tensity of the light concerned in assimilation. As is well known, the light of the sun, like that of most incandescent bodies, is a mixture of very different luminous rays, which are distinguished by their refrangibility, *i. e.,* by the amount of divergence which they undergo on entering another medium, as well as by their chemical effects; and obviously the question must force itself upon the investigator whether, and in what manner these different rays of light, of which daylight is made up, influence assimilation in the chlorophyll. For the preliminary guidance of those not quite familiar with the physical knowledge appertaining here, the following remarks may be made. If the sun's rays are allowed to fall through a narrow slit in the shutter of a room, they proceed through space in the form of a straight band, which can easily be seen as luminous striae in the dusty air: if these luminous striae or bundles of rays are allowed to pass through a triangular glass prism, the edges of which we suppose vertical, two results follow. First, the ray of light is diverted from its straight path—it falls on quite another spot on the hind wall of the chamber than was the case in the absence of the prism; and secondly, instead of the one bright stripe which the solar rays originally formed on the hind wall, there now appears a horizontal coloured band, the so-called solar spectrum, in which the colours of the rainbow, red, orange, yellow, green, blue, and violet, follow one another in such a way that the red portion is least, and the violet most strongly diverted from the rectilinear path of the beam of light. In this spectrum, by proper management, a number of black lines appear, running perpendicularly in the horizontal band of colours; these are the so-called Fraunhofer's lines, which, as Kirchoff and Bunsen have shown, are produced by the absorption of certain rays of light by the incandescent vapours of certain metals in the solar atmosphere. From these fixed lines in the solar spectrum, the most evident of which are distinguished by the letters *A, B, C,—H,* it is possible to determine exactly the place where definite effects occur. The refrangibility and colour of the different parts of the spectrum are a consequence, as the science of optics teaches, of the different wave-lengths in the vibrations of the luminous æther, of which the light consists.

If now the solar rays, passing through the slit, are allowed to traverse a glass vessel with parallel walls containing a dark blue solution of ammoniacal oxide of copper, the whole of the red and yellow, and part of the green bands in the spectrum disappear; the blue solution has absorbed, kept back, or destroyed these constituents of the sun-light. If a vessel with a concentrated solution of bi-chromate of potash, which appears to our eyes of a deep orange colour, is placed at the same spot, just those parts of the spectrum are cancelled which previously passed through the blue solution—*i. e.,* we now see in the spectrum the red-orange, yellow, and a part of the green, while the blue and violet have disappeared. We have thus in these two fluids excellent means for cutting out the one or the other half of the solar light; and we can therefore, with the aid of these two solutions, experimentally answer the question, what effect does the red-yellow or the blue-violet half of the spectrum respectively exert in the decomposition of carbon dioxide? After the preliminary and less instructive researches of Daubeny (1836), I made in 1864 a detailed investigation with regard to this question. In a glass cylinder filled with water containing carbon dioxide a water-plant was placed; at the cut surface of the stem of this the oxygen evolved under the influence of light escaped regularly in the form of bubbles. This cylinder was placed in a second, wider cylinder, and the space between both filled with one or other of the solutions previously mentioned, or with pure water. After careful consideration and preparation, I employed as a measure of the decomposition of carbon dioxide in the plant, the number of bubbles which escaped from the cut surface of the stem in one minute. It was now possible to conduct the investigations in such a manner that the plant could be observed alternately for one minute respectively in white complete light, in red-yellow, or in blue-violet light, one immediately after the other, and the gas-bubbles counted. It turned out that in the blue-violet light only very little carbon dioxide was decomposed, while (having regard to accessory circumstances) the effect in red-yellow light was nearly as strong as in the full light which passed through pure water. This result, as well as the observations previously made by Daubeny, Draper (1844), Cloez and Gratiolet (1851), contradicted the prevailing view of the physicists and chemists, that it is the blue-violet part of the spectrum which almost alone brings about photo-chemical effects. The decomposition of carbon dioxide in the plant evidently depends upon a photo-chemical effect; and yet we here see that that portion of the spectrum which is distinguished by physicists as the one chemically effective, is relatively inactive, while the other half of the spectrum is here the effective one. I directly confirmed this apparent contradiction again, by placing in the upper part of the glass cylinder containing the plant a small apparatus which enabled me, while observing the separation of oxygen, simultaneously to observe the effect of the coloured light on photographic paper. When the light passed through the blue-violet solution, the (*Please turn page*)

ENGINEERING

New Orleans Better Able To Pump From Under Water

RAIN that falls in New Orleans must be pumped out.

Because the city is below ocean and river level, New Orleans has always been pumping itself from under rain water. For years her pumping installations have been described in the superlative. And now their capacity has been made even larger.

The increase in size became necessary because during the past five years all previous precipitation records were exceeded, George C. Earl, civil engineer of this city, explains in the current issue of *Civil Engineering.* The present system will in one day remove 14 inches of water covering the entire city. It cost roughly $1,400,000 per inch of capacity and when all necessary canals are completed this figure will be increased to at least $2,000,000 per inch.

Science News Letter, June 4, 1932