

recognized as wrong when mistakes are made. This clerical operation calls for follow-up training to learn what to look for and workers are required to learn habits of alertness.

Final proof reading of CA, both abstracts and indexes, is a chemist's job, not a clerical task. The proof readers deal with concentrated scientific material and they must learn to detect and correct all kinds of mistakes, sometimes including mistakes in chemistry and presentation form overlooked by the editors. The reading of proof for CA is done by the editors of abstracts for the regular issues and by experienced indexers for the indexes. Training for this work is pretty much the same as the above-described training for editing abstracts and for indexing. There must be an additional period of training (mostly just experience) to acquire the ability to see every comma, letter, word, etc., while at the same time grasping meanings and noting forms of expression. Most new workers have had a life-long habit of reading rapidly for meaning only and really have not been conscious of the marks on paper which convey the meanings. Seeing everything down to detail with reasonable speed must be learned by prolonged conscious application.

CAS is going in for offset printing, as of its Formula Indexes. This requires composition to be done in the CAS office. Also the Research Department is building files of all compounds and related data for handling by computers. The coding of organic structures involves the use of the official system of Notation for Organic Compounds of the

International Union of Pure and Applied Chemistry. These and other tasks require special training, as computer school sessions and Varityper school work on the outside along with internal training.

#### PREJOB TRAINING

On-the-job training is perhaps necessary in just about all more or less extensive undertakings. Employers hope for considerable prejob training in hiring workers, and workers usually benefit when such preliminary education has been available and has been experienced. CAS usually has been unable to find workers with prejob training in abstracting, editing, and indexing. With the growing recognition of the importance of adequate utilization by scientists of the rapidly filling world's storehouse of research information, it is hoped that college training courses in the chemical literature field will increasingly include work on the production of searching tools as well as on their utilization. All would benefit. Whether or not students plan to go into chemical literature work, this kind of training would be helpful. Literature-handling services would gain in proficiency to the benefit of all and utilization of them would gain in efficiency. The best gatherer of grain is the man who knows the farmer's whole task.

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## Education of Information Personnel\*

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This paper is not intended primarily to reveal new factual information about literature chemists and their training. Rather, the purpose is to tell about what we hope will be a significant influence in the near future.

Since October of last year the Georgia Institute of Technology has been conducting a program to study the Training of Science Information Specialists. The study is sponsored by the National Science Foundation, and is directed by Mrs. J. H. Crosland, Director of Libraries.

Three types of specialists are included within the scope of the program, Science Librarians, Technical Literature Analysts, and Information Scientists, and they are defined as:

(1) **Science Librarian.**—A librarian with a broad though not necessarily deep acquaintance with science and a comprehensive knowledge of the literature of science. He differs from the literature analyst in two respects: (a) He is a librarian, and therefore qualified to deal with all the usual problems associated with the operations of a librarian, and (b) while he can and does perform literature searches, he cannot in general critically evaluate the scientific content of the literature.

(2) **Technical Literature Analyst.**—One who is trained in a substantive technical field, who has, in addition to the depth thus provided, some breadth of technical knowledge, and a thorough knowledge of the technical literature. He can analyze the literature for researchers who are investigating problems in the areas of the analyst's technical competence. Analysis implies a search, an organization, and an evaluation of the literature in question. In his ability to deal with the technical literature the analyst differs from the conventional science librarian in that his knowledge of science is sufficiently deep for him to make value judgements of its literature.

(3) **Information Scientist.**—One who studies and develops the science of information storage and retrieval, and who devises new approaches to solutions to information problems.

Our study has been divided into two halves, long-range and short-range approaches to training. As the name implies, the short-range activities are intended to help solve immediate problems. In particular, this plan includes short courses and in-service training programs. These two programs are linked because they are intended primarily for people who already are involved in information work. The length of a short course is not defined; we have sometimes been inclined to define them as non-degree

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programs. The long-range programs have been restricted to degree programs—undergraduate, Master's, and Doctor's. Of course both these definitions are arbitrary.

It should be emphasized that our program is not directed specifically to Georgia Tech.; it is intended to elucidate the varied problems sufficiently to assist other organizations interested in such work. We have taken what might be considered an inductive approach; we are attempting the look at the over-all problem, from which specific applications may be selected.

The study began with a conference attended by about 30 individuals from throughout the country who have strong interest in related work. A second, somewhat larger, conference will be held in April. At this second conference there will be a series of brief papers from a variety of organizations. There will also be a series of reports indicating the results of our questionnaires, interviews, discussions, and study. I wish this paper were being delivered one month later; we are now at a critical point in our study.

### GENERAL OBSERVATIONS

We believe that recruiting is a primary problem. The problem stems from the general difficulty of competing with other vocations from the standpoint of prestige, salaries, and time required for preparation. We have been surprised to find the importance of chemical vocabulary, especially organic chemistry. A number of literature specialists with interdisciplinary responsibilities have reported they have more difficulty in understanding chemical terms than they have with medical terms, biological terms, engineering terms, etc. Although the need for chemical vocabulary in order to understand chemical reports is an obvious requirement, we have been surprised that the need appears to be so much more explicit than it is in most other fields. The majority of the people who are practicing as technical literature analysts have been educated as subject specialists. Very few have training in library science or even in less specific information-oriented education.

### SHORT COURSES

There are two interesting orientations for short courses—training in information subjects for people with technical background, and training in scientific subjects for people with only a library science background. Most people are of the opinion that it is impractical to try to provide useful courses in science for librarians. In spite of this reluctance, we believe there is some opportunity for such training. Such short courses would have to be restricted severely in order to be useful. They should be oriented toward a specific subject area, and they should be limited in objective to providing an over-all perspective and a working vocabulary. It is unrealistic to hope that such short courses could provide sufficient background to permit the student to make value judgements of the literature. We believe that the opportunities for short courses on specific science subjects for librarians deserve additional investigation. There is greater opportunity for short

courses which provide instruction in documentation for subject specialists. As an example of such a course, one might consider the following outline. The numbers show the relative effort which we have placed on these subjects in planning two-week short courses.

	Relative emphasis
1. Communication of information of science and technology	2
2. Information sources and search techniques	6
3. Organization of information for storage and retrieval	7
4. Presentation of information	6

In any short course program it is extremely important that both the students and the instructors (and the promoters as well) recognize the limitations of what can be achieved. To strive for too much is unfair, both to the student and the instructor. Furthermore, it may bring disrepute to the institution which offers the course. Overly ambitious efforts have led many people to take a pessimistic view of what can be accomplished by short courses. They are, however, about the only practical way of providing additional training to people who already are employed in the field. Generally, it is impractical for a person to spend more than one or two weeks away from work. The alternative of extended evening sessions usually is not feasible for information personnel because there are too few located in most communities to support an active instructional program.

### DEGREE PROGRAMS

There are many opportunities for training information personnel. However, most of them are lacking in many respects. Library schools today are generally willing to accept individuals with a technical education. However, very few people with such backgrounds ever enter library school. Only about 800 technically trained students have graduated from accredited library schools during the past ten years. This group is somewhat less than 10% of the total library school graduates.

A few library schools have plans whereby an individual may take a substantial amount of graduate work in his subject speciality while working on a major or a minor in library science. This procedure would seem to be a satisfactory way of training science librarians, and almost equally satisfactory for technical literature analysts. However, practically no one takes these programs.

Actually, even these programs leave something to be desired. Little attention is paid to specific library resources of interest to technical people. Also, additional emphasis is desirable on the history and philosophy of science, the organizations of science, and language capabilities. These comments are particularly applicable to the technical literature analyst.

We have concluded that the following new degree programs are the most practicable:

1. A program designed to train technical literature analysts leading to the degree of Master of Science in Technical Information. This program would deepen and broaden the student in his technical fields, provide him with the basics of information science, and strengthen his abilities in language.

2. A program in information science to be incorporated as the minor in a traditional doctorate program in science or engineering. With such an educational background a researcher would be able to make the most efficient use of the literature for himself and for others. This program could be offered with no change from existing procedures by any institution which has a program in information science. It also would serve to train technical literature analysts.

3. A program leading to the degree of Doctor of Philosophy in Information Science, designed to train information scientists. This degree program would be research oriented, with the course work concentrated in information science, including linguistics, logic, and machine storage and retrieval.

For the curricula leading to the M. S. in Science Information we believe a reasonable division of the time among the various blocs is science—45%, information science—35%, language—20%. In the science bloc we include both the deepening studies in the student's own major field and the broadening studies in other technical fields. The Ph. D. subject specialists with a minor in information science would take approximately the same information courses as the technical literature analyst earning a master's degree. We have not yet come to a conclusion concerning the division of time in the Ph. D. program in Information Science except that its primary emphasis will be in information science.

We are in process of devising typical curricula which students with various technical backgrounds might take at Georgia Tech in pursuit of the M. S. in Technical Information. These are not yet sufficiently well worked out to warrant presentation in this report.

## IN-SERVICE TRAINING

We have been concerned about the apparent demands in time and leadership of the instructing staff in order to maintain a satisfactory in-service training program. Furthermore, or perhaps I should say consequently, in-service training programs do not offer much opportunity for training substantial numbers of people. However, they do provide a means to develop an especially deep insight into the nature of the work responsibilities and the over-all picture of the operation. Consequently, these programs may be very desirable to train people who have high potential to be real leaders in their field. A number of libraries, especially medical libraries, have in-service training programs, often called internships. In-service training for technical literature analysts is common but only on an informal and relatively superficial basis.

There is a great deal of interest today in teaching as well as in studying the various facets of the information field. It is important that we not sell short the library schools simply because they have not been producing the type of talent which many of us think is needed. They are showing increasing signs of interest in modifying their programs to adapt to the demands which we feel. At the same time, there are opportunities for many types of educational institutions to provide training for science information personnel. Incentives for the students are needed. Finally, and perhaps most of all, there is a major need for education of the public, of college teachers, and especially of students to the existence of opportunities in this field. The work is attractive and rewarding and the opportunities are great, both for the students and the educational institutions.

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## The Literature Chemist Encouragement and a Curriculum Needed

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My contribution to this program has been arrived at by a circuitous route. In August of 1961, Bill Waldo offered an invitation to participate in a symposium on "Creating Literature Chemists" sponsored by the Division of Chemical Literature. By early October the symposium had become "Educating Literature Chemists" and the Division of Chemical Education had become a co-sponsor. At that time it was suggested that my part in this symposium take its cue from a "Conference on Training Science Information Specialists" held at the Georgia Institute of Technology because that meeting was of national interest. In addition, I could inject as much of my personal experience in technical information work as possible, and I might express my views on whether education of literature chemists really constitutes an academic discipline.

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When the abstract was submitted in December it was my intention to stress the need for a suitable curriculum to train "literature chemists," and the need for education of their associates to an appreciation of the contribution which the literature chemists make to the end that greater incentives and greater rewards would be proffered to entice more, and more able people into this work.

Finally, the program arrived. There were no abstracts of the proposed papers but the titles suggested to me that by 10:45 a.m. Messrs Waddington, Gordon, Langham, and Kyle undoubtedly would have covered the matters of curriculum and training quite adequately. Hence, in the few minutes allocated to me, I decided to make just a few suggestions in regard to a suitable curriculum, to urge adoption of standards, and to stress the desirability of greater rewards both in appreciation and in money. Most of all, I decided to avail myself of the opportunity to express some personal views.