I said above, that the ordinary operation of physical causes is amply sufficient to account for all the changes which took place upon the earth's surface, up to the time of the appearance of the first germ of something organized, of something which could move of itself, and did not derive the ability of motion from some force without. And if the chemist in his laboratory can produce everything which is not made up of organs, and composed of carbon, nitrogen and the elements of water, in other words, all organic bodies, Nature, which is the greatest of all chemists, could have done the same. Whether nature could have produced the material of which animals and plants are composed—that structure which makes up the walls of a cell, which chemists, looking from a chemical point of view, call Protein, and naturalists, regarding it from a histological stand-point, term Protoplasm—I dare not, without more thought and study than I have yet given to the subject, pronounce an opinion.

There is a matter, however, of still greater importance than the preceding. It deserves to be reckoned of infinite and eternal importance. It is the following:—granting that physical forces could have originated cell-structure, could they ever have determined the formation of a cell, or the aggregation of two or more cells so as to form a living organism?

As yet, all the experiments that have been tried, and all the reasoning which has been brought forward, have failed to show that such an effect could have resulted from material forces alone.

LABORATORY APPLIANCES.

BY PROF. LEEDS.

New Form of Dessicator.—The dessicator in most common use, as is well known, consists of a low broad glass bottle, the outside of which is fitted by a ground glass joint to a glass cover. The inside is partly filled with fused calcic chloride, and the platinum crucible is supported either upon a glass tripod or upon a platinum triangle. It has the objection that the air in the interior expands when the hot crucible is introduced, and lifting the lid makes it escape. On cooling, a partial vacuum is sometimes produced which renders it difficult to remove the lid. To obviate this difficulty a hole is frequently drilled in the cover. But in doing so it makes the ground glass joint of little benefit, and the apparatus thus arranged is little if any better than a bell-jar set upon a ground glass plate.

Schrötter's dessicator provides for the free egress of air in contact with the hot crucible. It consists of a bell glass placed upon

a glass plate and containing the crucible. Through a hole in a cork fitted to the tubulure of the bell-jar a fine glass tube is passed to allow an escape of the heated air. This first tube is inclosed in a second tube, somewhat wider, closed at its upper end, and with holes drilled in the lower end, through which the air passes and bubbles up through sulphuric acid contained in the bottom of a third tube that includes the other two. The top of this outer tube terminates in a bulb opening upward, which is filled with calcic chloride. When a partial vacuum is produced in the interior, the air is made to pass through the sulphuric acid before re-entering and thus dried.

A more compact and convenient dessicator is represented in the woodcut. It consists of the base of an alcohol lamp, which is

ground into the tubulure of a small bell-jar. The base is partly filled with sulphuric acid, and has a hole drilled in the side near the top to permit the egress of air. The bottom of the bell-jar is covered with fused calcic chloride and the top by a ground glass plate. One of the two disks which are used to exhibit the cohesion between polished glass surfaces answers nicely. Through the tubulure a funnel with a very large bulb is passed, its end dipping somewhat beneath the surface of sulphuric acid. The platinum crucible is supported in the mouth of the funnel by a triangle. When the air is heated by the introduction of the

crucible it bubbles up through the acid and makes its escape by the opening at the side. On cooling, the air forces the acid through the tube and partly fills the funnel, but as soon as the surface of the acid sinks below the end of the tube, air bubbles up through the long column of sulphuric acid until equilibrium is restored. The calcic chloride insures complete drying. It is hardly needful to say that the tube of the funnel is supported in the tubulure by an air-tight joint.

Water Air-Pump.—When the water air-pump is used in connection with a bell-jar and beaker, such as I described in a former

number of this *Journal*, a difficulty is encountered arising from the bursting of air-bubbles contained in the water, so soon as the latter finds itself in a vacuum. In order to obviate this difficulty a number of expedients were resorted to, the one figured in the woodcut proving most satisfactory. To the end of the funnel tube, which is passed through the tubulure of the bell-jar, a very small funnel is connected by a short piece of india-rubber tubing. The ends of the funnel tubes are ground so as to bring them as near as may be in contact. They may be fused, but this not only requires careful workmanship, but was found to be an arrangement very liable to accidents from the rigidity of the parts. The tube of the little funnel is bent in such a way as to bring one of its sides nearly vertical and parallel to the inside of the breaker against which it rests. When now the bubble expands it finds itself hemmed in by the walls of the funnel, and finally breaks quietly and trickles down the vertical side of the funnel until it comes into contact with the beaker.

The exhaust of the water air-pump with which I am working at present is somewhat more than thirty-six feet in length. It is not unusual

to have the barometric columns in the gauge rising to the height

of 78 c.m., and to filter under a pressure of 65 c.m. When the vacuum is allowed to stand, the water supply being shut off, the water remaining in the exhaust tube is frequently lifted and runs back. To prevent it from entering the bell-jar the contrivance represented in the above cut was resorted to. The exhaust pipe represented by D enters through the india-rubber cork of a wide-mouthed quart bottle, and passes down almost to its bottom. The tube connecting with the bell-jar to be exhausted C terminates on the inside of the bottle just below the cork, and so likewise does the tube forming the mercury gauge. When the water regurgitates it fills the bottle nearly to the top, but not a drop ever passes over into the bell-jar. On starting a fall of water again through the long exhaust pipe, the water in the bottle is entirely and at once removed by means of the syphon, and the exhaustion of the air follows immediately.

LECTURE EXPERIMENTS.

By PROF. THOMSEN, of Copenhagen. Translated by PROF. LEEDS from the *Ber. der deutsch. chem. Gesell.* No. 18, Vol. III.

Reciprocal Combustion of the Elements of Water.

This may be demonstrated very instructively in the following manner. A pair of narrow platinum tubes, 1 centimetre long and 1 millimetre diameter are formed up of quite thin platinum foil. These tubuli are melted into a pair of small glass tubes, and are thus made the burners of the two gases, hydrogen and oxygen. The glass tubes are passed through openings about 1 to 1½ centimetres apart in an india-rubber cork. One tube is connected with the oxygen, the other with the hydrogen reservoir. After the cocks of the reservoirs are proportionately opened the hydrogen is ignited. The cork with its two burners is then inserted into a glass tube about 10 to 15 centimetres long with its upper end much narrowed down but still left open. The entire apparatus has then the form shown in the following woodcut.

The hydrogen now burns in oxygen, the fusing together of the orifice of the glass tube being prevented by the end of platinum. If now the cock of the oxygen reservoir be slowly turned off, and the quantity of oxygen so diminished, the point is soon reached at