months of each winter in Victoria playing eighteen holes of golf every day, and the summers at Salmon Arm or on Shuswap Lake at Celista. In November 1962 he wrote saying that he felt extremely fit but a month later he died suddenly from a heart attack within sight of his house as he was walking home from Salmon Arm—just as he always said he wanted to go. He was buried 21 December 1962 in a peaceful little cemetery in the woods below Mt. Ida, near Salmon Arm.

He is survived by one sister and two nieces to whom are willed his house just outside Salmon Arm and his hillside property at Celista; his books were donated to men friends and to the Library in Salmon Arm and his splendid collection of mounted game heads and skins, to a museum to be founded in Salmon Arm, together with two other collections.

—G. J. SPENCER

BOOK REVIEW

Wasp Farm. H. S. Evans, New York, Natural History Press, 1963. Pp viii and 178. $4.75.

If there were more books like this there would be more entomologists, for biology is contagious when it is presented by an enthusiast like Dr. Evans. Despite the title the book is entirely on wasps: spider, digger, mud, sand, and social wasps. The farm, an agriculturally unproductive 8 acres in upstate New York, was kept as a sort of insect refuge and is really only the point of departure.

Probably none of the information is appearing for the first time. It is compiled from the immense literature and largely from the experience of the author and his students, as presented in scientific journals and in publications such as Natural History and Nature Magazine. The level of writing falls somewhere between these types. It is lucid, factual, unsentimental, non-technical, graced with a deft use of words, and tailored for swift, effortless reading.

Dr. Evans (b. 1919) earned his Ph.D. in Insect Taxonomy at Cornell University, and is currently Associate Curator of Insects at the Museum of Comparative Zoology at Harvard University. He is thus a taxonomist *par excellence* and also a student of live insects. All taxonomists should follow suit.

He does not experiment with wasps, believing that experiments often merely pose situations which wasps never encounter in nature. ". . . the urgent need is to know precisely what wasps and other creatures do . . . until our understanding of animal behavior is on a very much higher plane than it is now . . ."

In discussing the *Ammophila,* wasps that use tools to close their nest holes, much of his own observation is used to give a reasonable slant to the much-discussed problem of instinct, intelligence, and behavior patterns. He puts the matter neatly in describing a spider-hunting *Priocnemis,* which emerges from pupation "ready to enact a script which is already largely codified in its nervous system". And again in outlining the vestigial instinctive behavior of *Microbembix,* which goes through the motion of stinging the dead, dried insect detritus with which it stocks its nest. This is a recent development from *Bembix.* In fact, the evolutionary history and arrangement of the

groups are traced clearly for laymen, to whom the connection between evolution and taxonomy may well be new.

This is a tidy book. The loose ends are pulled together: nesting habits, types and numbers of prey, anatomy of the larvae, methods of stinging and carrying prey, are all discussed and arranged in tentative order of complexity, efficiency and development, and with no hint of anthropomorphism. Even the scanty fossil record is brought in and the author traces tne relationships of wasps with other Hymenoptera and other orders.

Physically this is a neat little hard covered book, well presented and organized. The paper, type, and 16 text figures are good, as they should be at the price. There are 25 photographs by the author, with captions, but no reference to them in the text. At the end of each of the 15 chapters is a bibliography of significant papers and some general texts. At the ends of 12 chapters are listed the species described (50 in all), with Latin or Greek roots translated and the pronunciation indicated. Proper names are used throughout but not italicised. The book is a natural for the paperback trade.

—*H. R. MacCarthy*

BOOK REVIEW

The Insect Factor in Wood Decay, by Norman E. Hickin. London. Hutchinson & Co. Ltd. 1963. Pp. 336, illus., 2 colored plates. £2 10s.

The author regards conservation of building timber *in situ* as an important new technology that becomes more so as we use up forests and demand longer service from wood already in use. For pest control operators, inspectors, builders, lumberyard operators, and those in related work, he has produced a valuable reference book. It is clearly written and very well illustrated with numerous line drawings, some photographs and a spectacular colored fold-out plate of 9 longicorns. There is an adequate index. The high quality, paper, printing, and illustrations may account for the price.

There is one irritating feature: certain references, cited normally in the text by author and date, are omitted from the list at the end of each chapter. In a book so carefully written the omissions are probably deliberate, but they are not explained and they are disconcerting. In 33 pages of chapter III alone there are 9.

The book is written with special reference to Great Britain and the insects concerned are covered very thoroughly and mostly keyed. The coverage of *Anobium punctatum* de Geer and *Xestobium rufovillosum* de Geer is particularly detailed, since these anobiids are the most economically important insects in the field. The groups dealt with are: Anobiidae, Lyctidae, Bostrichidae, Buprestidae, Lymexilidae, Cossoninae, Cerambycidae, Scolytidae, the ambrosia beetles, termites, and wood-boring wasps and moths. Other chapters deal with the nature of wood, direct factors causing decay, the importance of the various wood-boring insects, and research on wood preservation.

—*Peter Zuk*

BOOK REVIEW

Research Problems in Biology: Investigations for Students. Series 1 and 2. American Institute of Biological Sciences. New York, Doubleday & Co., Inc., 1963. Pp xxxii and 232; xxviii and 240. 95c each.

Regular readers of *Science* and the *AIBS Bulletin* during the last 5 years have observed with interest as tangible results came out of the Biological Sciences Curriculum Study, whose activities and meetings have been regularly reported. These two paper backed books are the most recent results. The Study has been supported by the National Science Foundation.

The books have three identical sections. Dr. Bentley Glass, Chairman of the BSCS, and Dr. A. B. Grobman, Director, each contribute a single page, and Dr. P. F. Brandwein, Chairman of the Gifted Student Committee, contributes four. These are aimed at high school students. The tables of contents and lists of contents by subject categories, confirm that these books are indeed addressed to gifted students, preferably having gifted teachers. The scope of the books is shown by two tables adapted from the indexes. The first gives the numbers of experiments in each area of research:

	Series I	Series II
Animal Behavior	4	5
" Physiology	5	6
Ecology	4	6
Genetics	5	4
Growth, Form and Development	7	6
Microbiology	6	6
Plant Physiology	9	7

The second table gives the numbers of experiments in which various organisms are used:

	Series I	Series II
Protozoa	5	3
Euglena and **Tetrahymena**		1
Volvox		1
Hydra	1	
Worms	1	2
Insects		3
Ants	1	
Aphids	1	
Beetles		1
Damselfly		1
Fruit flies	2	1
Houseflies	1	
Tent caterpillars		1
Termites	2	
Spiders		1
Amphibians and Reptiles		1
Frogs	4	1
Salamanders		1
Fishes	2	
Birds	2	1
Birds' eggs		1
Bacteria and Virus	3	7
Fungi and Mold	3	1
Moss	1	
Pollen		1
Flowering Plants	8	11
Seeds and Seedlings	4	4

The authors originate as follows: State and other colleges and universities, 55; U.S. Government and State institutions, 7; industry, 5; private addresses, 5; high schools, 4; and research foundations and laboratories, 4. In outlining their experiments they follow no hard and fast format, but most of them use some of the following subheads: Background, Suggested Problem, Suggested Approach, Possible Pitfalls, Procedure, Precautions, Special Considerations, and References, general and specific. The latter are commendably up-to-date. The titles of the experiments invite comment, but space will not allow mention of more than a few examples in which insects are featured.

The experiment on aphids is by Gert B. Orlob, currently at South Dakota State College, entitled, Can

Aphids Find Their Host Plants. This is one of the simpler examples but is typical. A good background section of three paragraphs precedes a clear statement of the problem: Is there any food-finding mechanism operating in apterous aphids by which they become aware of the host plant before taste stimuli have been received? Then follow suggestions: use a host and a non-host plant, a paper or plastic dummy plant, sticks or wires, singly or in groups; release aphids into equidistant rings around the plant or object. Pre-experimental treatment can be varied, as by starvation. If a mechanism exists it should become apparent if 40-50 aphids are used singly. Use monophagous species at first. The tests must be run under uniform light intensity, the aphids must be of the same age, and so on. All quite obvious perhaps, but sound advice to a teenage learner. Orlob offers encouragement by pointing out that the only equipment needed is a 10X hand lens, and that aphids are not difficult to rear. The six references are well chosen.

The two examples using termites would need more patience. The Association of Subterranean Termites and Fungi: Mutual or Environmental, by A. E. Lund (Koppers Co., Verona, Penna.), involves petri dishes containing sterile nutrient agar, inoculated with wood destroying fungi, later to be occupied by termites, both in various combinations. A further study could be on the relationship between termites and fungi with the symbiotic protozoa in the termites' gut. There is a good deal of room for error and contamination here. The Problem of Castes and Caste Determination in Termites, by E. M. Miller (University of Miami, Coral Gables, Fla.), might take up to three years. Colonies should be established in jars with disproportionate numbers of soldiers, workers, nymphs or reproductives. Communication by Trail Laying in Ants, by E. O. Wilson (Harvard University), moves from setting up colonies and simple observations, through dissection of the abdominal glands producing pheromones, to imaginative behavioral studies with artificial trails.

A good contribution is Genetic Aspects of Competition Between Species, by A. C. Bartlett (U.S.D.A., State College, Mass.), who revives the classic problem of analyzing the factors that determine competitive ability in two species of *Tribolium*. A more original problem is to sort out the factors influencing the Rate of Heartbeat in Nymphs of Damselflies, by L. Bush (Drew University, Madison, N.J.). A genetic approach is advocated in the Population Dynamics of Tent Caterpillars, by W. R. Henson (Yale University). Using Wellington's classification of larvae he suggests establishing colonies comprising various proportions of each type of larvae, and mating adults of maximum and minimum vigor.

The important thing in these two books is the fresh approach to teaching high school biology, in which the student is given an investigative, experimental attitude and is expected to acquire background for himself from standard texts as a supplement and a means to an end. Lists of general references and periodicals are given for each area of research.

This reviewer's impression is that if more than a few per cent of high school students are capable of attempting these experiments and carrying them to successful conclusions, there must be less wrong with the education system than we had realized.

—*H. R. MacCarthy*

Printed by The Vernon News