the trees within 20 miles south of Jackson. At 40 miles south of Jackson, the smaller trees were so loaded with ice that they were bent to the ground and many branches had been broken off. Ten miles farther south, at Rochester, N. H., there was no more ice on the trees nor snow or ice on the ground. This great difference in ice and snow covering was the result of a difference in temperature of not more than 5° (31° Jackson, 33°–40° Blue Hill).

In each of these three cases the daily weather maps showed an area of high pressure ("high") directly north of a low pressure area ("low"), both moving slowly eastward, each more or less in the way of the other because of the prevailing tendency of a "high" to move east-southeast and of a "low" to move east-northeast in these parts of the United States. These cyclones ("lows") were thus amply supplied with cold air in their northern quarters. The ice storms occurred in the region where the normal warm southerly winds on the east side of the cyclones overlapped the cold north and northeast winds on the northern side.

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A PHLEBOTOMUS THE PRACTICALLY CERTAIN CARRIER OF VERRUGA

Experiments on laboratory animals with bloodsucking arthropods, looking to the solution of the problem of verruga transmission, have been under way at Chosica, Peru, in charge of the writer, since May 15, 1913. A study of the bloodsuckers occurring in the verruga zones has been going on for a longer time. At first the writer strongly inclined to the theory of tick or other acarid transmission, but the trend of the investigation has been to make such transmission seem very improbable of late. No argasid ticks have been found to occur commonly on mammals in the verruga zones, and ixodid ticks will hardly explain the night infection. The experiments in feeding, biting and subcutaneous injection of animals with the bloodsucking Gamasid mites of the vizcacha, which seemed at first most promising, have so far entirely failed of result. A resurvey of the situation had therefore become necessary in order to start out on new lines.

Culicids, *Simulium,* Tabanids, *Stomoxys,* fleas, lice and bugs are all precluded either by their extended occurrence, by their dependence on man, or by their day-biting proclivities. The question of punkies and like small gnats remains. The writer's attention has recently been drawn to the possibilities of *Phlebotomus,* chiefly through the investigations recently published by Marett on the genus in the Maltese Islands. His results are most impressive and suggestive in this regard. The habits of the early stages and of the flies, as described by Marett, fit so well into the conditions obtaining in the verruga zones that the conclusion was irresistible that a *Phlebotomus* must be the carrier of verruga. Hitherto there has been no record of the occurrence of *Phlebotomus* in Peru, or anywhere in the Pacific coast region of South America.

Ceratopogon and other genera of Chironomidæ with mouth-parts more or less adapted for bloodsucking occur at night both in and out of the verruga zones. They were therefore contraindicated. Night collecting at Chosica, just below the limits of the verruga zone, has never disclosed *Phlebotomus,* and as these gnats are never seen under ordinary circumstances in the daytime the writer determined to investigate the verruga zone by night in order to demonstate if possible the existence of *Phlebotomus* therein. Accordingly he passed the night of June 25, 1913, at San Bartolomé in the verruga zone of the Rimac valley. The result was that, besides *Ceratopogon* and other Chironomids, several specimens of *Phlebotomus* were actually found. The natives call all nocturnal gnats *titira,* considering that most of them bite, but certain of the more intelligent distinguish the true *titira* as the *Phlebotomus* sp., stating that it has white wings.

The true explanation of the oft-repeated facts that verruga is confined to deep and narrow canyons, with much vegetation, heat and little or no ventilation, evidently lies here. The flies of *Phlebotomus* avoid wind, sun and full daylight. They appear only after sunset,

and only then in the absence of wind. They enter dwellings if not too brightly lighted, but are not natural frequenters of human habitations. They breed in caves, rock interstices, stone embankments, walls, even in excavated rock and earth materials. The verruga canyons contain ideal conditions for such breeding. They hide by day in similar places or in shelter of rank vegetation. Deep canyons, free from wind and dimly lighted, are especially adapted to them. Thick vegetation protects them from what wind there is by day or night. This explains the very peculiar restricted distribution of verruga both local and altitudinal. The flies suck the blood of almost any warm-blooded animal, and even that of lizards in at least one known case. Thus they are quite independent of man, and this accords with the verruga reservoir being located in the native fauna. The habits of *Phlebotomus* correspond throughout so minutely with the conditions of verruga and the verruga zones that the writer wishes to announce his entire confidence in the belief that the transmission experiments, now about to be initiated with these gnats on laboratory animals, will demonstrate their agency in the transmission of the disease.

CHARLES H. T. TOWNSEND

CHOSICA,
June 29, 1913

SCIENTIFIC BOOKS

Examination of Waters and Water Supplies. By JOHN C. THRESH. Second edition. Philadelphia, P. Blakiston's Son & Co. 1913. 644 pages; 36 plates; 16 illustrations in the text. Price $5.

This is a new edition of a book that is well known to American waterworks engineers. The author is one of the foremost water analysts in England and the book shows evidences that it is written by one who speaks with authority. It is needless to describe the book in detail.

Part I. relates to the examination of the sources from which water is derived. Part II. treats of the various methods of examining water and the interpretation of the results of such examinations. Part III. describes in more detail the analytical processes and methods of examination.

Most American readers will be particularly interested in the first three chapters that relate chiefly to ground water. The author describes numerous personal experiences in the detection of underground pollution, and an excellent description is given of the use of fluorescein, and other substances which may be detected either by sight or by smell, in tracing the course of water through the ground. From his experience he states that water which enters a dug well at a depth of six to twelve feet, depending upon the porosity of the soil, is usually efficiently filtered and purified. Water entering at a less depth is nearly always liable to be imperfectly purified and unsatisfactory in quality. The nearer the ground surface at which water can enter the greater the danger of pollution.

One statement of the author will strike most readers with surprise, namely, "Every known fact with reference to typhoid fever epidemics indicates that the typhoid bacillus alone is not the cause of disease, and it has long been suspected that some other organism either by itself or in conjunction with the typhoid bacillus was the cause." He then quotes from an article in the *Lancet* and describes a new anaerobic bacillus which has been found only in the feces of typhoid fever patients and which is agglutinated by their serum. It is a spore-bearing organism and is said to be capable of retaining its vitality for a very long period.

An interesting example of the growth of organisms in water mains is mentioned. A thirty-six-inch main at Hampton-on-Thames was recently taken up and found to contain fresh-water mollusks to such an extent that its bore was reduced to nine inches. It was estimated that ninety tons of mussels were removed from a quarter of a mile of this main.

Reference is made to the ill effect of the continued use of soft waters on the human system, and a method of artificially hardening water by the addition of calcium chloride and sodium bicarbonate is described.