that it is a semi-solid, like soft cheese. Its taste is agreeable, and pleases at once, while kefir, being more acid, sometimes requires some days' habit to become reconciled to it. However, in the yohourth the micro-organisms are less abundant, and the albuminoid matter is less modified. In the same way as abcve mentioned, a dry powder is now prepared, known as yohourthogene, by which this product can be made when desired from milk.

PURPLE BACTERIA.

By Prof. A. NESTLER.

PECULIAR organisms known as sulphur bacteria are often found in stagnant and even in running water, salt or fresh, which contains large quantities of decomposing organic matter. Imbedded in the cell substance of these bacteria are numerous microscopic pellets of pure sulphur. Some of the bacteria are colorless, others are red or purple and betray their presence to the naked eye by their color when they occur in large numbers. A few of the purple bacteria were discovered and described early in the nineteenth century, but the researches of Engelmann and Winogradsky first made known the curious movements and other remarkable peculiarities of these extremely interesting organisms.

Prof. H. Molisch has recently published* the results of several years of study of purple bacteria. A few of his most interesting discoveries are briefly described in this article.

If a little pressed hay is put in the bottom of a tall and narrow glass jar or large test tube and the vessel is filled to the brim with water from a pond or stream, covered with a pane of glass, and set in a window exposed to the direct rays of the sun, the water soon becomes filled with infusoria, green algæ, flagellates, and other organisms. After a few weeks in summer, or a somewhat longer period in winter, the liquid assumes a red color which gradually extends upward from the bottom and a red deposit is formed on the hay and the wall of the vessel. A soft-boiled egg, a bone with a little adhering meat, or a few dead earthworms or snails may be substituted for the hay. If the surface of the water is covered with a layer of oil the purple bacteria multiply so rapidly that a fine reddish violet coloration is obtained in a short time in sunny weather. Marine species of purple bacteria can be obtained by using seaweed and sea water.

The success of these methods of culture proves that purple bacteria are very widely distributed in nature. Molisch succeeded in obtaining pure cultures of a number of previously unknown species, of which the most interesting are distinguished by the absence of the sulphur nodules which are characteristic of the family in general. Many species are surrounded by a mucous envelope which can be made visible by adding a little India ink to the culture liquid.

Purple bacteria are remarkable for their need of abundant light, which is fatal to most bacteria, and also for their extremely small consumption of oxygen. They begin to develop at the bottom of the vessel and flourish best when the air is excluded by a film of oil. Many species can live and thrive for an astonishingly long time without any oxygen whatever. Numerous bacteria of the marine genus *Chromatium*, which had been sealed in a drop of water between a microscope slide and cover glass, with Canada balsam, in May, 1906, remained as lively as ever in March, 1907.

If an individual alga of the species *Pleurococcus vulgaris*, which is found as a green deposit on trees and varies from 1/12,000 to 1/4,000 inch in diameter, is placed in the center of a colony of active purple bacteria (there are also motionless species) on a microscope slide, the bacteria scatter in all directions, leaving an empty space, because they cannot endure the infinitesimal quantity of oxygen exhaled by the microscopic alga under the influence of light. Now, if the production of oxygen is interrupted by shielding the alga from the light, the clear space becomes filled with bacteria in half a minute, and it is cleared as quickly when the alga is again exposed to light. Hence these purple bacteria furnish a very delicate test for the presence of oxygen in quantities too small to be detected by any chemical reaction.

By this and other experiments, Molisch has proved that the pigment of the purple bacteria does not, as had been supposed, resemble the chlorophyl of green plants in performing functions of assimilation.

Even without the presence of algæ, the active purple bacteria exhibit a sensitiveness to light that may fairly be called marvelous. This is most conspicuous in the species which Molisch has named *Rhodospirillum photometricum*. The individuals of this species are comparatively large (1/5,000 to 1/2,000 inch long and 1/18,000 inch thick) and are easily visible with a power of 300 diameters. They are shaped like a corkscrew and they rotate and move to and fro in straight lines with great velocity. If the field is darkened for a fraction of a second by passing the hand over the illuminating mirror the bacteria instantly reverse their movements of rotation and progression. This astonishing phenomenon must be seen to be fully appreciated. It is characteristic of all active purple bacteria and it furnishes a valuable means of identification, for except in the largest species the color is apparent only in masses, not in single individuals. And as Molisch has indicated the simple method already described for obtaining purple bacteria, it is easy for any possessor of a good microscope to observe this sudden recoil, which seems like a movement of fear.

If a piece of black paper perforated by a hole of the size of the microscope diaphragm is placed beneath a slide on which is a drop of culture liquid flattened by a cover glass, and all top and side light is cut off by screens, all the bacteria in the extended drop will congregate in the little illuminated circle within a few minutes and will remain there, darting back toward the center whenever their movements bring them to the circumference.

According to Molisch, the coloring matter of the purple bacteria contains a reddish purple pigment, and also a green pigment. The latter, bacteriochlorin, has nothing in common with chlorophyl, which is not found in these bacteria. The red-purple pigment, bacteriopurpurin, can easily be obtained in crystalline form.—Translated for the SCIENTIFIC AMERICAN SUPPLEMENT from Umschau.

* Hans Molisch. Die Purpurbakterien nach neuen Untersuchungen. 95 pp. Published by G. Fischer, Jena, 1907.

ASTRONOMY ON MONT BLANC.*

PROFESSOR JANSSEN AND THE MONT BLANC OBSERVATORY.

BY H. RADAU.

IT is worth while to state briefly why the astronomers of our day have chosen to establish their instruments at high altitudes. When one has passed some time under an overcast sky, which obscures the light and renders all observations impossible, he recognizes the advantage of a station above the clouds. But even when the sky is perfectly cloudless the atmosphere is still a serious obstacle, for it is in fact a translucent and changeable veil between the observer and the heavens. This veil is very thick at sea level, and both distorts and changes the nature of the images of celestial objects. First of all, by its refraction it falsifies the position of the stars more and more as they approach the horizon, because the denser layers of the air form there a larger proportion of the path of the beam of light. Another inconvenience, more serious from the point of view of physical astronomy, is the diffuse reflection of the atmosphere, which causes a beam of light to illuminate in all directions the air it traverses. The light of the sky is a great obstacle to investigations of objects near the sun, and for a long time it prevented the observation of the solar prominences excepting at the rare occasions of total solar eclipses. It is now possible to view them in full daylight, thanks to Janssen's discovery of a method of enfeebling the diffuse sky light by the aid of the spectroscope, while leaving nearly unchanged the monochromatic light of the prominences.

Among the effects due to the presence of the atmosphere should be mentioned the absorption which it exercises upon the radiations of the sun and stars, for by retaining a portion of such radiation it profoundly alters the quality of the rays which reach the earth's surface. Not only is the intensity of the rays reduced by the passage through the atmosphere, but their composition is essentially changed. This is the reason why the sun appears red near the horizon, and it is also the cause of some of the dark lines in the solar spectrum, lines whose terrestrial origin is attested by their variation at high and low sun. These effects are much diminished when the observer stations himself at an altitude of several thousand meters.

At the summit of Mont Blanc (about 15,780 feet above the level of the sea) the barometer stands at about 17 inches, from which it follows that the weight of the atmosphere above is still a little more than half that of the entire atmosphere. Upon the highest peaks of the Himalayas the barometric pressure is only about a third of its value at sea level, where each square meter of the earth's surface supports a weight of about 22,000 pounds of air. By choosing a station at a great elevation the difficulties due to the presence of the atmosphere may be partly overcome. The measure of success which has already crowned tentative efforts in this direction has encouraged many who were hesitating to make the sacrifices accompanying perilous and costly ascents, and now we see mountain observatories multiplying and equipped with the most powerful instruments.

In his first ascent of Mont Blanc, in October, 1888, M. Janssen did not proceed beyond the inn at Grands Mulets, at the altitude of 9,300 feet, situated on the rocks at the junction of the Bossons and Tacconaz glaciers. At this time of the year the inn was already abandoned, and there had recently been a heavy fall of snow which had effaced the trail, hidden the crevasses, and rendered the ascent very difficult. Owing to these obstacles thirteen hours was consumed in reaching the inn by a route which in the favorable season is traversed in four hours, and the travelers arrived greatly exhausted. Accordingly, when two years later Janssen determined to try to reach the summit he discarded all thought of ascending on foot and devised a sledge somewhat similar to those of Lapland. The guides were ill pleased with this innovation; but at length, on August 17, 1890, Janssen left Chamonix in company with Durier and twenty-two guides and porters. Next day, while in one of the shelter stations on the route, a terrific storm burst and detained them three days. Finally, on the 22d, the weather moderating, Janssen continued the ascent with the twelve men still remaining, for the others had demanded permission to return. The sledge was finally hauled to the summit, and after some hours given to rapid observing in excellent weather conditions they resolved to go down.

For carrying on researches of considerable magnitude it is not practicable to depend on simple ascents, even frequently repeated; and it is indispensable to provide a permanent observatory equipped with a number of instruments and suitable for a stay of considerable length. M. Janssen represented this need strongly to the Académie des Sciences in his report of the expedition of 1890, and his appeal was not neglected.

The preliminary studies relative to the establishment of the observatory were commenced in August, 1891. They consisted, first of all, in the measurement of the thickness of the sheet of ice which covers the summit of Mont Blanc. M. Eiffel had promised to have these soundings made at his own expense and put them in charge of a Swiss engineer, M. Imfeld.

The summit of Mont Blanc is formed by a very narrow arête of rock, more than 100 meters long, running east and west. This arête terminates probably in peaks and has been imbedded in snow which has formed a crust thicker on the north side than the south, where it is more exposed to melting. Two horizontal galleries, each 25 yards long, were constructed about 13 yards below the crest without encountering rock, but only hard snow. It is therefore probable that the icy crust which covers Mont Blanc is more than 13 yards thick, and M. Janssen soon proposed a solution of the problem of construction in these novel conditions, which consisted in the laying of the foundations upon the permanent snowcap which forms the summit. All accounts of ascensions during the last century prove that the appearance of the smaller rocks near the summit has not changed much, and it may be concluded that the configuration of the top is being altered very slowly, if at all. It follows that a rigid construction securely anchored in position would be perfectly safe and relatively stable; but the question had to be settled whether the snow layer upon the summit offered sufficient resistance to support the weight of the structure. M. Janssen thought it necessary to make direct experiments to determine this.

During the winter there was erected near the observatory of Meudon a hillock of snow as high as a single story. The snow was rammed down until it acquired about the density of the snow on Mont Blanc. Upon the well-leveled summit was placed a pile of 60-pound lead weights. When twelve disks had been piled up and afterward removed, it was found that the depression had been only about a quarter of an inch. The result surpassed expectation and demonstrated the safety of the proposed building. If built on a rigid sub-base and provided with jackscrews, any strains which might arise by settling could be relieved, and the whole could be leveled as it might require. In order to guard against the fury of the storms, it seemed desirable to make the structure in the shape of a truncated pyramid and to bury the lower part in snow, so as to have a large and strong foundation.

The object being approved by M. Vaudremer, the eminent architect, member of l'Académie des Beaux-Arts, the construction was commenced according to plans prepared under his direction. It comprised two stories, with a terrace and balcony. At the base the pyramid measured 11 by 5½ yards. The underground parts

* Abstracted from Revue des Deux Mondes.