be discovered in the future. If once established on a sufficient scale, such a laboratory could maintain not only workers in pure science but also individuals with a sense for the profitable utilization of scientific findings in ways that would probably be overlooked by the investigators themselves.

Briefly, the findings at Cincinnati aside from their theoretical importance have such commercial possibilities that the patents granted have been sold for an amount sufficient to build a laboratory and operate it for several years, while the royalties expected in addition to this fixed payment should be sufficient for the indefinite operation of the undertaking. After a study of the practices in other institutions that support investigation by such means a plan was devised that merits consideration by any university so fortunate as to command revenues of this nature. The essentials of this plan include:

(1) Payment of a cash sum to the university. This money will be used in various ways to further basic research.

(2) Formation of a holding company in which the corporation that has contracted for the patents owns a majority of the stock but the University of Cincinnati a good minority. The university has two members on the board of directors of this holding company, and the corporation involved has three members.

(3) Agreement that the name of the university can not be used in advertising, except with the consent of both university members of the board in each case; that the university will not be involved in the commercial part of the work, except as it is represented on the board of the holding company by the two members; that all developmental research shall be done by the holding company; and that the university shall retain all rights as to medical discoveries and shall derive no financial profit from such discoveries.

(4) There are a number of other provisions, including the control of advertising, stock sales, licensing, etc., all with a view to protection of the public as well as the good name of the university.

Under this form of organization the royalties are received by the university as dividends on its stock in the holding company. The patents are taken out by the workers in the laboratory, and then turned over to the university with the proviso that all the receipts go into scientific research, until this part of the university's function is adequately met. Any remaining funds may go to the general funds of the university, after certain other needs related to research have been provided.

Foremost among the studies that have resulted in this financial provision for future research is the work of Professor Sperti and his associates in the field of ultra-violet radiations. Germicidal and other effects of these rays occur, in many instances if not universally, at critical wave-lengths. It is possible by means of filters to use the radiations for one effect and to block out another effect if the critical points are not too close together. For example, an enzyme had been developed for use in bread-making. As commercially prepared, it produced a bread that decomposed within a short time after baking because moulds and bacteria found their way into the enzyme mixture as manufactured. To have sterilized by heat would have destroyed the enzyme, and to introduce an antiseptic strong enough to be effective was impossible in a product destined for food. The findings at Cincinnati had shown that many enzymes were inactivated at a critical wave-length far enough removed from the wave-length at which bacteria were destroyed so that proper filtration gave destruction of the bacteria without injury to the enzyme. The mixture as thus sterilized produces large loaves of fine texture which can be kept in good condition for long periods. There are so many other applications that one of the largest corporations in the country has become a party to the agreement described in preceding paragraphs of this article. By this means the laboratory in which these facts were established should obtain funds for its continued and independent existence.

If an increasing number of research laboratories can thus be established and "live by their findings," such a development will be one of social as well as scientific importance. Great corporations maintain research laboratories, because in the long run both laboratory and corporation live by new discoveries or by more precise applications of old ones as determined by research. In the situation proposed, workers in pure science would themselves develop industrial applications in order that basic research might obtain adequate financial support and thus live by its findings. If self-maintaining relationships like the one just initiated at the University of Cincinnati could be widely established under the control of scientists, the method would be superior to the existing condition by which basic research is supported inadequately and in haphazard fashion through private philanthropy or as a "noble charity" by industrial organizations.

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THE SUPERVISION OF STUDENT RESEARCH

THE practice of having the student who is engaged in experimental research submit weekly written reports of progress has so many advantages that one wonders why it has not come into more general use. Because research is usually costly, there exists the

pernicious, and false, idea that it must be inefficient *per se* and that an almost wanton extravagance in the use of time and of materials may be justified, or even necessary, for the accomplishment of results. There are many who know, however, that it is quite possible to teach the beginner in research how to be economical with his time and materials and how to work systematically and speedily toward definite objectives, so that he may obtain, in the most efficient manner, the best results that his abilities will permit. By this, I do not mean to imply that research can be reduced entirely to formulas, any more than can any other kind of creative work.

It is my experience that the written progress-report, when used as a complement to the personal conference, is a most effective means of promoting such efficiency. The student must of course be made to see very clearly that these reports are only a means toward an end in his research and that they are not, for example, intended to be a check on the number of hours that he spends each week on his work. Their purpose is to encourage systematic planning of work and frequent estimates of progress and to afford the student the opportunity of laying his case, so to speak, before the director of his research at least once every week. There is a great advantage in having the student begin to make his reports as soon as he has selected his problem; these initial reports, which must necessarily deal mostly with the preparatory reading, provide definite objectives toward which he can work from the very start, something which the beginner often lacks in the early stages of his problem.

The form of report that follows has proved itself suitable for experimental physics; the numerals in parentheses indicate the number of blank spaces allowed for each item:

Weekly Report of Research Progress

Name ..... Date .....

General problem: .....

1. Particular work in which now engaged: (4)
2. Progress during the past week: (8)
3. Specific difficulties encountered: (10)
4. Approximate date of completion of this particular work: (2)
5. Next specific project probably to be undertaken: (6)
6. Unavailable apparatus and supplies needed for this new work: (8)
7. Bibliography of the week,
   (a) Publications found: (8)
   (b) Publications read: (Use reverse side for titles and for points involved in these papers which need discussion in conference.)

The reasons for including these various items in the report are too obvious to require much comment. The fifth item is perhaps the most important of all. The usefulness of the sixth will be apparent to any one who has experienced the aggravating delay involved in obtaining equipment that is not already in stock. The last two items serve as weekly reminders to the student to be constantly on the watch for new papers having a bearing on his problem and to read continually. In this connection, it is worthy of remark that a certain foreign-trained physicist whose opinion is to be respected and who has a high regard for the state of experimental physics in this country deplores the waste of time and money which results from the failure of many American-trained physicists to study thoroughly the literature dealing with their problems.

It must be emphasized that these written reports are not intended to supplant the personal conferences which the supervisor must have with his students. In a sense, they are to be regarded as a preparation for the conferences. Through the medium of the report the supervisor has advance knowledge of the specific difficulties confronting the student, and it sometimes happens that the student himself will arrive at a solution of these difficulties, simply because the written report has forced him to define and clarify them.

If there is a single disadvantage in using such a system of reports it has not yet become apparent. Seven students are at present using this method under my direction; four of them are graduate students working independently, two are graduate students working as apprentices to more experienced students, and one is an undergraduate. All of them have reacted favorably to the plan and have recognized its advantages. The research supervisor who has not as yet used this or a similar method would do well to consider it, especially if he is attempting to direct the research of several students while engaged in other teaching and in his own research.

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VITAMIN A AND THE IODIN-FAT BALANCE[1]

So many papers have been published within the past two years regarding the rôle of carotene as a precursor of Vitamin A that it may not be out of place to call attention to the fact that carotene is a highly unsaturated hydrocarbon ($C_{40}H_{56}$), and that it is commonly administered in combination with arachis (peanut) oil which has an iodin value ranging from 83.0 to 100.0 and which contains the unsaturated linoleic and oleic acids, together with several of the saturated acids. While the manner in which carotene may behave has not been clearly demonstrated, it is the belief of the writer that its significance in

[1] From the Laboratories of West Virginia University, Morgantown, West Virginia. Aided by a grant from the National Research Council.