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.

the formation of Vitamin A in the animal depends in large part upon:

(a) The rôle of the unsaturated hydrocarbon carotene and the associated fatty acids found in arachis oil in restoring the fat-iodin balance in animals, fat depleted by Vitamin A deficiency diet.

(b) Its action in restoring the desaturating power of the liver.

From a series of studies with ferrous iodide carried on since 1925 we have come to the conclusion that there are two factors in recovery from Vitamin A deficiency, one, effective in curing *xerophthalmia,* and *otitis media,* and in awakening the dormant thyroid; the other belonging to unsaturated fats and hydrocarbons, aiding to restore the iodin-fat balance and facilitating growth.

As reported at the Cleveland meetings of the American Association for the Advancement of Science (1930) we find that linoleic acid is extremely effective when combined with the ferrous iodide. Studies during the past winter and now in progress indicate that ferrous iodide and linoleic acid will act more favorably on rats, profoundly depleted of Vitamin A, than cod liver oil.

That ferrous iodide alone should prove beneficial in Vitamin A deficiency, accompanied by certain symptoms of thyroid disturbance is probably due to the iodin action on keratinized tissues and the withdrawal of stored fats from the animal. The dormant thyroids of animals that have received a fat-free diet for some time are apparently stimulated by the ferrous iodide, and the addition of unsaturated fats aids in restoring the balance. Further details regarding the experiments now in progress will be published soon, with the names of our laboratory assistants (Chidester, Bourne and Wiles).

For a long time it has been known that while Vitamin E is essential for reproduction, it is no more so than Vitamin A. Evans and Burr (1925) have stressed the fact that Vitamin E is concentrated in the seeds and embryos of certain plants as well as in egg yolk. The fact that in experimental studies that we are now carrying on, we have noted gonadal development in animals thoroughly depleted of Vitamin A and then furnished linoleic acid and extremely small quantities of ferrous iodide is, we believe, rather significant. Schmidt (1891) and also Miller (1910) and Ivanow (1912) have shown that the *iodin* numbers of the *unsaturated acids* and oils of various seeds decrease during germination. Numerous investigators have demonstrated that either an excess of iodin or an excess of fat will induce sterility in experimental animals. We contend that iodin-fat imbalance is a most fundamental one in deficiencies in fat soluble Vitamins A and E.

F. E. CHIDESTER

## THE FEEDING HABITS OF THE FIRST INSTAR LARVAE OF THE CLUSTER FLY

FIRST instar larvae of the cluster fly, *Pollenia rudis* (Fab.), have been observed in the laboratory feeding upon the earthworm *Allolobophora caliginosa* (Sav.). Former records indicate only *Allolobophora chlorotica* (Sav.) and *Eisenia rosea* (Sav.) as hosts to this parasite.

Former investigators have not observed the entrance of the first instar larvae into the body of the earthworm. Keilin (1915) suggested that the larvae probably enter by means of the genital pores while the worms are in copula.

First instar larvae have now been observed by the author to enter directly through the cuticula. They have been observed in various stages of entrance, from the time when only the mouth parts were imbedded in the cuticula until only the posterior spiracles were exposed. First instar larvae apparently always feed with the spiracles exposed.

As many as five larvae have been observed feeding on one worm. They usually enter the anterior portion of the worm in the region from the tenth segment to a few segments posterior to the clitellum. All the larvae so far observed have entered the worm from the dorsal side. While the usual place of entrance seems to be the intersegmental furrows, the larvae have been observed entering through the thicker portions of a segment and also through the clitellum.

The earthworms were placed in a petri dish containing usually about thirty eggs of the dipterous parasite. The worms were introduced as the larvae began to emerge from the eggs. Parasitism usually occurred about two days later.

Mrs. Grace Pickford Hutchinson, of Osborn Zoological Laboratory, Yale University, very kindly identified the earthworms as *A. caliginosa* (Sav.).

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## BRANCHINECTA COLORADENSIS IN COLORADO

IN the February 27 and September 11, 1931, issues of SCIENCE there was a discussion as to means of dispersal of the fairy shrimp, *Branchinecta coloradensis.* In the latter article it is also recorded from a hollow in a boulder at the elevation of 8,000 feet near Estes Park. In Ward and Whipple it is recorded as an alpine species. Dodds, in his "A Key to the Entomostraca of Colorado," gives its distribution as alpine, but with one record from St. Vrain at an elevation of 5,100 feet.

My own experience shows that it is not nearly so strictly alpine as has been supposed. I have collected