

UNIVERSITY OF CALIFORNIA

DEPARTMENT OF ZOOLOGY  
BERKELEY 4, CALIFORNIA

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Dr. Viktor Hamburger  
Department of Zoology  
Washington University  
St. Louis, Mo.

Dear Dr. Hamburger:

I have been thinking a great deal about the work I want to do as an embryologist these next ten or fifteen years, and I have tried to approach the problem from only one point of view, i.e., where can the time and energy and enthusiasm of my youth be spent with the best returns in the advancement of embryology. I am faced with one of two choices: 1. I can immediately specialize, restrict myself to some relatively limited problem such as the development of pigment patterns on which I am now working; although I know I can contribute several papers in this field, I feel that this will be no great contribution to the advancement of embryology as a field of science. Nevertheless, this seems to be the direction taken by most young ph. D.'s. 2. Or, I can do just the opposite. Instead of spending all of my time in the laboratory working on some minute phase of the total embryological process, I can spend the same time with the literature, digesting it carefully and emerging with a salient picture of development as we now understand it at this moment. I have an almost unlimited curiosity to know all that is known about the embryological development of all animals. I have been much interested in human embryology and have built my premedical course around this interest. To give me a better appreciation of human development, I am now taking the medical course in gross anatomy, particularly because the man in charge, Dr. Saunders, places such emphasis on human development. I have also read widely in the field of general vertebrate embryology. In both of these fields, however, there seem to be plenty of workers and the texts are sufficient at present to introduce the student who would specialize to the problems and possibilities of research in this field.

However, in order to have a really comprehensive picture of development, I feel I must know what is known of invertebrate embryology as well, and here there is a different situation. There are almost no workers in this field at present, and especially there is no adequate source book where an interested student can find what we have accomplished in this field to date. This field is at a standstill, and, as we have discussed before, our function at Woods Hole should be to revitalize this field as a promising field of research. Surely if M.B.L. does not do this, it will not be done elsewhere for many years after the war. However, I do not feel that we can do this very successfully until someone with a good background in vertebrate embryology goes to work methodically to digest the widespread literature of invertebrate embryology and incorporates his information into a sort of guide book of invertebrate embryology.

Such a guide book should include at least the following points, and at the outset, I would restrict the contents to include only the embryology of marine invertebrates, and would exclude Protozoa.

1. There should be a chapter for each group of marine invertebrates.
2. The first part of each chapter should give
  - a. a description of normal development, written in the most readable manner possible, trying to present completely the descriptive embryology of that group of invertebrates insofar as we know it to date. It is my feeling that this description should be in such a form that it can readily be grasped and appreciated by junior and senior zoology students of colleges and universities. In order to do this, it must be
  - b. adequately illustrated. This is not true of the books now available. I feel that insofar as possible the illustrations should be from the fauna of our own seashores, because I feel that one of the problems in reading the present texts is our lack of familiarity with the European forms used as examples. I think it might be well to use many original illustrations drawn from materials available at Woods Hole.
  - c. This section should also indicate where additional work in straight descriptive embryology needs to be done to give us a more complete picture of the development of this group of marine invertebrates.
3. A second part of each chapter should bring together the experimental methods used to study this particular group of marine invertebrates, and the ways in which the results of such experiments augment the descriptive material to give a more complete picture of development should be emphasized. Insofar as possible needed experimental work should be pointed out, constantly trying to emphasize the types of embryological problems best approached with this particular group of animals as material.
4. A third part of each chapter should cover methods for handling this particular group of animals, and particularly at what laboratories they can be studied most successfully.
5. The entire book must be thoroughly documented to serve as a guide to the literature of the embryology of marine invertebrates.
6. Throughout the book an attempt should be made to emphasize the contributions already made by the Marine Biological Laboratory to this field of study.

A question arises as to how such a book could be used, and by whom.

1. By students in embryology at M.B.L.
  - a. Our emphasis there is to examine the living material, and such a book might cause the students to study the book instead, but I think not. No book can surely distract from the fascinating living forms available at Woods Hole. Moreover, if written properly, such a book could be a stimulus to the student to check, point by point, the descriptions given in the text with the development of the animal before his eyes. It would serve to emphasize the more striking features of development which must be seen. I do not believe it would introduce too much "bookery" into the course.
  - b. It would show the students how very much remains undone in this field, which is one of the major purposes of the course.
2. By staff members of the course. Such a book would perhaps point out other embryological material, at present unused in the course, which could be used with even greater success. It would surely list many experiments that could be repeated with value in the experimental

part of the course. Its list of methods would assist greatly in starting a student to work with a special group of animals not especially familiar to the instructor. It would be extremely useful for training assistants and new instructors for the staff, because it would orient them much more quickly in the tremendous literature and would especially serve to give the research of these instructors a definite and useful direction almost from their first connections with the course, instead of having to stumble blindly for some problem, perhaps not too significant. Moreover, it would give the instructor a chance to know more than the one or two groups of invertebrates whose embryology he is teaching.

3. M.B.L. in general. Much of the work there, physiological and otherwise, is carried out with invertebrate embryos, and often the men working with given embryos are not too familiar with the straight embryology of their material. Such a source book would surely prove useful to them.
4. By courses in universities. Certainly a course in invertebrate embryology is not amiss, especially on the graduate level of universities, and a suitable text, if it were available, especially if it used as examples materials available from our biological supply houses, would surely stimulate the organization of such courses and would lead eventually to more students interested in research in invertebrate embryology.

Perhaps such a book is in the process of writing by someone. Perhaps you have planned such a book, because certainly the outline given above is built largely on your plans for the course. At any rate, now seems the ideal time to write such a book, and if one is not under consideration elsewhere, I would like to write it. I feel in a position to do so for a number of reasons. 1. I have a tremendous interest in the field and by such a study could become almost the authority in this field. 2. I am young, 28, and although such a book will require many years for its completion, I should be able to finish it while still reasonably young and still in a position to use that information personally to guide my own research and that of any graduate students. If I can maintain connections with the embryology course at Woods Hole, my own interests may stimulate some of the students there to continue to advanced degrees with me in this type of work. We have a salt water system here which can be put into a workable condition after the war, and we are close enough to the west coast marine laboratories to get materials for year-round work. 3. There is an excellent library here adequate for much of the reading I will have to do. 4. I believe the staff here would appreciate the need for work of this sort and would appreciate that my contribution through such a text would be much greater than through a number of isolated publications which might come out much earlier. I do not believe my advancement here would suffer if I give my full concentration to such a project. 5. One of the men on the staff, Dr. S. F. Light, is mainly interested in invertebrate zoology, and could be very helpful. He gives excellent graduate courses in this field. 6. My entire teaching time here will soon be in embryology. Instead of teaching comparative anatomy, I am to give part of experimental morphogenesis, in cooperation with Dr. Eakin. Instead of giving micro-technique, I am soon to give a course here in invertebrate embryology. Consequently all of my thinking can then be directed into this one field and all that I learn will likewise improve my teaching assignments here. 7. I will be a more efficient and better satisfied worker if I have such a long range program and if I know it will result in a useful contribution eventually.

I think I realize what a tremendous undertaking this will be, but I feel that I can carry it through to completion over a period of years. Evelyn, my wife, is very capable, and will be a great help to me. I would greatly appreciate any time you could give to considering these suggestions, and I would very much welcome your reactions and comments.

I am still planning to come East this summer. I hope I can arrange things so I can spend the entire summer at Woods Hole. However, the financial situation will no doubt be complicated. My wife has been ill and is now with her parents and mine in the middle west. The length of time I will be able to spend in Woods Hole will depend largely upon her improvement. That boy of ours is perfection itself! If this book proposal meets with favor from you, I would like to spend much time in the invertebrate course this next summer getting much more familiar with the Woods Hole fauna and studying mostly the reproductive systems.

A merry Christmas to you and your family from all three of us. I am enjoying every minute of my work out here and only regret that days are so short and energy so limited, even in this age of vitamins! Many thanks for the recent reprints you sent.

Sincerely,

*Ray L. Watterson*  
Ray L. Watterson

*Korschelt.  
Small book outline for W. H.*

*W. H. financial situation*