justors (central nervous organs) and effectors (muscles or other organs that enable the animal to react on the environment). Of these, effectors alone are found in sponges. "They mark the beginnings of the neuromuscular mechanism in that they possess the original and most ancient of its constituents, muscle, around which the remainder of the system is supposed subsequently to have been evolved."

Two chapters are devoted to the sponges, a third to independent effectors in the higher animals, and a fourth to a sluggish type of non-nervous transmission (*neuroid*) that is exhibited by sponges, ctenophores and probably by the ordinary tissues of animals. These four chapters constitute the first of three sections concerned respectively with effector systems, receptor-effector systems, and central nervous organs.

Section two, comprising eight chapters, deals with the neuro-muscular structure of, and nervous transmission in, sea anemones, jellyfishes and hydroids; the nerve net, of which their nervous systems are in large part representative, and which reappears also in the higher animals, *e. g.*, in connection with the musculature of blood vessels and intestine; the diffuse transmission which characterizes the nerve net; and its relation to the appropriation of food and other complex responses.

The single chapter in section three discusses by way of conclusion the relations of the elementary nervous system to the central nervous system of the more complex animals, especially the evolution of that novel element in the system, the central organ or adjustor, which arises in the region between receptor and effector and out of that material which in the elementary system constitutes the nerve net.

General readers as well as special students of science may congratulate themselves on the publication of another book in the growing list by American authors that is making accessible to them in untechnical and attractive form the latest episodes in scientific progress, each with all the authority of a master in his chosen field.

Harry Beal Torrey

NOTES ON METEOROLOGY AND CLIMATOLOGY

METEOROLOGY AS A SUBJECT FOR STUDY

The great importance of weather in military operations[2] early made current European weather information a matter of military secrecy, and put a premium on meteorologists. The U. S. Signal Corps met the demand by training about 500 scientific and technical men in meteorology,[3] and the Naval Aviation Service trained about another 100.[4] Meteorology was also introduced in some institutions as part of the prescribed work of the S.A.T.C.,[5] but most of them had planned this work for the second or third term, and so failed to give it.

Thus at the end of the war, in spite of the stimulation, the amount of meteorological instruction given in the United States had changed but little from its pre-war status: in fact, the loss of instructors eliminated meteorology from the list of courses given at a number of institutions. A recent survey of the extent of instruction in meteorology in the colleges and universities of the United States, revealed only 70 (less than a sixth of the number reporting) in which any course in meteorology or climatology were given; though perhaps an additional third of the institutions of higher learning in the country touch on meteorology in more general courses.[6]

Nevertheless, the present demand for meteorological information, particularly for special aeronautical forecasts, is much greater than ever before; and the demand for more detailed forecasts and for longer range ones has become more insistent. Our institutions of higher learning are already beginning to appreciate

[2] See R. DeC. Ward's articles on the influence of weather on military operations: Bibliography in *Monthly Weather Review*, February, 1919, Vol. 47, pp. 84–85.

[3] See *Monthly Weather Review*, December, 1918, Vol. 46, pp. 560–562, and April, 1919, Vol. 47, pp. 210–225.

[4] *Ibid.*, April, 1919, Vol. 47, pp. 225–230.

[5] See the text-book written for this: "Introductory Meteorology," New Haven, 1918, 149 pp.

[6] For further details see *Monthly Weather Review*, March, 1919, Vol. 47, pp. 169–170.

the situation, and a number are planning new or extended courses. In aid of this encouraging tendency and to meet the demands for such information, the Weather Bureau has published a group of articles on "Meteorology as a subject for study." The titles and brief discussions of the contents of these articles follow:

In discussing, "How meteorological instruction may be furthered," Professor R. DeC. Ward of Harvard shows that the pressure of the students' desire for increased facilities for instruction in meteorology, and the enthusiasm of the instructor will probably be most effective in promoting meteorological training at each institution. The second paper is a rather detailed discussion of, "Collegiate instruction in meteorology," by C. F. Brooks, treating particularly of the methods used in the large classes at the Signal Corps school of meteorology at College Station, Texas. In the third article, Dr. O. L. Fassig has discussed the purpose, organization and results of this school. Following this, a group of the most important new meteorological books have been reviewed to aid the student or teacher in selecting such general publications as will be of most immediate use. Professor W. J. Humphreys' "Some recent contributions to the physics of the air," is an abbreviated edition of his vice-presidential address at the Baltimore meeting of the A.A.A.S.[7] It is introduced with the other papers here to indicate to some extent the present-day trend of meteorology.[8] Finally, to direct research to some of the most important problems now confronting meteorologists, a list of fifty subjects for research in meteorology have been compiled by the scientific staff of the central office of the Weather Bureau.

This group of papers, which was published in the December, 1918, *Monthly Weather Review* has been reprinted, and copies have been sent to several hundred colleges and universities. A limited number of other copies may be obtained on application to the chief of the Weather Bureau.

[7] Published in full in SCIENCE, February 14 and 21, 1919, pp. 155–163, 182–188.

[8] Annual reviews of the progress of meteorology and climatology in the United States are published in the "American Year Book."

THE MILD WINTER OF 1918–1919

In the eastern United States, and over most of the Missouri Valley the past winter was so extraordinarily open in contrast to the winter of 1917–1918, that a Detroit newspaper was led to say we had both winters together in that cold one. Except in the south, the mean temperatures of last December and January were generally 15°F. higher than during the same period a year before. The snowfall was practically negligible as compared with the great accumulations of the previous "old-fashioned" winter. The accompanying table shows some of the marked contrasts in the weather at representative cities. Perhaps the most extreme reversal is shown by Cincinnati weather. There the mean temperature of December and January, 1917–1918, was 19.3° F., while that for December and January, 1918–1919, was 38.5° F., 19.2° F. higher. The snowfall in the two cold months was 36.5 in., but in December and January, last winter, only 1.2 in. Considering together the daily temperatures and snow on the ground, it seems evident that the heavy snow-cover of the cold months made them still colder than they otherwise would have been.[9]

The warm weather and lack of snowfall was a great economic advantage to the country, for transportation was practically unhindered: in striking contrast to the conditions a year earlier. The snowfall in New York City, 0.4 inch in December, 0.3 in January and 0.7 in February was so slight as not to require any expenditure for snow-removal—truly an extraordinary occurrence.[10]

[9] For detailed discussions of the meteorological conditions of the cold winter, see *The Geographical Review*, May, 1918, Vol. 5, pp. 405–414; SCIENCE, 1918, Vol. 47, pp. 565–566, and particularly the article by P. C. Day, on "The Cold Winter of 1917–18," in the *Monthly Weather Review*, December, 1918, Vol. 46, pp. 570–580, 4 figs., 24 charts.

[10] See article in *New York Times*, April 6, 1919, pt. 2, p. 2.

WINTERS OF 1917–1918 AND 1918–1919 COMPARED

	December						January						February					
	Mean Temp. °F.		Departure from Normal		Snowfall (Inches)		Mean Temp. °F.		Departure from Normal		Snowfall (Inches)		Mean Temp. °F.		Departure from Normal		Snowfall (Inches)	
	1917	1918	1917	1918	1917	1918	1918	1919	1918	1919	1918	1919	1918	1919	1918	1919	1918	1919
Boston	23.7	34.7	− 7.9	+3.1	7.0	8.4	21.0	33.2	− 6.0	+ 6.2	13.8	4.1	26.9	32.6	−1.1	+4.6	5.7	6.2
New York	25.0	39.0	− 9.4	+4.6	11.7	0.4	21.6	35.2	− 8.6	+ 5.0	13.6	0.3	29.6	34.7	−1.1	+4.0	3.5	0.7
Washington	27.9	41.6	− 8.2	+5.5	6.8	T.	23.7	38.1	− 9.2	+ 5.2	22.6	0.5	36.8	37.2	+2.3	+2.7	1.5	2.8
Atlanta	36.2	48.2	− 8.4	+3.6	4.9	T.	34.8	43.8	− 7.4	+ 1.6	2.9	0.3	50.8	44.4	+5.6	−0.8	0.0	0.1
Cincinnati	22.3	41.8	−12.1	+7.4	16.3	1.0	16.3	35.2	−14.0	+ 4.9	20.2	0.2	34.5	34.4	+2.1	+2.0	T.	0.4
Chicago	22.4	37.7	− 6.9	+8.4	9.0	8.6	13.3	31.0	−10.4	+ 7.3	42.5	2.0	27.2	30.5	+1.8	+5.1	8.4	6.6
St. Paul	10.1	28.7	− 9.2	+9.4	7.1	6.7	3.7	21.8	− 7.9	+10.2	8.1	6.2	17.4	17.0	+2.4	+2.0	5.0	14.8
St. Louis	26.8	43.0	− 8.7	+7.5	7.5	0.5	18.8	37.8	−12.2	+ 6.8	11.7	0.7	35.6	36.7	+2.1	+3.2	0.2	3.1
Kansas City	23.4	39.4	− 8.1	+7.9	5.3	16.4	17.4	34.4	− 8.8	+ 8.2	10.3	1.0	34.0	34.2	+4.1	+4.3	0.1	13.1
Helena	24.2	28.5	− 0.6	+3.7	31.2	0.6	21.0	32.4	+ 1.0	+12.4	13.4	1.4	23.7	20.4	+1.5	−1.8	5.2	12.5
Boise	43.2	29.6	+11.0	−2.6	T.	2.2	34.4	32.8	+ 5.1	+ 3.5	4.9	0.4	36.0	35.8	+2.2	+2.0	3.2	6.3
Santa Fe	38.2	27.0	+ 7.9	−3.3	0.7	14.4	26.2	24.4	− 2.3	− 4.1	22.7	1.7	35.8	27.2	+3.8	−4.8	1.7	7.6

The region west of the Rockies, which was so warm in the winter of 1917–1918, was generally unusually cold in December, 1918, and in much of Utah, northern Arizona and New Mexico, where the depth of snow was great, in January, and much of February, 1919, as well. Throughout the rest of the region, the past winter was not very unusual.

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SPECIAL ARTICLES

A POSSIBLE CASE OF INSTINCTIVE BEHAVIOR IN THE WHITE RAT

YERKES and Bloomfield[1] demonstrated that kittens instinctively kill mice but barely implied the instinctive behavior of the mice used. Berry[2] states that mice do not show any fear of cats. The following single observation seems to suggest that white rats do instinctively fear cats. An entirely accidental circumstance furnished a situation in which a young cat came into the presence of several cages of white rats. Although the cages were some feet above the cat, its behavior was quite comparable to that described by Yerkes and Bloomfield. In spite of the intensity of the olfactory stimulus in the room, the reaction of the cat did not take place until the visual stimulus was presented.[3] A periodic and almost spasmodic humping of the back and bristling hair, but entire lack of vocal sounds, were the prominent features. Several minutes produced no change in the situation save that the cat, although making no effort at all to reach the cages, became a little restless. When, however, the cat was placed upon a cage containing five white rats (female) about six months old, their behavior was very definite and specific. The cat responded to the new situation—being high in the air with unsafe footing—by paying no attention to the rats but rather evidencing some fear. The rats retreated to the rear of the cage uttering peculiar whines, and showing other evidences of fear. The cat was then removed and an effort made to feed the rats. A specific vocal sound made by the experimenter has always been sufficient to call the rats to the front of the cage where they are given small bits of cheese. This stimulus has been so grafted on to the feeding reactions that it invariably awakens the rats immediately from sleep, or calls the female from a litter, and, subsequent to the incident described, has repeatedly become prepotent over states of fear produced in other ways. Although over thirty-six hours

[1] "Do Kittens Instinctively Kill Mice?" *Psychol. Bull.*, 1910, 7, pp. 253–263.

[2] Berry, C. S., "An Experimental Study of Imitation in Cats," *J. of Comp. Neurol. and Psychol.*, 1908, 18, pp. 1–25. (Quoted by Yerkes and Bloomfield.)

[3] See Yerkes, *et al., op. cit.*, p. 262.