several of the necessary nutritive substances may be present in such small quantities as to act as factors that limit the development of the vegetation, then the more or less considerable exchange taking place between the illumined surface-layers and the vast water-masses of the deep is certain to produce a great effect. All the forms of animal life inhabiting the sea below 200 metres live solely upon organic substances which are due to plants in the surface layers; that is to say, they either feed directly upon the plant-cells which sink downwards, or upon the inanimate remains or excrements of the animals living up above, or else upon other animals which, in their younger stages, have inhabited the surface-layers and fed on the plants they found there. A large proportion of the produce of the surface-layers must thus be continually descending into the deep sea, and these nutritive substances are therefore withdrawn from their regular circulation in the photic zone. Down in deep water, no doubt, the destructive metabolism of animals will set free these nutritive substances, so that eventually carbonic acid and ammonia will be produced; still these gases can only regain the photic zone by very slow degrees if diffusion is their sole means of conveyance. If, however, whole masses of water are brought up from the deep sea to the surface, the nutritive substances contained in them will once more enter into circulation, and cause an abundant plant life to develop. Nathansohn has pointed out that marine areas where such ascending currents occur, and where the surface-layers are replaced by water from the deeper layers, are well known to be extremely prolific, not merely in plankton, but also in larger organisms. In anticyclonic systems like that of the Sargasso Sea, on the other hand, where, conformably to the laws of ocean-currents, the water-masses cannot ascend from the deep sea, but where the surface-layers sink downwards, the plankton is much less plentiful than in any other similar area where investigations have been made. Our researches in the Atlantic during the summer of 1910 have done a great deal to settle this question. I shall first of all, however, refer to a series of investigations which bring quite another light to bear upon the question, and show what difficulties we have to face.

Ascending currents.

In 1907 Professor Nathansohn and I commenced to study the Christiania fjord, and subsequently I continued these investigations alone. My previous observations had taught me that the pelagic algæ in this fjord attain their maximum between

Pelagic algæ of Christiania fjord.