Carolina for the first time. To get the eggs of *P. ciliata* the following method was used: A horse was driven into a low place inhabited by these insects and from him specimens loaded with blood were transferred to a jar. They were then put into a tin bucket with a little water in the bottom and covered with netting. They were fed daily with blood from the hand, and after about five days their eggs were found in the water. The eggs lie separately, like those of *Anopheles*. Contrary to expectation and report, *Anopheles* was found breeding abundantly in a barrel.

Dr. J. E. Duerden gave an account of his work on 'Boring Algæ as Agents in the Disintegration of Corals.' The corolla of about thirty species of West Indian corals, decalcified in the course of a morphological study of the polyps, all yielded a fluffy mass made up of filamentous algæ. The algæ were present in greatest number and variety in the older dead parts of corals, especially in so-called 'rotten coral,' but were also found throughout the part of the skeleton directly clothed with the polypal tissues, the only exception being at the tips of rapidly growing branches. The filaments occurring most frequently belong to two species of green algæ and a red alga; where present in quantity the former give a green color to the freshly macerated corallum, and the latter a pink tinge. Similar boring algæ were also obtained from many Pacific corals.

The algæ attack the calcareous skeleton of corals in the early stages of development, and their ramifications keep pace with its growth. Penetration of the hard coral is evidently affected by chemico-physical means, and their presence in such abundance results in a serious corrosive action, both superficially and internally; when assisted by other boring organisms, such as sponges and molluscs, it must lead to the rapid disintegration of dead coral blocks. Attention was drawn to the bearing of such disintegration upon the various theories associated with the formation of coral reefs.

Chas. Baskerville,
Secretary.

Discussion and Correspondence.

The Kinetic Theory and the Expansion of a Compressed Gas into a Vacuum.

Mr. Fireman, in his reply to my note regarding his communication to the American Association, states that I misread his abstract, and that it was on this account that I failed to understand its contents.

My difficulty was not in understanding the contents, but in understanding how they explained the facts, or why this picturesque conception of a sorting out of the fast and slow molecules without the aid of Maxwell demons, was in any way deemed necessary to the explanation of the heating and cooling of the gas.

Neither Natanson's elaborate quantitative treatment nor what Mr. Fireman calls his simple qualitative explanation appears to be necessary to account for the heating and cooling in the two receivers, in spite of Mr. Fireman's assertion that the explanation commonly given is unsatisfactory.

Mr. Fireman appears to have overlooked the fact that, when a compressed gas passes from a receiver into an exhausted chamber, there is, in addition to the molecular motion, a motion of the gas as a whole, *i. e.*, a mass of the gas is given a motion of translation, which is superimposed on the molecular motion.

To originate this motion requires an expenditure of energy, and a consequent lowering of temperature results. The matter is fully treated in the works of Clausius, Maxwell, Kelvin and Meyer, where it is shown that when a mass of gas is set in motion by its own expansion, the mean molecular velocity becomes less and the temperature is lowered; since the mean velocity is less, the component of molecular perpendicular to the direction of flow is less, and consequently the pressure in this direction is less than in the case of the gas at rest. This accounts for the cooling in the compression chamber.

The heating of the gas in the second receiver is to be referred to the same causes as the heating of the gas under the piston in the case of compression.

Mr. Fireman has difficulty in understanding how a higher average molecular velocity,

and consequent higher temperature, can be given to the gas which has passed into the second receiver by the portions which subsequently enter it. This is due to the fact that he ignores the motion of translation which the entering gas possesses. A mass of gas in motion as a whole, will act on another mass of gas in the same way as a moving piston, namely, increase the velocity of the molecules which collide with it.

Detailed criticism of Mr. Fireman's paper will have to be suspended until its publication. The statements in the abstract are very vague, and the author certainly does not show how the molecules with slow velocities force their way back against the rushing stream, and congregate in the first receiver.

We sometimes find the statement in textbooks that a gas expanding under such conditions that no work is done experiences no cooling, for example, when expanding into an infinite vacuum. It appears questionable, however, whether a gas can expand without doing work. Leaving out of consideration the internal work, *i. e.*, the overcoming of the forces of cohesion, we still have the gas in the receiver doing work in giving a motion of translation to the mass of gas thrown out into the vacuum.

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BITTER ROT OF APPLES.

IN the article upon this subject in SCIENCE for October 24, 1902, page 669, there is no reference to similar investigations with like results previously published. There is, however, an intimation that earlier knowledge was insufficient to justify publication.

There is sent herewith a 'circular' and a 'bulletin' issued by the Agricultural Experiment Station of the University of Illinois, which were put into the mails on respectively the fourteenth and twenty-ninth days of July of this year. Of the first there were sent out 1,200, and of the second 20,000 copies. They have each been referred to or copied entire in at least one hundred different periodicals throughout the country. Copies were mailed direct on the days indicated to the author whose name is signed first to the article now in question, and he may easily have first learned by this means of Mr. Simpson's discovery. At all events the publication of July 14 was in the possession of the general public before these special studies were begun in Illinois by the authors of this later paper.

Field studies made on July 11, 12 and 13 in orchards near Parkersburg, Olney, Clay City, Salem and Tonti, Illinois, by Professor J. C. Blair and myself, left no room for doubt that the early infection of the fruit was mainly from the limb cankers. These cankers were found, after we learned how to look for them, as sources of such infection in hundreds of instances with not five per cent. of failures. Then two hours with the compound microscope on the evening of July 12, at our laboratory at Salem, demonstrated beyond cavil the protrusion of the spores of this specific *Gleosporium* from the cankers. Such spores positively so produced were at this time inoculated into fresh apples, and the resultant spots, which showed on the 14th, were clearly identified as those of bitter rot on the 15th—three days after the inoculations—while check punctures remained sterile. These tests were often repeated during following days, with the same results.

This disease of the apple has annually caused serious losses, amounting to over $1,500,000 in the same region of Illinois two years ago. Here was evidently a new and presumably an efficient method of combating the scourge if prompt action should be taken. Surely delay in making the facts known would have been reprehensible. As a matter of pure science the subject was sufficiently ripe for publication on the 29th of July as the bulletin fairly shows.

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A PECULIAR HAILSTORM.

DURING the past summer, while on a reconnaissance survey in southern Keewatin, for the Geological Survey of Canada, the writer's party encountered an unusual number of electric storms, particularly during the months of June and July. Quite frequently these storms were accompanied by heavy rain and hail. The heaviest of these commenced about