or biological properties. Kinetics as a search term brought in many more items than we needed since determination of rate of reactions was not our objective if not related to structure in a quantitative treatment. Correlation as a keyword produced a large number of citations, most of them to work in quantum mechanics. Structure–activity relationships and quantum calculations do overlap to some degree but not sufficiently to warrant using this keyword.

We did know on an anecdotal level of items which had been of interest and were not in the Keyword Index under several of the words deemed logical by chemist-users.[3] Since one of our objectives in this work was determination of depth of coverage, we counted the number of papers wanted out of the total of papers cited in the Index (see Table II). We also physically scanned all the abstracts in likely sections and listed all the papers whose abstracts included our keywords and compared these with the Index listing. We found that almost 50% of the papers we thought were significant according to their abstracts were not listed in the Index under any of the terms we thought significant (Table I).

A paper of interest was found by handsearching the Pharmacodynamics section. Its title, "Structure, Absorption and Distribution Relations: Significance for Drug Design", was mildly interesting. Only the abstract revealed that quantitative studies had been carried out. The Keyword Index did not list this work under any of the terms we developed in Table I, so we wrote to CAS for their keywords used in indexing this work. They are shown in Table III.

Table III

A. Chemical Abstracts Index Terms for Structure–Activity
Absorption Relation Pharmaceutical Design Review
Biol Transport Pharmaceutical Design
Review Pharmaceutical Design Biol Transport
Structure Relation Pharmaceutical Design

B. Suggested Keywords for the Cumulative Index
Free Energy, Hammett, Ionization, Linear Free Energy, Reaction Constant, Reactivity, Structure–Activity/Reactivity/Relation, Substituent, Taft[4]

Why cannot the suggested keywords be used in the index which abstracts the paper? They are so similar to Table I that the obvious conclusion is that Table I is a valid listing of the pertinent terminology in the field. The list A in Table III is the compilation of entry titles for a useful paper which would not have been found using the Index. To wait for the Cumulative Volume does two things, both undesirable to a *chemist* working in the field. It unnecessarily ages a useful piece of work at least a year, and it lumps it together with many other such useful items into a large, unmanageable mass of information.

Since the issue Keyword Index was not intended to be more than a quick-and-dirty tool, we waited for the volume index and repeated our search. It turned up 10 of the 64 papers we had found by hand search alone and an additional seven that we had missed. Two of the seven that had been missed were in sections we do not routinely handsearch since incidence of significant papers appearing there is minimal. While the volume index produced 17 relevant papers that were not picked up by the issue indexes, it also produced an enormous number of irrelevant papers; irrelevance increased 80%. The number of relevant papers now in hand, by using the best index tool available, the Volume Index, is 84. This still leaves us with 54 papers that are good, significant, and to us, important which were not retrieved. Thus, the efficiency of the index did rise but only to 61%.

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