conditions will have a certain similarity to those existing in the atmosphere. The difference in the character of the circulation in the two cases could scarcely fail to give some useful hints.

Another illustration of the kind of flow to be expected near the borders of the Trades may be observed (although the analogy is not so close as in the experiment) whenever a current of water flows into a pond. The central part of the stream continues on its course for some distance unbroken, but the margins are bordered by eddies, which (looking down stream) are right-handed on the right, and left-handed on the left side, and consist of equal volumes of water from the stream and from the pond wrapped together after the fashion of a "roly-poly" pudding. When once formed, they have a certain life of their own, and follow erratic courses, often generating secondary eddies further from the main stream. In general their life is short, but occasionally vertical components in the flow of the main stream give rise to components in the eddies parallel to their axes, and in such cases the vortices may be sustained and intensified.

Much the same sort of action must be going on at the borders of atmospheric currents, and it must happen, especially in the turbulent regions, that either on account of the general circulation or from local causes, warm air will sometimes underlie colder strata, and this is what is required to prolong the life of eddies or vortices with vertical axes.

It may be said with some confidence that tornadoes, sand pillars, and waterspouts are due to local causes of this kind, and it seems highly probable that the deep barometric depressions which accompany the greater storms have a similar origin depending on inversions of level of the general circulation. In referring to warm and cold strata, the temperature must be supposed to be compared at the same altitude since, so far as thermometric readings are concerned, the upper air is always colder than that near the ground.

A. MALLOCK.

9 Baring Crescent, Exeter,
August 10.

The Conditions of Sex-change in the Oyster (*Ostrea edulis*).

IN the issue of NATURE for August 12, p. 212, and in several previous numbers, Dr. Orton has given some interesting information concerning the old question of the breeding habits of oysters, especially sex-change and its conditions. This problem has been discussed in a certain number of ancient treatises (Davaine, Van Beneden, Lacaze-Duthiers, Hoek, etc.), but has been but little investigated in the course of the last few years. During my work at the Danish Biological Station I have, since 1919, been making experiments and investigations on the biology of the oyster in the Limfjord. As my results in several respects confirm and amplify those of Dr. Orton, I will give here a short account of some of the most important. In the course of the winter a more detailed paper will probably be published in the Report of the Danish Biological Station.

Dr. Orton confirms the observation, made by Möbius, that in European oysters a specimen directly after breeding produces spermatozoa, and I fully agree with him. In several cases I have proved, through experiments with oysters, in the shells of which a little hole had been bored, that an oyster in the course of less than a week changes from a female to a male.

Dr. Orton further mentions the interesting fact that he has been able to state that an oyster born in 1921 was spawning already in 1922; this phenomenon he ascribes, and very rightly, to the high temperature of the summer 1921. I have investigated several thousand oysters in the Limfjord: the youngest female found by me was at least three years old, which is no doubt due to the lower temperature of the Limfjord. Neither did I ever find that oysters had ripe spermatozoa in the summer in which they were born; in the Limfjord that phenomenon only occurs in the following summer. Formerly the earliest time for an oyster to breed was much discussed. If we examine from where the different authors have obtained their material, it appears that those who advocated early breeding had got theirs from Southern France, while those who advocated two to three years as the age for breeding had had material from the English Channel and the North Sea.

From my experiments, and from the study of previous papers on this subject, I have come to the conclusion that the duration of the male stage depends on temperature, so that the colder it is the longer the stage lasts. At the temperature which ordinarily prevails in the Limfjord (15°-16° in July), this stage will last three to four years. The oyster, therefore, breeds for the first time (the first stage being the male stage) when it is three to four years old; further, every single oyster individual in ordinary circumstances of temperature breeds only every third or fourth year, in especially cold years still less often, in warm years more often. These phenomena, together with the shorter duration of the female stage, explain the fact that in a certain number of oysters in the Limfjord we always find only a relatively small percentage of females. This likewise explains why the oyster breeds more sparingly the further north it is, and decreases regularly in number without any sharp boundary-line.

The breeding of the oyster is in at least three respects influenced by temperature. A high temperature increases the number of times an oyster may breed in its life, it shortens the time which the breed passes in the mantlecave of the mother animal, and, according to Hagmeier, it shortens the pelagic larva stage.

R. SPÄRCK.

Copenhagen, September 5, 1922.

Rise in Temperature of Living Plant Tissue when infected by Parasitic Fungus.

WHILE engaged on some work connected with the export of citrus fruits from South Africa to England, we have come across a point of interest to plant pathologists and bacteriologists which would seem worth recording at this stage.

In investigating the effects of inoculating oranges and grapefruit with *Penicillium digitatum* we found that a very definite rise of temperature took place in the infected tissue. We are not aware of such an observation having been made before in connexion with the invasion of plant tissue by a parasitic fungus, and it will be interesting to ascertain whether a similar rise of temperature takes place in all cases where living plant tissue is attacked by parasitic fungi or bacteria.

To what extent direct reaction of the host is responsible for the rise of temperature is still to be determined; certainly no rise of temperature was observed when the host tissue was killed prior to inoculation. Mercury-in-glass thermometers were used in making these observations, but the employment of thermo-electric apparatus will naturally be necessary to carry the investigations further.

This observation of ours would seem to open up