The Making of an Encyclopedia: The 3rd Edition of the "Kirk-Othmer Encyclopedia of Chemical Technology"

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The utility of encyclopedias in the specialized chemical information library and the historical development of the "Kirk-Othmer Encyclopedia of Chemical Technology" are discussed. Methods used for the development of the editorial plan for the third edition of the Encyclopedia are reviewed, comparisons are made between the projected third edition and the previous editions, and new features of the third edition, such as use of Chemical Abstracts Service Registry Numbers, SI units, and semiautomated index procedures are discussed. Development of programs for the machine-controlled phototypesetting and pagination procedures as well as the indexing system for the third edition are also reviewed. The relationship of these new composition methods to development of an on-line data base from the Encyclopedia are considered. The publishing schedule for this internationally recognized Encyclopedia calls for completion of the projected 25-volume work by 1984.

Everyone knows that an encyclopedia is an alphabetically arranged collection of topics from all branches of an art or science that provides a comprehensive treatment of the subject. Although there are many encyclopedic books, and many single-volume encyclopedias, the public and the specialist alike assume that to be truly comprehensive an encyclopedia will be composed of many volumes. Although the encyclopedist can no longer hope to literally encompass everything as did Diderot and D'Alembert for the great Encyclopedia of the Enlightenment, for a work to be correctly labeled encyclopedic it must indeed be all things to all readers within the bounds of the subject defined.

What is the place of an encyclopedia in this era of the computer? The advanced special library has its terminal that can interact with an enormous, remote memory bank containing literally all the bibliographic information of the past decades stored in the Chemical Abstracts Service tapes and other data bases. A skillful searcher, often with the help of a trained information specialist, can search these enormous files and produce a wealth or, perhaps more accurately, a glut of information in response to a relatively narrow question. For broader subjects, the response of the machine can be frightening. It is the skilled specialist in the field under question who benefits most from the interactive search. However, the specialist in the branch of a given science has no need of an encyclopedic review of that branch of the science.

The "Encyclopedia of Chemical Technology" (ECT) is designed for the library user who does not know what questions to ask, or for the specialist from another branch of that science taking a first look at a neighboring field to uncover general principles, to obtain an overview to see if a detailed search is needed, or simply to browse for new ideas. These needs cannot be satisfied by a collection of primary literature references.

The Encyclopedia provides the reader the equivalent of consulting an expert in a given field, someone who can summarize the state of the art, interpret the trends, and tell where the best sources are for the details that initial inquiry may lead one to require. The Encyclopedia provides the reader with intelligence, not simply data. In this sense the modern Encyclopedia is the logical prelude to a useful interactive search with the computer. In fact, rather than be supplanted by the information glut that the computer has made possible, the Encyclopedia serves an increasingly real need somewhere close to the top of the information hierarchy. Similar conclusions were reached by the editor of the "International Encyclopedia of Social Sciences" a decade ago.[1]

The Encyclopedia is a European tradition. The first edition of the ECT was brought to these shores in the mind of Eric Proskauer in 1937 when he came to New York to start his U.S. publishing career. In 1940 the Interscience Publishing Company, now the Wiley-Interscience Division, was founded. After an interruption by the Second World War, Proskauer, his business partner, Maurits Dekker, and Herman Mark of the Polytechnic Institute of New York decided that it was time to begin an encyclopedia in the English language that would derive its lineage from the "Thorpe Dictionary of Chemistry" and the "Ullmann Encyclopedia". Raymond Kirk, then Chairman of the Chemistry Department at the Institute, was induced to take on the editorship, and he was joined by Donald Othmer from the Chemical Engineering Department to begin the great work. The first edition was produced from offices very near the Institute by a professional editorial staff under Janet Scott and Anthony Standen with the nearly day-to-day guidance of Kirk and Othmer. The first volume was published in 1947 and the last in 1960 at about the time that Professor Kirk died.[2]

The foresight of the founders and the professional competence and thoroughness of the editors and staff were rewarded by the excellent reception of the first edition. The second edition began publication in 1963 under the editorship of Anthony Standen who had served jointly as editor with Janet Scott in the first edition. The staff now worked entirely in the offices of the Interscience Publishing Company, which had become part of John Wiley in 1961. As the first edition reflected the world-wide interest in the dominant technology of the American chemical industry, after the Second World

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Table I. Comparison of ECT Editions

ECT 1 1947-1960	16,400 pages 800 articles	15 volumes + 2 supplements	
ECT 2 1963-1971	20,900 pages 825 articles	22 volumes + 1 supplement + 1 index vol.	
ECT 3 1978-1984	24,700 pages 1,100 articles (estimated)	24 volumes + 1 index vol.	

War the second edition provided a broadened international outlook with increased coverage and contributions from the experts of the international as well as the American chemical communities. The growth of the chemical industry in the intervening period is reflected in the size of the second edition compared with the first (Table I). Although the number of subjects did not increase appreciably, the multiplication of technologies and the growth of the literature are reflected in the 50% growth in size of the second edition. The total projected size of the third edition, included for comparison in Table I, indicates that a further growth in size of the Encyclopedia is expected, although not nearly as great as the one from the first to the second edition. But more significantly Table I shows that a considerable increase in the number of subjects treated is anticipated in ECT 3. This change and other anticipated changes are discussed in this paper, as well as some of the new features of the third edition and the innovative methods of composition being employed.

WHAT IS CHEMICAL TECHNOLOGY?

Perhaps one of the key ingredients in the success of the ECT is the fact that it deals not just with chemistry but with chemical technology. Therefore, to understand what this Encyclopedia covers it is necessary to know how chemical technology is defined. There is no simple, absolute definition. One starts with an understanding of the core of chemical technology and works outward in an ever-widening circle, including finer and finer branches of the science until a perimeter of sorts is reached. The boundary condition may reflect the individual taste of a given editor, but the overall picture is rather clear if we consider the broad categories of subjects from which the ECT is made (Table II). Table II also gives a breakdown of the total number of individual articles expected in ECT 3 related to the 23 subject categories that define the scope of chemical technology. The total is somewhat greater than the actual number of individual articles in ECT 3 since there is considerable overlap between many of these categories. The miscellaneous category includes many interesting service aspects of chemical technology, including marketing functions, economic aspects, technical services, patent and literature information functions, etc.

It is evident from this listing that chemical technology broadly includes both the theory and practice of chemical engineering and the industrial production and uses of chemical materials, as well as consumer uses, and the basic subjects of chemistry itself. The value of the ECT, therefore, depends to a considerable extent on the fact that it is an exhaustive and comprehensive treatise of applied chemical science and industrial technology, its methods and materials, as well as the latest scientific advances in every branch of the useful arts of chemistry.

The 23 categories of subjects in ECT 3 closely parallel the functional divisions of *Chemical Abstracts*. This is not surprising since the original planners of the first edition made extensive use of *Chemical Abstracts* in designing the Encyclopedia and considering the weight to be given to various facets of the subject. In planning the third edition, therefore, we were careful to consider the changes that had occurred in individual sections of *Chemical Abstracts* in the past decade.[3,4] Both the analysis by Baker[3] and the in-house study by Proskauer[4] showed that increasing attention was being given to environmental and toxicological problems in the literature; that exceptional growth was being shown by the plastics industries, followed closely by the inorganic and mineral industries, including those aspects related to electronic materials; and that energy conversion technology was rapidly assuming an important place in the literature of chemical technology. Some of these changes are reflected in the projected growth of several subject areas in the third edition as shown in Table III.

Note that although Semiconductors and Electronic Materials appears to have the greatest percentage growth, the largest number of new subjects has been added in the category of Plastics and Elastomers. The apparent decline in the surfactants and emulsion area is largely an artifact since there are few actual subjects in this category and several composite articles were created to provide greater systematization of this subject. For example, *Drycleaning* and *Laundering* were combined as one subject and *Surfactants and Detersive Systems* replaces the two separate articles in the second edition on *Surfactants* and *Detergency*. In a similar way, *Chemical Cleaning* is now a part of *Metal Surface Treatments*. In terms of actual pages, this category is expected to grow by 19% compared to the second edition. Other subject categories that are projected to show important growth in the third edition

Table II. Subject Categories of ECT

category of subjects	no.
1. AGRICULTURAL CHEMICALS	14
2. CHEMICAL ENGINEERING	142
3. COATINGS AND INKS	64
4. COMPOSITE MATERIALS	23
5. DRUGS, COSMETICS AND BIOMATERIALS	91
6. DYES, PIGMENTS, AND BRIGHTENERS	42
7. ECOLOGY AND INDUSTRIAL HYGIENE	48
8. ENERGY CONVERSION AND TECHNOLOGY	88
9. FATS AND WAXES	12
10. FERMENTATION AND ENZYME TECHNOLOGY	20
11. FIBERS, TEXTILES AND LEATHER	44
12. FOOD AND ANIMAL NUTRITION	52
13. FOSSIL FUELS AND DERIVATIVES	72
14. GLASS, CERAMICS AND CEMENT	30
15. INDUSTRIAL INORGANIC CHEMICALS	191
16. INDUSTRIAL ORGANIC CHEMICALS	247
17. METALS, METALLURGY AND METAL ALLOYS	92
18. PLASTICS AND ELASTOMERS	165
19. SEMICONDUCTORS AND ELECTRONIC MATERIALS	45
20. SURFACTANTS, DETERGENTS AND EMULSION TECHNOLOGY	11
21. WATER SUPPLY, PURIFICATION AND REUSE	21
22. WOOD, PAPER AND INDUSTRIAL CARBOHYDRATES	34
23. GENERAL AND MISCELLANEOUS TOPICS	101
Total of Individual Articles = 1100	

Table III. Growth in Several ECT Subject Areas

	no. of articles		
	ECT 2	ECT 3	% growth
SEMICONDUCTORS AND ELECTRONIC MATERIALS	16	45	181
PLASTICS AND ELASTOMERS	101	165	63
ENERGY CONVERSION AND TECHNOLOGY	76	88	16
METALS, METALLURGY AND METAL ALLOYS	86	92	7
SURFACTANTS, DETERGENTS, and EMULSION TECHNOLOGY	15	11	−27

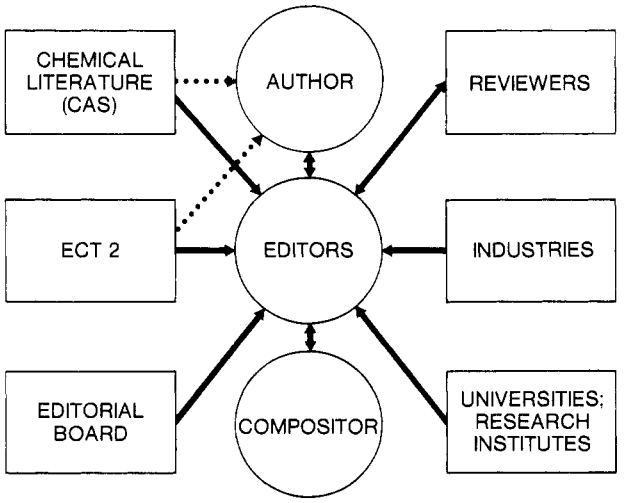

Figure 1. ECT development.

in terms of total pages compared to the second edition are Composite Materials (29%); Coatings and Inks (22%); Fibers, Textiles and Leather (18%); Ecology and Industrial Hygiene (17%); and Wood, Paper and Industrial Carbohydrates (15%).

The increases in most of these categories reflect the addition of many new subjects to the third edition. The inclusion of these new subjects in the Word List came about in a number of ways: numerous visits to centers of industrial excellence, suggestions by members of the editorial board of the Encyclopedia,[5] extensive vertical files based on clippings from the literature, and suggestions made by many reviewers, both industrial and academic, of preliminary lists of subjects in individual categories. This process is symbolized in Figure 1. Authors are selected by the editors with the help of the Editorial Board. Contributors and their affiliations are acknowledged at the end of every article.

A listing of typical additions is provided in Table IV in which the new subjects added to the category of Energy Conversion and Technology are marked by a black diamond. Although the Encyclopedia is broadly and nearly equally divided between Substance and Use categories, there are rather few Substance categories in the Energy Conversion listing; they include Alkali and Chlorine Products, Carbon, Plutonium, etc. Most of the others are Use categories; that is, they represent a process or type of application that may involve widely different substances. There is frequent cross-referencing from Use articles to those related to the individual substances involved, and conversely, Substance articles will always have a section on Uses which may be cross-referenced to individual Use articles.

GENERAL EDITORIAL POLICIES FOR THE THIRD EDITION

The editors of ECT have always had a broad general picture of the typical users of the Encyclopedia. This picture is based on general experience, discussions with librarians and other frequent users of the Encyclopedia, and similar heuristic methods. It is felt that the Encyclopedia is a place of first search by a technically competent person, usually with a masters level or equivalent training in chemical technology or a related science, generally seeking an overview of some branch of the subject, although frequently looking for an item of specific information such as a physical property. The search is being conducted in an area peripheral or largely unfamiliar to the training and background of the reader. It is evident, of course, that the Encyclopedia is sometimes used by high-school students and the lay public since it is found in many municipal libraries; and very frequently it is used by information specialists who are asked to conduct a preliminary search in a given subject in a special library situation. But the Encyclopedia is primarily designed for a technical audience.

Therefore, to assist in making room for the many new subjects being added to the third edition, a few essentially undergraduate subjects such as Aromaticity, Heterocyclic Chemistry, and Nomographs were deleted. The editors also decided to severely limit the horticultural aspects of subjects dealing with naturally grown fibers, foods, and related products. Authors are asked to stress the manufacturing, materials, and by-products aspects of natural substances rather than methods of cultivation.

Wherever possible in the third edition the policy has been to combine conceptual with descriptive aspects of a subject rather than treat them separately; e.g., *Electrochemical Processing*, which includes theoretical and descriptive process information, replaces the second edition article *Electrochemistry*.

A few composite articles formed by collecting subjects that would otherwise be scattered throughout the alphabet were introduced. A few such systematic articles are considered justified in order to effect some compression of the subject by allowing the authors to interact and to provide the editors with a simultaneous oversight of related materials. One such article is Hydrocarbons, C_1–C_6, which replaces the original articles on Methane, Ethane, etc. In general, however, this sort of activity has been kept to a minimum in the third edition since, harking back to the definition of an encyclopedia, the alphabetical organization is a prime consideration.

Regardless of these organizational variations, the reader is always provided with a suitable cross-reference under the expected alphabetical entry if the subject is to appear elsewhere in a systematic article. Systematic, composite articles are often conceptually satisfying to the theorist in a given field, but extremely frustrating to the reader in search of rapid access to information.

Although it was general policy in the earlier editions to have expert reviewers for articles, a full review procedure was

Table IV. ECT 3 Articles in Energy Conversion and Technology Category

Alkali and Chlorine Products
Batteries and Electric Cells, Primary
Batteries and Electric Cells, Secondary
♦ Burner Technology
Carbon, Carbon and Artificial Graphite
♦ Chemiluminescence
♦ Chromogenic Materials
♦ —Photochromic
♦ —Thermochromic and Electrochromic
Coal
—Coal Conversion Processes
Color Photography
♦ Color Photography, Instant
♦ Deformation Recording Media
Deuterium and Tritium
Diatomite
♦ Digital Displays
Diphenyl and Terphenyls
♦ Dyes, Sensitizing
♦ Electrochemical Processing
Electrolytic Machining Methods
♦ Electrostatic Sealing
♦ Fans and Blowers
♦ Feedstocks
Ferrites
Ferroelectrics
♦ Fiber Optics
Fuels, Survey
♦ Fuels, Synthetic
♦ —Gaseous
♦ —Liquid
♦ Fuels From Biomass
Furnaces, Electric
Furnaces, Fuel-Fired
♦ Fusion Energy
♦ Geothermal Energy
♦ Heat Exchange Technology
♦ Holography
♦ Hydrogen Energy
♦ Insulation, Acoustic
Insulation, Electric
Insulation, Thermal
♦ Integrated Circuits
♦ Interconnection Technology
♦ Ion-Specific Electrodes
♦ Lasers
♦ Laser Dyes
♦ Light-Emitting Diodes & Semiconductor Lasers
♦ Liquid Crystals
Luminescent Materials
—Fluorescent Pigments (Daylight)
♦ —Phosphors
Magnetic Materials
—Bulk
—Thin Film
Mass Transfer
♦ Metal Anodes
Microwave Technology
Nonlinear Optical Materials
Nuclear Reactors
♦ Particle Track Etching
Petroleum (Products)
Photochemical Technology
Photography
♦ Photoreactive Polymers
Phototubes and Photocells
♦ Photovoltaic Cells
Plutonium and Plutonium Compounds
Power Generation
Printing Processes
♦ Radiation Curing
Radiochemical Technology
Radioisotopes
Reprography
Semiconductors
—Theory and Properties
—Fabrication
♦ —Amorphous
♦ —Organic
♦ Solar Energy
Steam
♦ Superconducting Materials
Thermoelectric Energy Conversion
Ultrasonics
Uranium and Uranium Compounds

adopted for ECT 3; every article in ECT 3 is reviewed by two experts. The selection of competent reviewers is as difficult a job as finding the proper author. However, it has been our experience that this procedure ensures that at least one of the reviewers will provide fairly detailed suggestions for the improvement of the article to guide the author during the revision process. Sufficient time is allowed for these procedures which have benefitted many authors and strengthened their articles.

NEW FEATURES OF THE THIRD EDITION

SI Units—Simultaneous Translation. Metrication is proceeding slowly in the United States, but it is nevertheless proceeding. Although the Metric Conversion Act of 1975 provides only for voluntary conversion, the demands of international commerce have moved many of the larger U.S. corporations into the forefront of metric conversion. The position of Metric Coordinator has appeared in many key chemical and engineering firms. Since the shelf life of the Encyclopedia is measured in decades rather than years, and because of its broad international distribution, the use of the SI system in the third edition was inevitable.

However, in this period of change the unfamiliar symbols and names of the SI system present a real problem for contemporary engineers and chemists. Therefore, a system of simultaneous translation is used in the third edition with the stress on the SI system. Whenever a numerical value is provided in the text or tables or elsewhere, the common or English unit is provided in parentheses following the SI unit. The only exceptions to this are the very common units of mass, temperature, and length where only the SI values are provided.[6] A minor variation is the use of footnote conversion factors in tables rather than have repeated columns of parenthetical entries containing the common unit.

The reader is also provided with front matter in each volume of the Encyclopedia containing a detailed discussion of the SI system, its symbols, conversion factors from common units, and information on acceptable equivalents for the SI units. This information was put together for the Encyclopedia by Robert Lukens of the ASTM. Assistance was also provided by the American National Metric Council and industrial Metric Coordinators who served as reviewers of the material.

As an interesting sidelight to the development of the list of abbreviations for the third edition, the editors appear to have precipitated the use of the symbol L by the Chemical Abstracts Service in place of ℓ for liter. After studying the recommendations of various international groups for the use of this sensible symbol, the matter was discussed with the editor of *Chemical Abstracts* to discover the attitude or timetable for this change. The response was a fairly rapid announcement of the conversion of *Chemical Abstracts* to the use of L.

Where possible, the use of the SI system in the third edition has been conservative. Put in another way, the error of purism has been avoided where a compromise using acceptable metric practice was more in keeping with common usage. For example, in ECT 3 the mole is reported in grams, unless otherwise noted, the non-SI symbol t is used for metric ton for the sake of brevity, and liter and meter are spelled with the "er" ending, in keeping with U.S. practice. The purist, of course, would not even use liter, but would resort to dm^3. The editors hope that this simultaneous conversion principle will enable the readers of this transition period as well as those who are completely immersed in the SI and metric traditions to be entirely comfortable with the third edition.

Chemical Abstracts Service Registry Numbers. Chemical Abstracts Service (CAS) Registry Numbers are unique numerical identifiers assigned to substances recorded in the CAS Registry system. They appear in brackets in the *Chemical Abstracts* (CA) Substance and Formula Indexes following the names of compounds. The value of the number lies in the fact that it is a concise and unique means of substance identification, which is independent of, and therefore bridges, many systems of chemical nomenclature. For polymers, for example, one Registry Number is used for the entire family of homologues.

The use of the Registry Numbers in the third edition has many advantages. For one, it enables the reader to go directly to the CA index name by means of the CAS Registry Handbook-Number section. The Registry Number is also a useful link for the reader in retrieving additional published information on substances from various data bases, including the Structure and Nomenclature Search System of the NIH–EPA Chemical Information System.[7] The increasing value of the Registry system is not only evident in the Toxic Substances Control Act (TSCA) Candidate List of Chemical Substances (April 1977) published by EPA, but in the routine listing of Registry Numbers in standard fine chemical catalogs.

An important feature of any Encyclopedia is accessibility by the user through conventional nomenclature. In ECT 3, as in the earlier editions, the editors have adhered to the principle of using the most common correct name of a substance. This nomenclature frequently differs from that in the CAS system. The use of the Registry Number also frees the editor of the onus of providing every usable and known synonym for a common name. Furthermore, rather complex substances with space-filling lengthy names can be identified simply by a formula and Registry Number. This is especially useful with structures and equations.

The ECT policy is to provide the Registry Number for all title compounds in the text of an article or where possible in tables. Intermediates or products unrelated to the title of the article, or substances mentioned in Use or Process articles such as Absorption or Adhesion will have their Registry Numbers in the index but not in the text. All substances identified by name as well as others where full formulas are provided in an equation or in the text will appear in the index with their CAS Registry Numbers. The only exception to this is ions, which are not usually indexed. In some articles where great numbers of substances are mentioned in the text, such as Alkaloids, a table is provided at the end of the article listing the names and Registry Numbers of the substances that appear throughout the text. Examples are given in Table V.

Index. As noted above, names of substances with their CAS Registry Numbers will appear in the index. Another new feature of the third edition is that an annual running index will be provided to cover the four volumes published the previous year. The annual indexes will not be cumulative; they are intended as a temporary measure to facilitate use of the Encyclopedia until the collected, cumulative index can be issued as Volume 25 in 1984. This useful feature of ECT 3 has been made possible by simultaneous text entry and flagging of index terms in the computer composition tape. Coupling of this indexing procedure with an automatic pagination program for text and index has immensely reduced the editorial burden of indexing. Indexing can now be carried out in a uniform, consistent manner by the editorial staff as an article is prepared for composition. The actual entry of text and flagging of these terms is carried out by the compositor. Details are discussed below.

COMPOSITION PROCEDURES

The modern procedure for computer-controlled phototypesetting involves magnetic disk storage of text, either by direct keyboarding or OCR scanning of a machine-readable font, correction and editing of the stored text either directly with a video screen on an editing terminal or with possible

Table V. Use of CAS Registry Number in ECT 3

Structure	Structure number	Chemical Abstracts Registry Number
ergoline-8-(4′-(*p*-anisyl)piperazinyl)methane, 6-methyl	(103)	[24679-20-7]
ergonovine	(98)	[60-79-7]
ergosine	(96)	[561-94-4]
ergostine	(96)	[2854-38-8]
ergotamine	(96)	[113-15-5]
fagaronine	(58)	[41758-44-5]
febrefugine	(39)	[24159-07-7]
folicanthine	(83)	[6879-55-6]
fusaric acid	(40)	[536-69-6]
galanthamine	(69)	[357-70-0]
gentianadine	(126)	[679-32-5]
gentianine	(120)	[439-89-4]
gentiatibetine	(122)	[26005-36-7]
gentioflavine	(121)	[18058-50-9]
glaziovine	(63)	[6808-72-6]
harmaline	(81)	[304-21-2]
harmine	(80)	[442-51-3]
harringtonine	(72)	[26833-85-2]

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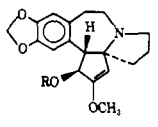
***Cephalotaxus* Alkaloids.** The structure of cephalotaxine (72), the major alkaloid of the Japanese plum yews, *Cephalotaxus* species (215), was determined by x-ray crystallographic analysis (216–218).

Cephalotaxine itself is of little importance but the esters of this compound have become significant because of their potent antileukemic activity (219–220). Typical compounds are harringtonine (72) and deoxyharringtonine (72). The absolute configuration of the ester moiety has been separately determined (221). The α-hydroxy ester is essential for *in vivo* antileukemic activity (222). Cephalotaxine has been synthesized by two groups (223–224), and these and other pertinent data have been summarized (218).

(72) cephalotaxine R = H



harringtonine R = —COC(CH$_3$)$_2$C(CH$_3$)$_2$
CH$_2$CO$_2$CH$_3$
OH OH

deoxyharringtonine R = —COC(CH$_3$)$_2$CH(CH$_3$)$_2$
CH$_2$CO$_2$CH$_3$
OH

5-methoxy-*N*,*N*-dimethyltryptamine	(78)	[1019-45-0]
9-methoxyellipticine	(82)	[10371-86-5]
10-methoxyibogamine	(94)	[83-74-9]
16-methyl-16-hydroxy-14,15-dehydro-eburnamenine	(109)	[52530-91-3]
monocrotaline	(30)	[315-22-0]
morphine	(59)	[57-27-2]
muscazone	(136)	[2255-39-2]
muscimol	(135)	[2763-96-4]
muscopyridine	(1)	[501-08-6]
narciprimine	(71)	[18033-21-1]

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intermediary production of galleys for proofing by author and editor, followed by conversion of the disk storage to magnetic tape and phototypesetting controlled by the proper program. The composition of ECT 3 at the Mack Printing Company has essentially followed this procedure with the edited manuscript being typed in machine-readable font for scanning, input to the disk storage, and subsequent tape-driven photocomposition. However, as shown in Figure 2, some additional steps have been added to permit indexing directly from the composition tape. These steps involve marking of index terms in colored inks on the manuscript by the editors and then manual encoding of the index heads by staff at Mack, followed by typing of the index head codes as well as the index heads themselves along with the text in the OCR machine-readable font. The initial magnetic disk storage of the text, therefore, contains both text and coded index terms appearing directly at the point of reference.

The visual evidence of this process appears first on the galleys. As shown in Figure 3, the index terms are shown in the margin of the galley as they will appear, after suitable editing and, of course, alphabetization in the final index. This enables the author and editors to proof index terms, insert CAS Registry Numbers if they were unavailable at the time of editing the manuscript, and make other additions and deletions while reading the article and being fully aware of its content rather than at some later stage when the subject of the article is no longer fresh. This opportunity to reevaluate the index material in typeset form and make corrections prior to final storage, sorting, and printout as paginated index, should decrease errors and permit a more uniform and fuller indexing process. At the time of text and index entry, the compositor is also coding the material for figures, tables, and structures.

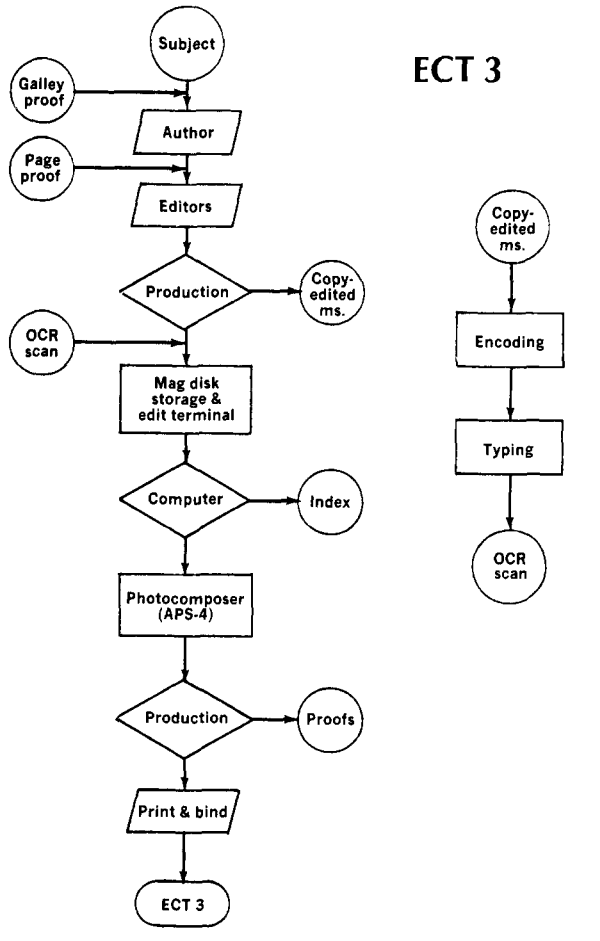

Figure 2. ECT production.

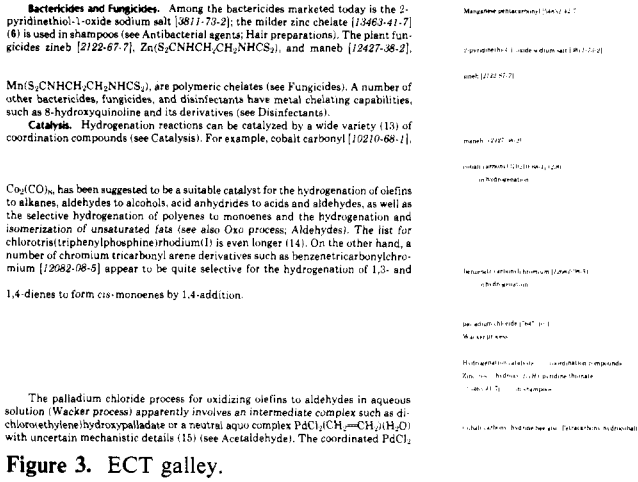

Figure 3. ECT galley.

As with normal composition, corrections made by authors and editors on the galleys are made by the compositor on the editing terminal using the magnetic disk storage. At this point, an additional step is introduced. The programming for automatic pagination is added to the magnetic record. During this process the pagination of the index terms also takes place as the magnetic record, now on computer-drive tape, is processed through the pagination program (Figure 4).

As noted in Figure 4, the raw tape with the flagged index term locations is converted through the computer program to a typesetting, paginated tape for processing by the photocomposer (APS-4) with the flagged terms in place. In the final run through the computer the index tape containing the index terms with actual page numbers is separated from the phototypesetting tape which is now free of index terms. The latter

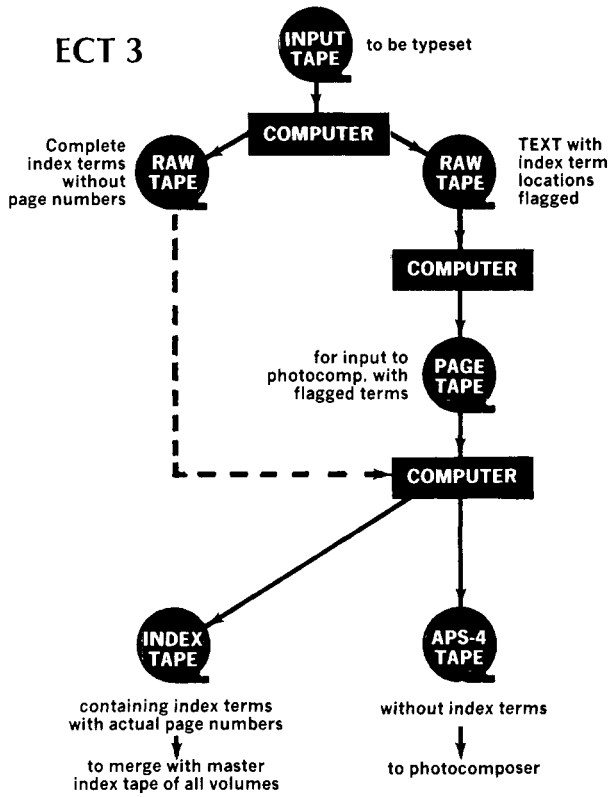

Figure 4. ECT index generation; runs made at final page stage.

is then used to drive the CRT photocomposer for processing of the final pages by the editorial and production staffs. Unlike the galleys, these pages are not seen by the author. The index tape with the page numbers is now stored for a later merging with tapes from other volumes of the Encyclopedia. At the end of every four volumes, the tapes are merged and an annual running index is produced for distribution as a temporary paperback adjunct for users of the Encyclopedia pending the production of Volume 25, the complete index for the entire set.

The abstract is also something new for ECT 3. It does not appear in the final pages of the Encyclopedia, but it is available in the galleys for corrections by the author and editors. The abstract is later "spun-off", that is, extracted from the tape, and stored separately for later retrieval. The abstracts are sent to *Chemical Abstracts* for their use in abstracting each volume of the Encyclopedia prior to actual publication. They have possible future value in an ECT data base (see below). Index proofs are also provided as necessary for editorial review and correction, either for individual volumes or for the merged and sorted annual, four-volume output.

The pagination and indexing programs include many detailed instructions such as the automatic italicization of CAS Registry Numbers, both in the text and the index, automatic capitalization for the index, and a series of automatic sequencing and hierarchy codes to permit main and subhead alphabetization without regard to minor modifiers such as prepositions and nondefining chemical descriptors (*meta*, *N*-, *tert*-, etc.). Of course the computer allows room for later insertion of figures and handles the placement decisions involved at the beginning and end of every article.

Fewer problems were encountered than expected. Schedules have been kept and composition errors have been minor. Some of the problems have been alleviated by later modification of the programs. Others, such as floating of tables to the bottom of every page, and of index terms to the point of insertion of the next term, not to mention an occasional "stutter" or other aberration by the computer, have persisted. These matters are now handled routinely by the production staff. In addition to the expected savings of manpower and time, the new production procedure has provided the added possibility of later conversion of composition tape to data-base format.

DATA-BASE FLEXIBILITY

As the various parts of an article are stored in the tape for production, the individual sections are flagged as separate fields. This means that in addition to retrieval of whole articles or groups of articles, individual portions of one or all of the articles can be retrieved. This would include, for example, the title of the article and the bibliography with the author's name and affiliation. In addition the abstract could be added. Thus, with relatively little additional investment, a data base could be developed which would provide the user with the name of an article, and an abstract to indicate the content. If desired, the bibliography could also be provided. In addition to data-base production, the flexibility of magnetic tape composition offers additional reprint and spin-off possibilities, including publication of related groups of articles for special users, etc. A separate collection and reprinting of the abstracts in hard copy would also be a possibility.

PUBLISHING SCHEDULE

The third edition of the "Kirk-Othmer Encyclopedia of Chemical Technology" is projected to contain 24 text volumes and a 25th index volume. The publication began in 1978 with the first four volumes and is continuing at the rate of four volumes per year. At this rate, ECT 3 will be completed, including the index volume, by 1984.

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(6) The use of °C as well as K, and g as well as kg, and metric ton is found in the Encyclopedia. The abbreviation t for metric ton is also used. Complex functions containing °F, lb, ft, etc., are given in parentheses; e.g., (lb/ft^3) follows kg/m^3 or equivalent.
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