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A Unified Index to Science

EUGENE GARFIELD
Institute for Scientific Information
Philadelphia, Pennsylvania 19106

The primary purpose of this paper is to discuss a plan for accomplishing what Neurath calls "an encyclopedic integration of scientific statements" (1), what I call a "Unified Index to Science." The intellectual values of such an index could be discussed at great length. However, the many social and philosophical implications and justifications for the "device" proposed here will be left to the sociologists, historians, and philosophers of science. (2) The justification for a unified index to science is made here strictly on its immediate practical value for improving scientific communication and documentation.

Unified Index defined

The term "Unified Index to Science" is intended to imply a single inter-disciplinary index to *all* documents, primarily periodical literature in *all* fields of science. Inter-disciplinary indexes are not new and revolutionary. Well-known examples are the *Industrial Arts Index* and *Die Bibliographie der Fremd-sprachigen zeitschriften Literatur.*

New and unique aspects of the Unified Index

A Unified Index to Science differs from existing indexes in scope. To be really effective, the Unified Index to Science must be as comprehensive as possible in coverage. It is in the borderland areas between specialties where such an index will not only provide a unique research tool, but also will fill a need that is not being satisfied by any of the current media of scientific communication. Since scientific research today is highly inter-disciplinary, the "selective" approaches of our traditional media, based on the old academic disciplines, can never give us anything more than makeshift tools, which do not function properly, considering the overall job to be done. Fragmentary approaches are not only inefficient but inadequate.

In addition to meeting the need for full and adequate coverage of scientific

literature, the Unified Index should also include a comprehensive Citation Index (3,4). The Citation Index is not only a practical possibility, but also provides the reinforcement and extension required to complement traditional approaches to information. None of the existing indexing agencies provides such a service.

Despite the unique features of the Unified Index, it is anticipated that efforts of the various indexing services now extant would be utilized insofar as possible.

Advantages of the proposed system

The methodology suggested in this paper for compiling the Unified Index, regardless of its physical form, would offer the following significant advantages:

1. Provision for *one* logical *starting point* for all literature searches, regardless of subject.
2. *Standardization of nomenclature,* particularly in the areas of overlap between existing indexing services.
3. Provision for *detailed indexing* not possible in specialty indexes. An increased number of analytical entries per article would be economically and intellectually more feasible.
4. Elimination of all doubt as to whether individual articles had been indexed by specialty indexes, particularly in inter-disciplinary subjects where selectivity exercised by specialty indexes is necessarily arbitrary. *Complete coverage of all individual articles* becomes a practical possibility.
5. *Economic utilization of machines* for the compilation of the present specialty indexes and indexes to individual journals.
6. *Economic production and distribution* of scientific indexes by virtue of broadening the number of potential users. Mass production is the best known method for reducing product costs.

Numerous other by-products of the proposed plan, not to be discussed here, include production of detailed indexes to individual journals, such as cumulated indexes in English to individual foreign language journals, indexes classified according to whatever system is desired, polylingual indexes, and more detailed indexing for the existing indexes, both foreign and domestic.

Conventional indexes to be used for many years to come

It is assumed that conventional printed indexes have a long life ahead, in spite of the current feeling that the recently published Decennial Index to *Chemical Abstracts* will be the last. By the use of modern techniques for printing and

for storing information, such indexes can be continued and even expanded more economically. The innate limitations of such conventional a priori type indexes (5) should not blind us as to their present and continued usefulness for years to come. In combination with a posteriori indexing (5) exemplified by the Citation Index (3), conventional indexes, particularly if composited to form the Unified Index, will meet many day-to-day requirements of information retrieval. However, the Unified Index to Science provides one definite point of departure for more sophisticated scientific information processing.

The Unified Index Described

A unified index to science could take many physical forms. In a large centralized science information center, this H. G. Wells type of "World Brain" might be a 3 by 5-inch card file, a random access electronic storage device, or a searching device such as Minicard or Filmorex. In this paper an alphabetical printed index is assumed. Subject headings (rubrics) like those found in the *Current List of Medical Literature* (CLML) would be followed by modifying sub-headings or "modifications" (6) such as those found in *Chemical Abstracts* (CA), or *Biological Abstracts* (BA). Headings would be followed by complete references such as found in the *Quarterly Cumulative Index Medicus* (QCIM), as well as a Citation Index (CI) reference. A typical entry might be:

ADRENALINE, antagonists to,
Brown, H. A., *J. Pharm. Pharmacol.* 42:1145–7 (1958), CI 367.

On page 367 of the Citation Index the same reference would be followed by the following:

J. Pharm. Pharmacol. 42:1145–7 (1958)
CA 42:994b, BA 35:4578, BrA 24:AIII, 601.

This means quite simply that the article has been abstracted by CA, BA and *British Abstracts* (BrA). The Citation Index would also provide a listing of all related bibliographical *descendants* of the article (5). The Citation Index has been discussed in previously published articles (3–5,15). However, this is the first time its use for consolidating references to and from the various abstracting services has been recommended. This feature of the Unified Index is significant. The significance of this feature can be illustrated by a concrete example. In Appendix I the differences between a CA and a BrA abstract for the same article are shown. The CA abstract is quite brief, whereas the abstract in BrA is more detailed. By the use of the CA subject index combined with the Cita-

tion Index, the BrA abstract would be quickly identified. This could also be done by use of the author index to BrA, if you assume an abstract will be found there. However, it is not known which abstracting service will have covered the article in question until the author index *is* checked. Yearly author indexes may not be available for some time. This type of situation is even more important when the article is in a foreign language. Abstracts must sometimes be relied upon in order to decide on making a complete translation.

Let me stress, however, that a Citation Index is not necessary, obviously, to produce a composite index to science. The organization and preparation of a Unified Index emphasizes in a different way the values to be derived from a Citation Index as a supplement to the conventional indexes. Further, the Citation Index could be used to supplement the conventional media as they function in the dissemination of scientific information (5).

Unified author index

An author index to the scientific periodical literature requires no great imagination either to visualize or to produce. It requires personnel with cataloging rather than scientific training. Linguistic difficulties in dealing with foreign names constitute the main problem of the author index compilation. The high value of a single author index to science should not be underestimated since an *author* is frequently the best "subject" approach one has to the literature.

Compiling the Unified Index to Science

In two published papers I have discussed specific techniques for the mechanical compilation of printed indexes and subject heading lists (7,8). In a paper specifically prepared for this International Conference, now attached as Appendix II, the same techniques are discussed in connection with the compilation of classified indexes from alphabetic indexing. By similar techniques made considerably simpler through technological developments during the past five years, the Unified Index to Science could be prepared economically and quickly. Modifications in the details of machine operations outlined previously would be necessary, but the same basic principles would be utilized. It is considered unnecessary to elaborate on these machine techniques except to mention that Hollerith punched cards could be easily combined with, replaced by, or supplemented by Flexowriters (tape perforating and tape operated typewriters), Listomatic cameras, Teletypesetters, Photons, etc.

Cost of the Unified Index

The high cost of preparing the index would be economically feasible. Such an index would have the widest possible market for a scientific indexing publication. The index would be used in the large inter-disciplinary libraries—sufficient justification for its compilation. It would also be used in the specialized scientific libraries, by individual laboratories, and if properly promoted, by individual scientists. Most institutions and/or scientists now subscribe to one or more of the various indexing services. At lower financial outlay each could now obtain a product of high quality and utility. Any publisher will testify to the "miracles" that can be performed if the sales volume justifies a low price.

Publishing the Unified Index in semi-microform

In order to satisfy the most skeptical critics, it is further proposed that the necessarily large Unified Index to Science could be *printed* by conventional printing methods, in a *semi-microform*. This would reduce the space and paper requirements by a factor of 16 to 1. It would more than offset the increased size of an index combining entries from a multiplicity of subject indexes. The high cost of paper, binding, and storage costs makes the use of micro-techniques imperative. Since indexes are reference tools for use in locating abstracts and articles to be read, the problem of readability is more easily resolved by simple enlarging techniques than is the enlargement of texts that must be carefully studied.

By the use of reduction ratios of 4 to 1, it is possible to reduce space and paper costs by over 90%. In addition, it is still possible for the user to employ inexpensive magnifiers which are commercially available in a wide range of types such as the readers used for enlargement of texts for the partially blind. At these reduction ratios, it is still possible to print by conventional methods, and it is also possible to read headings with the naked eye. Headings would be printed in a larger bold-face type. Once the desired heading were found, the 4X magnifier could be used to scan the individual index entries. This semi-micro method of printing scientific publications has great promise, I believe, for all types of large-scale publishing projects. We have been so obsessed with achieving high reduction ratios for microfilm storage that this simple intermediate approach has been completely overlooked, in spite of its successful use in wartime for publishing magazines.

Source of subject index entries

The discussion above has been directed primarily at the problem of mechanical compilation and description of the Unified Index. One might assume that a centralized indexing service could prepare the Unified Index to the periodical literature. There are advantages and disadvantages in a completely centralized service. It is assumed here, however, that indexing and abstracting by the many individual indexing services would continue and even expand.

After an appropriate period of time the mechanical unit record for each article (punched card, file card, etc.) would be utilized to determine whether that article had been abstracted by at least one of the indexing services. It would be particularly interesting to study the overlaps, and gaps, in abstracting of articles in broad spectrum journals like *Nature, Science,* and *Endeavour.* Even the specialized journals are not always completely covered for one reason or another. Indeed, the editor of *Endeavour* has said (19):

> It seems that, at present, about half the published articles are abstracted by the various abstracting services. The remedy might be a central indexing bureau, but its realization seems far away. Careful indexing by each journal of its own published articles, on some universally known classification system, would make the scrutiny of journals easier, and would help abstracting services in their selection of articles, enable them to extend the range of journals covered and contribute towards the reduction of the second time lag, namely that between the publication of a paper and the appearance of the abstract.

Treatment of unabstracted articles

Unabstracted articles would then be assigned to an appropriate abstracting service. It is further assumed that each indexing service would modify its indexing procedures by indexing each article or abstract on a current basis, rather than after a cumulation of a year's abstracts. The method of indexing on a current basis is used by the *Current List of Medical Literature* (7). Recently a similar procedure was recommended to *Biological Abstracts* by this author (9). Information sheets containing all index entries for each article would be submitted to the indexing center. The mechanics of preparing indexing sheets have been discussed in detail (7,9). The indexing center would then mechanically sort and collate all index entries. Since each article and its associated index entries contain article identification, it is possible to combine all index entries for individual articles regardless of the source. In this way the different indexing approaches of each indexing service would be utilized to advantage for more detailed indexing. The indexing center would then compile the indi-

vidual indexes to each specialty service, and subsequently would compile, as a by-product, the Unified Index, including the Citation Index, giving the complete abstracting record for each individual article. During the interval between publication of the article and appearance of the abstract as well as the index, there would be no gaps in the coverage of individual articles in the Unified Author Index and Citation Index. Unabstracted articles would be located indirectly by means of the Author Index and Citation Index. References for unabstracted articles would appear in the Citation Index listings for earlier articles previously abstracted and indexed. In this way the "reference chain" grows stronger, and few pertinent articles escape those who want to conduct a thorough search.

Benefits for participating abstracting services

The benefits derived for each of the participating abstracting services should be kept in mind. Men working in biochemistry would, through the Unified Index, use *Biological Abstracts* more effectively since the chemical indexing of CA would frequently turn up BA abstracts written from the biological, rather than the chemical point of view. CA abstracts would more often be referred to by biologists through BA indexing. In some searches, the biologist may be more concerned with the chemical aspects of the problem. Since abstracting services depend on the efforts of volunteer abstracters, the quality of abstracts must vary. *Redundancy* can be usefully exploited to make up for resulting deficiencies that creep in from individual preferences of abstracters.

Improved nomenclature

A biological indexing service cannot afford to pursue the problems of chemical nomenclature as would a chemical index. A chemical indexing service does not pursue all the ramifications of biological nomenclature. By suitable cross-referencing, the Unified Index can give the user the best of both. Neither service has to concern itself any more than at present with nomenclatural problems. If it chooses, BA could obtain an index including chemical entries according to the CA system and CA could obtain the BA approach in biology. Where the twain will not meet, then repetition will probably prove the simplest way out. However, I see no reason why BA cannot use "Dibenzylamine" instead of "Dibenamine" as a main heading. Nor can I see any reason why CA must use "Adrenaline" when "Epinephrine" is equally useful. Standardization of terminology is a complicated problem. "The naive answer to this problem is that it only requires agreement" (10). However, this system

offers an excellent opportunity for the meeting of minds because the problem is reduced to individual decisions about individual nomenclature situations rather than general principles. Authoritative indexes tend to produce increased standardizations as was exemplified by the decision of Eastman Kodak to use the CA system in its well-known catalog of 3500 compounds (11). Further, "stable" nomenclature (12) is an objective that is neither obtainable nor desirable. The proposed system, particularly if it includes a Citation Index helps to overcome the difficulties of a changing nomenclature (3).

Legislation, government, and complacency

In 1952 Avias (13) suggested legislation in order to bring about the resolution of scientific documentation problems. In the intervening years much progress has been made in the realization that governments must take an interest in these problems. The recent Congressional hearings are indicative of this. It would appear that those few heretics who have been crying in the wilderness for documentation centers capable of performing the tasks outlined in this paper may at last be vindicated (14).

The grandiose scheme

Grandiose schemes always meet with excessive resistance, not because they are impossible to achieve, but because there are only a few with sufficient persistence to materialize their dreams and even fewer to carry them out. Ultimately, most large endeavors must fall by the wayside, to be replaced by others. However, their value at a particular stage of history cannot be disputed. We may have seen the last Decennial Index to CA. But who would dispute the value of the CA Decennial, Beilstein, Index Catalog, etc., now and for years to come!

A Unified Index to Science would be a convenience even if the strictly academic intra-disciplinary approaches were still the primary targets of today's research. In this era, however, of the biophysicist, the psychochemist, the human engineer, the instrumentation scientist, and the cosmobiologist, a Unified Index to Science is an absolutely necessary working tool for unfettered scientific progress.

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APPENDIX I Comparison of the indexing of a single article by *Chemical Abstracts* and *British Abstracts*.

Chemical Abstracts 42, 6933f(1948).

Pharmacological and physiological aspects of adrenergic blockade with special reference to dibenamine. Mark Nickerson and Louis S. Goodman (Univ. of Utah, Salt Lake City). *Federation Proc.* 7, 397–409 (1948).

A review in the form of an address. 56 references. L. E. G.

British Abstracts, A III, 601(1949) same citation but no author address given.

Dibenamine (*N*,*N*-dibenzyl-2-chloroethylamine) (i) reverses adrenaline-induced blood pressure rise, (ii) reverses excitatory responses due to splanchnic nerve stimulation, (iii) reverses pressor effect of a generalized direct discharge of the sympathetic nervous system, (iv) blocks the response to reflexly elicited sympathetic discharge, (v) prevents cyclopropane-adrenaline arrhythmias, (vi) does not block or reverse inhibitory sympathetic functions, and (vii) only partially blocks the pressor effects of certain amines—e.g., amphetamine and Tuamin. Its chemistry, mechanism of action, therapeutic use, and relations to other drugs are discussed. B. G. Overell.

The article above was indexed by CA under:

Dibenzylamine, *N*-(2-chloroethyl)-, adrenergic blocking action of

The same article was indexed by BrA under:

diBenzylamine, *N*-ethyl-, 2-chloro-, in adrenergic blockade
Adrenaline, antagonists to
Adrenergic blockade,

In both indexing services there is a cross-reference from Dibenamine to the particular nomenclature preferred by each.

Experienced users of the indexing and abstracting services will not need to be convinced that there is considerable variation in indexing and abstracting from article to article. The example chosen here is not the best nor the worst. It was selected at random, to illustrate graphically several points.

1. Indexing under the same major subject heading by no means indicates that the indexing is the same or that an individual user will recognize the choices of the different indexers as being equivalent. Only a check of the actual article title would confirm that the article indexed was the same.

2. Abstracts vary in length, quality, uniformity, etc. In this instance the CA abstract is quite brief whereas the abstract in BrA is more detailed and useful.

3. Nomenclature varies in each case but in a Unified Index there would be no difficulty in making an arbitrary decision which to employ, if a choice must be made, without the loss of index access points. Both BrA and CA consider dibenamine a derivative of dibenzylamine, but the precise nomenclature is slightly different. (*N*-ethyl, 2-chloro- v. *N*-(2 chloroethyl). However, in BrA, all benzylamines are grouped together whereas in CA they are not. From the user's point of view what is most important is locating the desired abstract in the quickest time. His first approach to the index will often depend upon his first encounter with the name. If it is a British article he is likely to be looking for the compound with British nomenclature. A Unified Index could eliminate redundancy where unnecessary and retain it where

useful, as in this instance. All cross references should be maintained, but it is obvious that in a composited index the number of total cross references for various subjects would be minimized by standardization.

4. The example also illustrates the different viewpoints brought out by different indexers. In BrA the article is indexed under "Adrenergic blockade" as well as "Adrenaline, antagonists to," whereas in CA it was not indexed at all under the subject of "Adrenaline." The indexing under "Dibenzylamine" was similar (adrenergic blocking action vs. in adrenergic blockade). Consequently in a combined index one of these two entries could be eliminated without loss to the user.

5. The example illustrates how a combined index could take advantage of different indexing, eliminate redunancy in indexing, reduce the searching time of the user, and standardize nomenclature for further ease of index use. It also demonstrates that neither abstracting nor indexing are ever precisely the same even in similar types of indexes, in this case two chemical indexes.

APPENDIX II Mechanical preparation of classified indexes from alphabetic indexing

The pros and cons of alphabetic and classified indexes have been discussed quite extensively in the literature. It is not my intent to labor either view in this Appendix. During my work at the Johns Hopkins Indexing Project at the Welch Medical Library, it occurred to us that some useful compromise might be reached in dealing with the problem of alphabetic vs. classified indexes if one type of indexing could become the by-product of another. Project work on the preparation of subject heading lists clearly demonstrated the ease of converting alphabetic subject heading lists to categorized or classified lists of terms by the use of punched card equipment (8). In fact, the subject heading list of the *Current List of Medical Literature* used by the CLML staff is still maintained by this system.

Subsequently, the Project developed methods for the preparation of printed indexes by punched-card techniques (7). In this work the *Current List* was prepared *experimentally* by IBM machines, even though reports continue to appear which imply that the CLML is now prepared by machine methods. The project also did the pioneer work on the IBM 101 machine (17), and it was the combination of 101 capabilities and the system for preparing indexes by machine that led to the results reported here for the first time. The Project's support was terminated before all the data could be collected.

Figure 1 illustrates what I believe to be the first classified index to be prepared mechanically, by machine methods, completely as a by-product of alphabetic subject indexing. This is not mechanical classification; it is mechanical classifying in a limited sense only. Journal articles were originally read and indexed by *Current List* staff indexers by their present, i.e., conventional methods. This means that for each article, one or more subject headings were selected from the *Subject Heading Authority List* to describe the main subject matter of the article. For each alphabetic main heading, a standard sub-heading may or may not have been used. And for each entry a "modification" may or may not have been used (6).

Once this intellectual effort was completed, the necessary sets of punched cards

were prepared as described in the Manual of Procedures (18). The cards were then mechanically sorted and edited, as described in the Manual, and the alphabetic subject index mechanically printed. To produce the classified index, the deck of punched cards, as well as cross-reference cards, were then mechanically sorted to produce the classified index illustrated in Fig. 1. The classified index was printed on an IBM 407 tabulating machine.

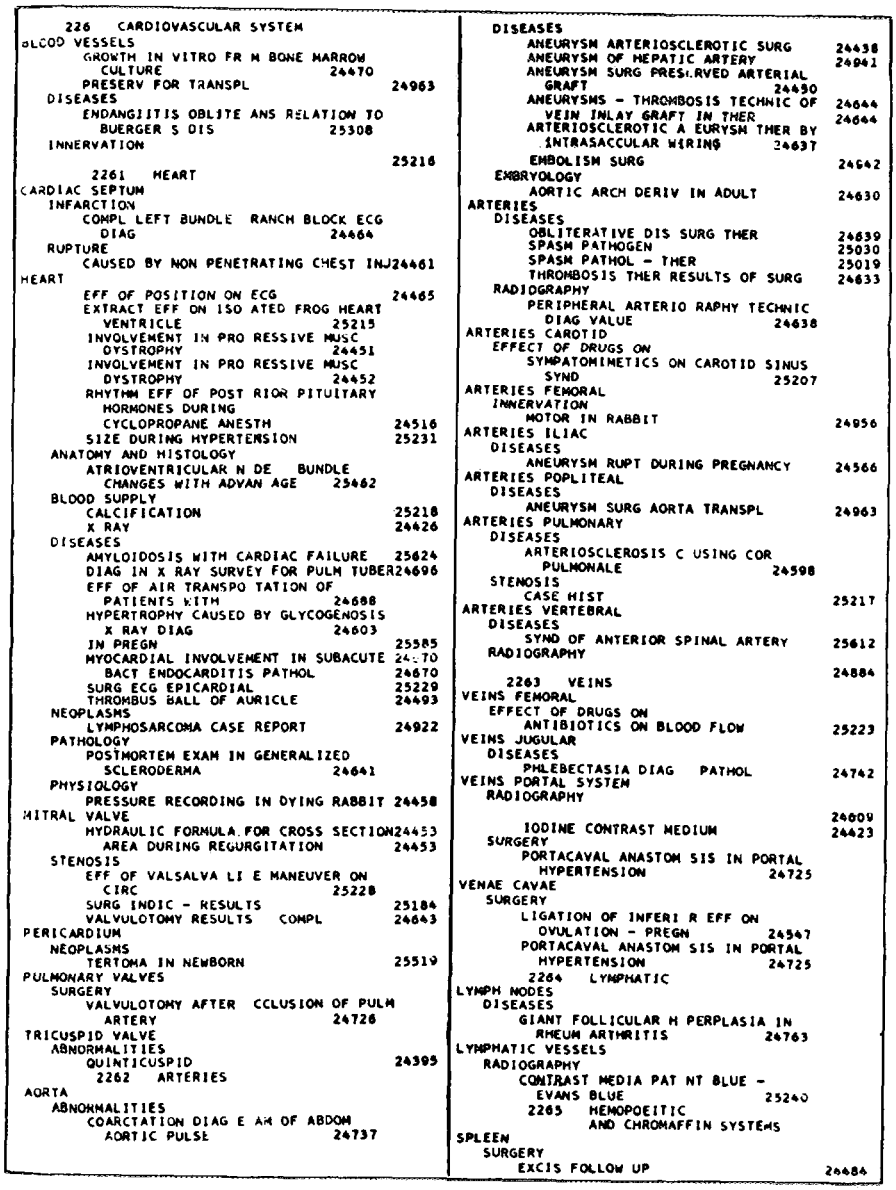
The sample shown is taken from category 2 (Anatomical terms), sub-division 2 (Organs), sub-division 6 (cardiovascular system), and includes subdivisions 1 (heart), 2 (arteries), 3 (veins). Thus, the complete class number for material on the heart is 2261. Under this classification are brought together all index entries for those subject headings which pertain to the heart. These include (in the sample) the cardiac septum, the heart itself, the mitral valve, the pericardium, pulmonary valves, and tricuspid valve. If the sample had been much larger, the grouping would include all terms which had been classified under this portion of the category list. The entries for each specific subject heading are exactly as they appear in the alphabetic index.

To accurately describe what has been accomplished, it should be noted that a method exists whereby the literature searcher can locate the same information provided to him by such a classified index. By use of the classified list of terms appearing in the *Subject Heading Authority List*—unfortunately the classified list is only available to *Current List* staff—he could determine all those subject headings pertaining to the heart and then locate these headings in the alphabetic subject index to the CLML. The classified index saves him the time of searching each of these terms individually. This is not intended as a criticism of the *Current List* which justifiably uses the most economical approach to serving the most people efficiently. Only with sufficient financial support and user demand can such classified indexes be justified. It is possible, however, that classified indexes would reduce the average number of subject headings required to index certain articles. The lack of indexing redundancy in the sample is a tribute to the excellence of CLML indexing efficiency. One might have expected that at least one or two articles would have been indexed twice under two closely related terms. This did not occur in the sample.

The mechanics of preparing the classified index from the alphabetical entries are quite simple. They involve a few wiring tricks with the sorting machines. It should also be noted that one could begin with a classified index and go over to an alphabetic index if desired.

During my work at the Project, I prepared a paper entitled "Unified International Scientific Indexes through Centralized Machine Indexing and Its Relation to Standardization of Nomenclature." Although this paper was approved by the then editor of *Science* and the referees, time was not available to complete the editorial revisions required. The complete paper was submitted to the present conference committee. Dr. Dwight E. Gray kindly suggested that the portion devoted to the problem of alphabetic vs. classified subject indexes be expanded for this Appendix. I am indebted to him for this suggestion and would like to close by summarizing the remarks I make on the subject of alphabetic and classified indexes in that paper.

The opinion is widely held that alphabetic indexes fail to group all related terms conveniently, i.e., they lack generic character. On the other hand, classification schemes rapidly outlive their usefulness, since they are unable to anticipate new subject fields. In practical terms, this means that the classification scheme must be



226 CARDIOVASCULAR SYSTEM

BLOOD VESSELS
- GROWTH IN VITRO FR M BONE MARROW CULTURE 24470
- PRESERV FOR TRANSPL 24963
- DISEASES
  - ENDANGIITIS OBLITE ANS RELATION TO BUERGER S DIS 25308
- INNERVATION 25216

2261 HEART

CARDIAC SEPTUM
- INFARCTION
  - COMPL LEFT BUNDLE RANCH BLOCK ECG DIAG 24464
- RUPTURE
  - CAUSED BY NON PENETRATING CHEST INJ 24461

HEART
- EFF OF POSITION ON ECG 24465
- EXTRACT EFF ON ISO ATED FROG HEART VENTRICLE 25215
- INVOLVEMENT IN PRO RESSIVE MUSC DYSTROPHY 24451
- INVOLVEMENT IN PRO RESSIVE MUSC DYSTROPHY 24452
- RHYTHM EFF OF POST RIOR PITUITARY HORMONES DURING CYCLOPROPANE ANESTH 24516
- SIZE DURING HYPERTENSION 25231
- ANATOMY AND HISTOLOGY
  - ATRIOVENTRICULAR N DE BUNDLE CHANGES WITH ADVAN AGE 25462
- BLOOD SUPPLY
  - CALCIFICATION 25218
  - X RAY 24426
- DISEASES
  - AMYLOIDOSIS WITH CARDIAC FAILURE 25624
  - DIAG IN X RAY SURVEY FOR PULM TUBER 24696
  - EFF OF AIR TRANSPO TATION OF PATIENTS WITH 24688
  - HYPERTROPHY CAUSED BY GLYCOGENOSIS X RAY DIAG 24603
  - IN PREGN 25585
  - MYOCARDIAL INVOLVEMENT IN SUBACUTE 24670
    - BACT ENDOCARDITIS PATHOL 24670
  - SURG ECG EPICARDIAL 25229
  - THROMBUS BALL OF AURICLE 24493
- NEOPLASMS
  - LYMPHOSARCOMA CASE REPORT 24922
- PATHOLOGY
  - POSTMORTEM EXAM IN GENERALIZED SCLERODERMA 24641
- PHYSIOLOGY
  - PRESSURE RECORDING IN DYING RABBIT 24458

MITRAL VALVE
- HYDRAULIC FORMULA FOR CROSS SECTION 24453
  - AREA DURING REGURGITATION 24453
- STENOSIS
  - EFF OF VALSALVA LI E MANEUVER ON CIRC 25228
  - SURG INDIC - RESULTS 25184
  - VALVULOTOMY RESULTS COMPL 24643

PERICARDIUM
- NEOPLASMS
  - TERTOMA IN NEWBORN 25519

PULMONARY VALVES
- SURGERY
  - VALVULOTOMY AFTER CCLUSION OF PULM ARTERY 24728

TRICUSPID VALVE
- ABNORMALITIES
  - QUINTICUSPID 24395

2262 ARTERIES

AORTA
- ABNORMALITIES
  - COARCTATION DIAG E AM OF ABDOM AORTIC PULSE 24737
- DISEASES
  - ANEURYSM ARTERIOSCLEROTIC SURG 24638
  - ANEURYSM OF HEPATIC ARTERY 24641
  - ANEURYSM SURG PRESERVED ARTERIAL GRAFT 24650
  - ANEURYSMS - THROMBOSIS TECHNIC OF VEIN INLAY GRAFT IN THER 24644
  - ARTERIOSCLEROTIC A EURYSM THER BY INTRASACCULAR WIRING 24637
  - EMBOLISM SURG 24642
- EMBRYOLOGY
  - AORTIC ARCH DERIV IN ADULT 24630

ARTERIES
- DISEASES
  - OBLITERATIVE DIS SURG THER 24639
  - SPASM PATHOGEN 25030
  - SPASM PATHOL - THER 25019
  - THROMBOSIS THER RESULTS OF SURG 24633
- RADIOGRAPHY
  - PERIPHERAL ARTERIO RAPHY TECHNIC DIAG VALUE 24638

ARTERIES CAROTID
- EFFECT OF DRUGS ON
  - SYMPATOMIMETICS ON CAROTID SINUS SYND 25207

ARTERIES FEMORAL
- INNERVATION
  - MOTOR IN RABBIT 24956

ARTERIES ILIAC
- DISEASES
  - ANEURYSM RUPT DURING PREGNANCY 24566

ARTERIES POPLITEAL
- DISEASES
  - ANEURYSM SURG AORTA TRANSPL 24963

ARTERIES PULMONARY
- DISEASES
  - ARTERIOSCLEROSIS C USING COR PULMONALE 24598
- STENOSIS
  - CASE HIST 25217

ARTERIES VERTEBRAL
- DISEASES
  - SYND OF ANTERIOR SPINAL ARTERY 25612
- RADIOGRAPHY 24884

2263 VEINS

VEINS FEMORAL
- EFFECT OF DRUGS ON
  - ANTIBIOTICS ON BLOOD FLOW 25223

VEINS JUGULAR
- DISEASES
  - PHLEBECTASIA DIAG PATHOL 24742

VEINS PORTAL SYSTEM
- RADIOGRAPHY 24809
  - IODINE CONTRAST MEDIUM 24423
- SURGERY
  - PORTACAVAL ANASTOM SIS IN PORTAL HYPERTENSION 24725

VENAE CAVAE
- SURGERY
  - LIGATION OF INFERI R EFF ON OVULATION - PREGN 24547
  - PORTACAVAL ANASTOM SIS IN PORTAL HYPERTENSION 24725

2264 LYMPHATIC

LYMPH NODES
- DISEASES
  - GIANT FOLLICULAR H PERPLASIA IN RHEUM ARTHRITIS 24763

LYMPHATIC VESSELS
- RADIOGRAPHY
  - CONTRAST MEDIA PAT NT BLUE - EVANS BLUE 25240

2265 HEMOPOEITIC AND CHROMAFFIN SYSTEMS

SPLEEN
- SURGERY
  - EXCIS FOLLOW UP 24684

FIGURE 1

revised periodically. These problems may be partially resolved by the system described above. This system evolved as a result of seeking a solution to the problem known in classification to some as "intercalation" or "interpolation" and by Ranganathan as "infinite hospitality." If one arbitrarily assigns a specific code number or some other notation to a concept, it is ultimately necessary to "intercalate" between two items in the schema more items than anticipated. This usually means considerable clerical work, if not a complete breakdown of the classification system. Through the "reproducing" features of some machines, it is possible to make such changes quickly. Special sorting techniques further simplify the procedure.

The preparation of a classified index of one type from an alphabetic list has been illustrated in this Appendix. However, it would also be possible to prepare other classified indexes from this same alphabetic index by the use of different class numbers or symbols in the master deck of subject heading cards. From the point of view of an international indexing center this capability could have considerable significance, since different classification schemes tend to bring out different approaches to subject matter. For example, a single deck of cards could produce one index according to the UDC system while another could be arranged according to the LC system. This capability could also be applied to classification systems such as chemical ciphering in which a single analysis of the chemical structure would enable codification according to numerous systems.

Contrary to the statements made in the original paper, I do not believe this system can handle, as easily as I had thought, changing terminology and concepts. I believe this problem is better resolved through Citation Indexing.