

by such gradual changes that a conservative public may not be offended. In the present instance the author's zeal does not seem to have led him to the point of giving offense, even though he may have laid himself open to the charge of inconsistency.

The book is comparatively free from minor errors or infelicities. On page 90, the skin of the earthworm is said to consist of three layers, the cuticle and epidermis, no mention being made of the derma. The coelomic epithelium is omitted in the enumeration of the coats of the body wall. The description of the papulæ of the starfish as 'holes thru the aboral wall from which extend slender projections of the thin, soft lining membrane of the body cavity' needs considerable revision. The term 'digestive tube' is used when the cavity of the digestive tube, not its walls, is meant. The statement that in the echinoderms the digestive tube is 'distinct from the body cavity' is not very illuminating as it stands.

The illustrations are mostly well chosen, and about forty of them are original. It is unfortunate that greater care was not given to matters of detail in some of the original diagrams; thus the oviducts in the snake and the oviduct in the pigeon are each incorrectly represented as opening in front directly into the cavity of the ovary.

The capital press work of the descriptive part contributes in no small degree to the general excellence of the book.

Part II., on 'Practical Zoology,' is a great improvement over the original laboratory guide with which teachers in secondary schools are familiar. Full directions are given for the observation of living animals in the field and in captivity.

This part, however, might be made much stronger in respect to its teaching of morphology, without greatly increasing its size. For example, the attention of the student is not called to the coelom of the earthworm either in connection with the dissection or in the study of the cross-section; and the term body-cavity is used loosely to apply to the enteric cavity in *Hydra* and to the coelom in verte-

brates. The directions for the study of the brain, particularly that of the rabbit, are exceedingly inadequate. We are told that the optic nerves 'directly enter the cerebrum'; and both diencephalon and midbrain are ignored. While this is in line with the popular notion that the brain consists of only two parts, it is not the sort of teaching that ought to find place even in a very elementary text-book. This part is remarkably free, however, from positive errors, and can be heartily recommended as a laboratory guide for secondary schools; the descriptive part is an elementary text-book of unusual merit.

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DISCUSSION AND CORRESPONDENCE.

METEOROLOGICAL OBSERVATIONS WITH KITES AT SEA.

TO THE EDITOR OF SCIENCE: Under the titles 'A New Field for Kites in Meteorology' and the above there were described in Vol. XIV. of SCIENCE experiments by the writer and his assistants of flying kites in calm weather from a tug-boat and from a transatlantic steamship. The demonstration that meteorological observations might be obtained at high altitudes, independently of the natural wind, over the greater portion of the globe and where no observations had been possible before, attracted the immediate attention of European meteorologists. The following brief accounts show that their application of this new method of meteorological research has been both extensive and successful.

The first to repeat the pioneer experiments of the late Mr. Sweetland and the writer during their voyage across the North Atlantic in 1901 were Messrs. Berson and Elias, of the Prussian Meteorological Institute, who, last August, made a voyage from Germany to Spitzbergen and back, achieving satisfactory results with their kites. Meanwhile Professor Köppen, of the Deutsche Seewarte, carried out analogous experiments on the Baltic Sea. About the same time, Mr. Dines, aided by grants from the Royal Meteorological Society and the British Association, employed

a small steamer for kite-flying off the west coast of Scotland, in connection with a fixed station on land. The vessel could be maneuvered at will, as in the writer's initial experiment in Massachusetts Bay, and the results published show that 38 records of the various elements were obtained at an average height of 6,000 feet, and that once an altitude of nearly 15,000 feet was reached, although, in this case, the upper kites and the recording instrument were lost, owing to breakage of the wire.

It is probably known to many of your readers that at several stations in Europe, and on Blue Hill in this country, balloon ascensions or kite-flights are made upon a specified day every month, in order to obtain meteorological data in the upper atmosphere simultaneously over a large region. In order to be independent of the natural wind, which is frequently unsuited to kite-flying, and to accelerate or diminish it as required, meteorological kites have recently been flown from steamboats on Lake Constance by Count von Zeppelin and Professor Hergesell on some of these term-days. Similar experiments upon the smaller lakes of Prussia and Russia have also shown that kites may be rendered nearly independent of the wind even in the interior of the continents.

A most remarkable campaign has been conducted by M. Teisserenc de Bort, who, with the aid of Scandinavian colleagues, established last summer a kite-flying station in Jutland, Denmark, where aerial soundings were made day and night, wind permitting, during nine months. After the termination of this work the apparatus was transferred to a Danish gunboat, and on a cruise in the Baltic Sea the following extraordinary results, which have just been communicated by the director, were obtained on five consecutive days: April 22, at an altitude of 9,450 feet a temperature of $-14.^{\circ}8$ F. was found; April 23, at 13,500 feet, the temperature was $9.^{\circ}1$; April 24, at 4,660 feet, $38.^{\circ}3$. On April 25, an altitude of 19,360 feet, which is probably the greatest height ever reached by a kite, was exceeded, and an instrument on

the lower portion of the wire, at a height of 7,415 feet, recorded $24.^{\circ}4$. In this flight the total length of the wire was 38,000 feet, and the upper 4,000 feet, with the highest registering instrument, broke away, but were recovered. On the morning of April 26 an altitude of 8,140 feet, with a temperature of $15.^{\circ}2$, was obtained and in the afternoon 13,320 feet with a temperature of $3.^{\circ}2$. Since the gunboat steamed only nine and a half knots, the kites could not be flown when there was a complete absence of wind.

These various experiments amply prove the practicability of the writer's project to investigate the atmospheric strata lying above the doldrums and trade-winds, by means of kites flown from a specially chartered steamship. This plan, which was outlined in *SCIENCE*, received the approval of the International Aeronautical Congress at Berlin last year, and an application for a grant to aid its execution is now before the trustees of the Carnegie Institution. Although the German, British and Scottish antarctic expeditions were equipped with meteorological kites, the reports received confirm the prediction of the writer that little use would be made of them during the voyages southward. On the vessel which the Baltimore Geographical Society sent last month to the Bahamas, Dr. Fassig, of the Weather Bureau, expected to fly kites, but, owing to the substitution of a schooner for a steamer, this could not well be done and, therefore, the kites were probably flown only at Nassau. It is to be hoped that Dr. Fassig has obtained observations of temperature and humidity in the trade-winds which, even if he did not succeed in getting through, owing to their becoming light above, will be of considerable value. These observations might serve as a starting point for the work of the expedition proposed by the writer, which would proceed across the equator and be capable of sounding the atmosphere to the height of four miles, notwithstanding the fact that winds either too light or too strong for the kites may be encountered when the steamer is stationary.

A. LAWRENCE ROTCH.

BLUE HILL METEOROLOGICAL OBSERVATORY,
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