Nägeli. He expressed his views in a powerful manner in his last writings—the physiological 'Notices'* published in 'Flora.' The manuscript found after his death, entitled 'The Principles of Vegetable Formation,' has been handed over to Professor Noll for publication.

This slight sketch can give but an inadequate idea of Sachs' life-work, with its abundant results as regards science; indeed, I can but liken what I have written to a man striking, one by one, a few strings of an instrument that has answered to the touch of some great musician.

One may well say with the Psalmist in speaking of his days:

"Yet is their strength but labor and sorrow."

Nevertheless his life has borne rich fruit; his name is forever bound up with the history of botany. He has enriched this science by the discovery of new and important facts and conceptions and by his unrivalled power of clear definition. In the nature of things it is impossible that all his theories should retain acceptance, but they have all profoundly influenced his contemporaries. There is no doubt that in any other calling Sachs would have risen to the first rank; eccentricities and narrow 'specializing' were alike repugnant to him. In the last years of his life he applied himself eagerly to paleontological and zoological studies. "I must be learning, always learning," he wrote in a letter. In spite of his incessant labors, he was one of the few men of the present day who possess the gift of letter-writing and withal a spirited style, clear and trenchant. And yet these letters, written during the last fifteen years of his life, form one long report of illness.

At last Death, who in the latter years had often drawn very near, took him gently by the hand and led him to his final rest.

K. Goebel.

* These will shortly appear as a separate publication.

THE BREEDING OF ANIMALS AT WOODS HOLL DURING THE MONTH OF APRIL, 1898.

The temperature of the water has remained above the average almost throughout the month. During the first week the thermometer registered 41 F. to 42 F.; during the last week, 45 F. to 46 F. The specific gravity has varied from 1.0231 to 1.0235. The weather has been generally cloudy and the temperature of the atmosphere low.

Vertebrates. — The winter flatfish, *P. americanus*, ceased spawning early in the month, and, though the height of the breeding season was in March, few of the young flatfish have been taken, even over the natural spawning grounds. Young sculpin (*A. æneus*) were very abundant in the tow, especially during the first of the month. On April 4th a very large number were captured, and many were taken on the 18th. On the 27th a few more were taken which apparently had just hatched. Small cod and pollock have been frequently captured, and the latter were more numerous than in March. The young of the sand-launce (*A. americanus*) have diminished in numbers but little since last month, though some have increased considerably in size. On the 17th an unusually large number were taken. The young of the fall herring (*A. harengus*), from three-fourths of an inch to three inches in length, have appeared in increasing numbers. A few specimens of *Ctenolabrus* were examined on April 19th, but the sexual glands, though quite large, were not nearly mature. *Petromyzon* has been taken in the fish traps, and may be seen frequently in the markets.

Crustacea.—The small species of *Gammarus*, abundant in the tow during March, are still breeding. Their appearance, from day to day, is uncertain. One day there may be only four or five in the net, and the next day hundreds may be captured. A

small species of *Mysis*, about one-half inch in length, has been abundant, and the brood-pouches have been filled with eggs or embryos. A larger species, bearing well developed embryos, was abundantly taken during the first two or three weeks. The red copepod, the favorite food of the young cod, sculpin and sand launce, has been present in great numbers. A few were caught at every haul of the skimming-net, and frequently great numbers were taken. Their sudden appearance and disappearance is very puzzling. Dr. Loeb has shown that in the aquaria they are positively or negatively heliotropic, according to the temperature, but I find that when first transferred from the surface-net into a dish a large minority become negatively heliotropic, though, of course, all are subjected to temperature of the ocean. Many other species of copepods were caught, though not in great abundance. Some were bearing eggs attached to the abdominal appendages. A small parasitic copepod is very frequently found attached to the young cod, sand launce and sculpin. Perhaps one-third of these fish are thus infested. The *isopod* (*Cirolana concharum*) was not breeding on April 26th, and the associated *amphipod* had apparently passed its breeding season. *Hippa* has not begun to lay, though the ovaries are full of large brilliantly-colored eggs. They have been found breeding in July.

Vermes.—No *Nereis virens* or *Nereis limbata* have been seen at the surface. *Autolytus*, with egg-clusters attached, were regularly taken in the tow, usually three or four at a time, during the earlier portions of the month. Later in the month only a few were noticed. An interesting species of *Syllis* has been taken from among the hydroids and algæ on several occasions. These annelids are in almost every case about to undergo fission. The new head is found in all stages of development in the midst of the trunk metameres. The eyes on the new head are large and brown, while those on the first segment are small and black. These annelids are full of mature eggs, which, in some instances at least, occupy the body-cavity both in front of and behind the new head. A light, cream-colored terebellid, full of eggs, has been taken from time to time, and was also taken during March. It is almost invariably present in clusters of the hydroid *Parypha*, along with one or two species of *Caprella*, *Eolis* and the little gasterpod *Astyris*. *Harmothoe* sp. has commonly been found under stones and among hydroids, laden with beautiful pink eggs, which show clearly through the body-wall. On April 11th the eggs, teased from the body cavity, were easily fertilized, and in less than two hours some had reached the eight-cell stage; specimens taken April 17th were also full of eggs. The common *Lepidonotus* has been laying during the last two weeks. *Cirratulus grandis*, collected at Ram Island, April 9th, and at Pine Island, April 17th, contained great numbers of eggs, apparently nearly ripe, though an attempt at artificial fertilization was not successful. Some of the spermatozoa were motile, but the male worms did not have the bright orange color which characterizes them in the height of the breeding season, early in July. Sagitta, though numerous, has been less abundant than in March. The specimens are much larger than those found during the summer months, and are filled with eggs. During the last week there has been a notable decrease in their numbers, and small individuals, less than one-half inch in length, have been frequently noted.

Mollusks.—A few egg-strings of *Sycotypus* and *Fulgar*, containing well-formed shells, have been taken at various localities along the shore. *Urosalpinx* has not begun to breed. Young 'veligers' of *Crepidula for-*

nicata were found in the egg-packets on April 6th and on April 17th, though specimens with young are not frequent. The eggs of a small gasteropod abounded on the stems of *Parypha* during the entire month. Five species of nudibranchs, belonging to the genus *Eolis*, have laid their eggs in the aquaria. The hermaphrodite gland of *Eolis papillosa* contains giant erythrophilous spermatozoa, like those of *Paludina vivipara*, which Auerbach has described. Eggs of *Ilyanassa* were found April 25th and 27th. The 'sand collars' of Natica were found at Hadley Harbor, April 25th.

Echinoderms.—*Echinorachnius parma* has not been examined since the early part of the month, when it was breeding abundantly. On April 16th the plutei, developed from eggs fertilized on March 22d, were still living in the aquaria. Eggs of this species have also been obtained in June and July. It is a remarkable fact that, though neither *Asterias vulgaris* nor *Asterias forbesii* at Woods Holl contain ripe sexual products, those of the latter species in certain parts of Narragansett Bay have been full, almost to bursting, of eggs and spermatozoa since the early part of April. The holothurians *Thyone*, *Leptosynapta giradii* and *L. roseola*, were examined April 24th, and were all full of nearly ripe eggs or sperm. Not the least attractive of the echinoderm eggs are those of the little starfish, *Cribrella sanguinolenta*. This species is not uncommon at Woods Holl, and the eggs, which were frequently laid in the aquaria during the third week in April, are as large as those of *Clepsine* or *Sycotypus*. They develop slowly, reaching the two-cell stage in about 6 hours. This material would undoubtedly be of great value in solving problems of cleavage and of echinoderm metamorphosis.

Cœlenterates.—The profusion of cœlenterate material was a feature of every collecting excursion during the first half of the month. Hydromedusæ of many different species were abundant in the tow until about the 17th of the month, and since then have been caught in small numbers. Among these, *Hybocodon* was perhaps the most numerous, although *Coryne* and *Tiaropsis* has been taken frequently. *Tima formosa*, abundant in 1897 at Newport, has not been seen. Hydroids of the brilliantly colored *Coryne* occurred in colonies that could be measured by the square yard, and those of a species of *Campanularia* could be measured by the square rod. On April 26th the *Coryne* had disintegrated. The large jellyfish, *Cyanea arctica*, has been represented throughout the month by specimens ranging from one-half inch to seven and eight inches in diameter, and *Ephyræ* were caught as late as the 21st. On April 8th the water at Waquoit was full of *Aurelia*, most of the specimens being from one to two inches in diameter, though some were much larger. *Metridium marginatum* was examined on the 18th, and was found to be full of eggs, apparently nearly mature. One of the 'sulphur sponges' was observed to extrude clouds of spermatozoa on April 10th.

The gelatinous alga, so abundant during March and the first half of April, gradually diminished in quantity after the 17th, and on April 25 little or none was found in the nets.*

A. D. Mead.

CURRENT NOTES ON PHYSIOGRAPHY.

THE ORIGIN OF PUGET SOUND.

The long fiords of the submerged mountainous coast of Alaska and British Columbia naturally give rise to the impression that Puget Sound and its many branches in Washington are also drowned valleys. This off-hand interpretation is combated in an essay on the 'Drift phenomena of Puget

* The Breeding of Animals at Woods Holl for the month of March was published in 'Science,' April 8, 1898.