cation known as the "Parent Compound Handbook". The editorial work for this publication is done, but the programming necessary to computer compose the necessary structure diagrams has not been completed. It was deferred in favor of some more pressing projects. Very few people have inquired about a new edition of the "Ring Index". The publication of drawings with locant numbering for new rings in each Volume Index appears to be sufficient for most users at the moment.

Q. You mentioned a change in abstracting policy regarding Russian publications. Have you also changed indexing policy?

A. My statement regarding abstracts of Russian publications applied only to those abstracts that we formerly translated from the *Referativnyi Zhurnal,* not to all Russian publications. For those references, we now publish only the title, and we index only from the title. This represents only a small fraction of our Russian coverage, however, and there have been no basic changes in indexing policies.

Terse Literatures. II. Ultraterse Literatures

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The creation of Ultraterse Literatures (ULs), demonstrated in this paper by reading the set of 30 Terse Conclusions (TCs), can be a part of generalization and of the creation of new knowledge and new research projects. Computers can probably be programmed to collect indexed TCs under index headings and under categories of index headings, and then to print out only those TCs under headings and categories that exceed a figure of merit or a specified growth rate. From the anticipated printout of important headings and categories of TCs, those people knowledgeable in the subject field can probably create ULs. TC: ULs with condensations to 1/1,000 or fewer the number of words in original works can probably be written from sets of TCs selected (possibly by computer) on the basis of the number of TCs, rate of growth of the set, or other figure of merit.

INTRODUCTION

Methods for keeping current in science and for putting to use what is read have become inadequate in the past half century.[1] Three of the principal methods for dealing with these inadequacies have been (1) specialization, (2) condensed surrogation, and (3) skipping. (1) Specialization has become overspecialization; closely related material that cannot be read for lack of time may be found later to be important. (2) Condensed surrogates (writings, condensed from the original literature, that can be used in place of the original works; examples are abstracts, annotations, and extracts) are now discovered to be delayed; too wordy to read, assimilate, integrate, remember, and use; and to be unorganized. Nearly all surrogates are scattered in space and time, and by language, and must be assembled and translated for use. (3) Skipping has never been satisfactory because the part skipped may contain essential information. Whether the skipping is done by ignoring articles, authors, books, languages, patents, or index entries in manual search, or is done by the use of the Boolean negative or too many Boolean products simultaneously in a correlative search[2] is immaterial; essential information can be lost.

Support for the existence of the problem of too much to read is to be found in hundreds of statements made by responsible individuals during the last 50 years. If it is possible (and if there is ready access to articles, language ability, and time) to read[3] two research papers (about 4,000 words) per hour, and reading is continued 365 days a year, then:

- The 10,000 articles in either oncology or cardiovascular research (as examples) estimated to be published each year would take 14 years to read.
- The 2,000,000 biomedical articles[4] per year would take 27.4 centuries to read; and
- The 413,000 papers and patents[5] of chemistry and chemical engineering estimated to be published in 1975 would take 5.66 centuries to read.

A third source of support for the existence of the problem comes from lags in use of research results. One illustration is:

The energy crisis, reported to be approaching for at least 4 decades, caught those in a position to contain the crisis unprepared to take effective action. This occurred despite a literature[6] that carries many tested ways to generate and conserve energy.[7]

The technical literature, well tested and reliable, remains unused, too-little used, or used only after years of delay. Some lags are deadly, some prolong suffering, and some are costly, e.g., $22.4 billion lost annually from heart disease through income not earned, diagnosis, therapy, hospitalization, and burial (in the U.S. in 1962).[8] For 1975, the cost is estimated to increase to $36.6 billion if we assume an increase from 600,000 to 700,000 deaths per year plus total inflation of 40%.

REPACKAGING

Abstracts, condensing the primary literature to about one-tenth the wordage, have been a fairly effective way of helping solve the problem of too much to read. However, there are still too many words in abstracts that are irrelevant to the immediate purpose of the searcher. Extracts that condense to about one-fifth the number of words present more irrelevant words than do abstracts. Handbooks of

data cover at most only a few percent of the data in the scientific literature. Handbooks, because of the time needed to compile them, are always out of date at the time of use. Reviews may condense to 1/100 or smaller; however, there are never enough reviews to cover all subject fields. Reviews are nearly always out of date at time of use. Encyclopedia articles and textbooks come along later. The present-day (2) condensed surrogates for primary papers and reports need supplementary services to cope with the flood of material.

Of the three methods for solving the problem of too much to read, only (2), the improvement of condensed surrogates, seems to offer hope of success. If we cannot read all relevant words that we believe we should, then we must read fewer words; and these fewer can be preselected and preorganized better and more promptly than they have been. *Terse Conclusions* (TCs) (that condense the primary literature to about 1% of the number of words) have been written by authors and by those who know the subject field. TCs have been published for years.[9–15] TCs can be indexed and the index entries categorized to create collectaneas (in which each index heading and each category hold complete sets of closely related TCs.)[1,15] TCs enable the reader not only to keep up in a larger subject area, but also to assimilate, integrate, and remember better what is read.

INTEGRATION

The integrating effect and the creation of Ultraterse Literatures (ULs) (that generally function as hypotheses) can be demonstrated by reading the following set of 30 TCs and then, from the information gained, synthesizing ULs that include *Ultraterse Conclusions* (UCs), *Admonitions, Intentions, Explanations,* and *Advocacy.* ULs can condense the primary literature to 1/1,000 or fewer the number of words in a set of ten or more related articles. The following example was chosen from the biomedical field because considerable material was already at hand.[15] However, examples could as well have come from other disciplines.

- Coronary heart disease is an epidemic that has increased in industrialized countries in the last 50 years.[16]
- Ischaemic (coronary) heart disease, rarely mentioned as a cause of death more than 200 years ago, now accounts for about 20% of all deaths in affluent countries.[17]
- The average daily intake of sucrose in 20 men with ischaemic heart disease was 148 grams; in the control group of 13 male patients without heart disease, it was 90 grams; and in the control group of 20 factory men with no apparent illness, it was 78 grams ($P < 0.01$).[18]
- Consumption of refined sucrose in the U.S. has doubled in the past 70 years and is now at least 99 pounds per person per year or about 1.9 pounds per week.[19]
- From 4 pounds a year that the statistical Englishman ate in 1750, his consumption of sucrose increased to about 25 pounds in 1850; today it's about 120 pounds per year or 2.3 pounds a week.[19]
- Rising mortality from ischaemic heart disease in Britain (1952–61) was accompanied by increasing consumption of sucrose, fat, and calories.[20]
- Deaths from coronary heart disease, which have gone up dramatically in the past 50 years, are more closely related to increasing sucrose consumption than to any other dietary change.[19]
- In Israel, Yemenite immigrants, who showed a considerable increase in coronary disease after 20 years in the country, had taken to eating very little more fat but much more sugar than they had eaten in Yemen.[16]
- The population of St. Helena has a fairly low fat intake, a high sugar intake, and is physically active, but has a high rate of heart disease.[19]
- The Masai and Samburu tribes of East Africa have a high fat intake and a low sugar intake, and have a low rate of coronary disease.[19]
- The sucrose consumption for 1962 in ten administrative regions of Czechoslovakia was related to mortality from cardiovascular disease in each region.[20]
- Those who have consumed almost no sucrose have almost no coronary disease.[21]
- We have yet to find an exception to the parallel between high sucrose intake and increased incidence of atherosclerosis as manifest by coronary heart disease.[16,17]
- Sucrose is an important cause of heart disease.[19]
- Medical Boards of Finland and Sweden have recommended that the entire populations reduce their consumption of sugar and of products containing sugar as well as their consumption of saturated fat and cholesterol, and increase their consumption of unsaturated fats.[19]
- A sucrose diet depletes body chromium stores of rats and causes higher concentrations of serum cholesterol.[22,24]
- Chromium-deficient rats have fairly high percentages of plaques in their aortas, especially when old.[23]
- One sign of chromium deficiency in rats is relatively elevated serum cholesterol.[24]
- Urinary chromium increases up to 400 μg/l. after oral glucose loads; the normal amount is 4 μg/l.[23,25]
- As the American adult contains an estimated 5 mg of chromium in his body, depletion of body stores could result from repeated insults with glucose or refined sugars having little or no chromium.[23]
- Chromium deficiency may cause the body's failure to use carbohydrates, often a problem with middle-aged and elderly people.[26]
- Chromium was found in almost all tissues of people from Africa, the Mid-East, and the Far East at concentrations 2.5 to 13 times those of the same tissues of Americans; the decline from childhood levels was relatively small in these areas and deficient tissues were unusual.[25,27]
- African tissues had 1.9 times, Near Eastern tissues 4.4 times, and Far Eastern tissues 5 times as much chromium as did American tissues.[25,27]
- The average chromium concentration in the United States population declines from birth to old age to very low levels, suggesting insufficient dietary intake.[31,33]
- An elevated insulin level is found in coronary heart disease and in peripheral vascular disease.[28]
- Traces of trivalent chromium are essential for insulin stimulation of glucose metabolism of rat lens.[25,29,30]
- Chromium is a cofactor with insulin at the cellular level.[25,29]
- With about a third of the volunteers, a high sucrose intake leads to a tremendous rise in insulin and a much more striking rise in corticosterone.[19]
- Insulin injected into the rat causes increased deposition of lipid into the aortic wall and thus may play a major role in pathogenesis of atherosclerosis.[28,32]
- High levels of circulating insulin may damage arterial walls and lead to deposition of atherosclerotic plaques.[19]

ULTRATERSE LITERATURES

An *Ultraterse Conclusion* (UC) derived exclusively from this set of 30 TCs, and that can function as an hypothesis, is: Atherosclerosis (and resulting coronary heart disease), mediated by circulating insulin, are consequences of chromium deficiency caused largely by dietary sugar.[16–33,34]

An *Ultraterse Admonition* is: Avoid chromium deficiency and high sugar consumption.[16–33]

An *Ultraterse Intention* is: I will decrease sugar and increase chromium intake.[16–33]

An *Ultraterse Intention* for the medical researcher is: I will design and implement a project to measure interrelationships among atherosclerosis, chromium, coronary disease, insulin, and sugars in the diet.[16–33]

An *Ultraterse Explanation* is: Excessive sugars in the

diet deplete body chromium and increase circulating insulin which increases lipid deposition in arterial walls in the absence of chromium, with resultant increase in atherosclerosis and coronary disease.[16-33,34]

Ultraterse Advocacy is: As a precaution, decrease sugars and increase chromium in the diet.[16-33]

The 30 TCs used to create the above ULs came from 18 papers (of about 2,000 words each) with a total of about 36,000 words. Condensation to a UC of 20 words represents a reduction to about 1/1,800 the wordage. While such a reduction in amount to be read is important, even more important is the integrating effect enhanced. A few pieces of the puzzle of coronary heart disease seem to fit into place. ULs are easy to remember and use; they are brief and dramatic and seem to be cogent. UCs have been used unnoted for many years. Researchers, after reading the literature, may come to conclusions based on what they have just read. Such conclusions, if derived from about ten or more papers (or their equivalent) would be UCs and might usually be expressed as statements averaging about 20 words. Making UCs from TCs should be more efficient than making them from the primary literature because of reading time saved and because of improved assimilation, integration, and memory. Formalizing the creation of UCs from TCs could become the next step toward improved integration of what is read and in systematic generalization. Ultraterse Explanations and Intentions can also probably be produced systematically from TCs to initiate the design of experiments that may serve to establish the validity of the UCs created.

VALIDITY

TCs, except for errors in editing, are as valid as are the conclusions to which the authors have come. This is so because they *are* the conclusions of the authors, edited without changing their meaning to make them terse, and understandable without additional context. There can, of course, be no guarantee that *any* vocal or written statement is valid. However, it is certainly in the best interests of all to disseminate only the truth, so far as it can be discovered. Experience has shown that published results of research and development, including the conclusions, can nearly always be trusted.

ULs, derived from a set of closely related TCs or from the original documents, are logical inductions. Terse Literatures can serve as bases for action other than research. ULs have been cogent, especially for those who have first derived them from the primary literature or from TCs. UCs have led to action, e.g., reduction of sugar in the diet and chromium supplementation. The validity of ULs depends on the truth of the authors' conclusions and on the knowledge, perceptiveness, and skill of the creators of the ULs.

USE

The details, normal conditions, and expected circumstances that have been omitted from the statements to make them terse are expected to be supplied from the knowledge of the reader. The applicability of this knowledge can be evaluated by consulting the original literature behind the Terse Literatures and the ULs—if the reader has the time. Such consultation is facilitated by use of the reference numbers following each statement or index entry and by use of the numbered references assembled after all of the terse statements and to which the numbers guide the reader. Terse and Ultraterse Literatures are generally intended to be surrogates for, rather than guides to, the primary literature simply because the last is too large to be read. However, use of these highly condensed literatures as guides to the few original works that can be read will be important in improving cogency and in evaluating validity. The same is true for abstracts, annotations, and extracts.

Information systems that promote application of scientific literature are available. They are not used widely enough at present. Information systems that use Terse Literatures are no longer experimental:

- Friedlander, Editor of the *Clinical Neurology Review*,[9] published categorized TCs to bring salient conclusions from 3,600 papers per year to neurologists. This Review avoids word-dilution of salient information and is intended to improve comprehension and integration in the field of neurological research. This Review was started in mid-1972.
- Gordon and Carr have initiated a system for organizing and disseminating TCs written by authors of reports within the Hooker Chemicals & Plastics Corp. This new literature of TCs is reported to be used in place of abstracts.[10]
- The Argentine medical newspaper, "Dia Mèdico," carries a column, "Aforismos Cardiologias" that brings a list of TCs to Spanish-reading medical people.
- Reviews, such as "Cancer Cells" by Cowdry,[11] may consist of one TC after another.
- Handbooks assemble data from research and papers for easy use and rapid comprehension.[14]
- Poison-control centers store their data and Terse Admonitions (short warnings, e.g., "Keep aspirin bottles away from children") for immediate access.

A discussion of Terse Literatures and ULs is being published.[12] Sultz and Bernier are studying implementation of a project that uses TCs.[13]

COMPUTERIZATION

TCs could be stored and collected (categorized) in computer memories. They are brief (enabling inexpensive storage), have few unusual symbols, and could be replicated in various places in memory with use of little extra space—when compared with storing primary documents or even abstracts.

TCs, for example, have been indexed and the index entries categorized by humans.[15] The TC has been used in its entirety as the modification (modifying phrase) following the human-selected subject heading. The reference number (locator) following the TC guides users of the index to the references to the original documents from which the TCs were derived. Thus, a collectanea of TCs has been formed. Readers of all TCs under a heading or category of related headings should, in this way, be aided in assimilating, integrating, and remembering conclusions in related fields.

Computer programs can probably be written to count the number of TCs under all headings and to print out only those TCs exceeding a specified minimum number. The number of TCs under a heading is a measure of the activity in the subject area; it is likely also to be a measure of importance of the area. Other measures of importance can also be used.

This will be genuine information retrieval, and not simply reference retrieval; the information retrieved will be that from related conclusions of authors and not simply subjects studied by authors as revealed in titles of references retrieved. Other measures of importance could include the number of citations: to documents represented by the TCs under a heading, to names of authors, and to names of journals. "Tightness" of the collection of TCs under the heading could be a measure. Tightness can probably be measured by the number of citations among papers represented by TCs under the heading and by the number of other identical subject headings used for indexing the TCs under a specific heading. These other measures can possibly be combined with the number of TCs under the heading to give an overall figure of merit for the heading. A high figure of merit would mean that these TCs especially

merited being brought to the attention of readers. A predetermined magnitude for this figure of merit might be used to cause the computer to print the heading with its TCs, which would indicate to the reader that something important might be happening in this subject area. Important areas might also be anticipated by the rate of growth in number of entries or by the number of citations to headings or to categories. The computer can probably be programmed to calculate the rates of growth and to print out all headings and categories (together with their TCs) that are growing above a predetermined rate. Use of the rate of growth should help to anticipate importance before growth to a certain minimum size had occurred.

By reading the TCs under the headings or categories, the user might be able to derive ULs similar to those demonstrated in this paper. A reasonable future goal would be to program the computer to index and categorize TCs, perhaps with the help of a computer- or human-generated thesaurus. A longer range goal is to program the computer to create ULs from Terse Literatures without human intervention and to print these out as soon as a figure of merit was exceeded. Thus, the computer, if any of the above were successful, should be able to enter more extensively than at present into research generalization and creativity. Research progress should be enhanced because computer memories are much less fallible than are human, because *all* relationships would be monitored continuously, because only those subject headings or categories above a specified level of growth rate or figure of merit would print out, and because delays in doing all of this would be less than at present. In this way we may be able to surmount some limitations of human memory[35] and put to better use what has been published.

The TCs could be provided by authors and others who now write abstracts, perhaps as the first sentences of the abstracts.

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