

the flask he then poured alternately small quantities of nitrate of silver and hydrochloric acid. This acid decomposes the nitrate of silver forming an insoluble chloride of silver, which diffuses in minute particles through the flask as a milky precipitate. The conditions are now favorable for bringing the sunbeam into action upon it. Having got the silver into a shape to be acted upon, that is combined with the chlorine and diffused through the flask, Dr. Draper arranged his twelve-inch burning lens so as to throw the centre of its brilliant light into the flask. The chemical action immediately commenced, the compound was decomposed, and the chlorine set free and the metal separated. He continued the exposure from eleven till one o'clock, which is equivalent to seventy-two hours; that is, by his concentrating glass he got seventy-two hours' action inside of two hours.—In this way he got the metal free; but what was it? It went in chloride of silver; he got it free; but it could not be silver—at least not ordinary silver—for it was liberated in the midst of nitric acid, and it did not dissolve. That which refuses to dissolve in nitric acid, whatever it may be, is not common silver; and, whatever it may be, it exhibits one of the properties of gold. Again; he burnished it in an agate mortar, when, lo! it did not give the true silver reflection and color; it had a yellowish cast—another one of the symptoms of gold. But, fortunately or unfortunately, the metal did not remain in this condition; but it serves as an illustration of the power of the sun in effecting allotropic transmutation. Thus it would seem that the fabled powers ascribed of old to the philosopher's stone we finally realize as a property of the celestial radiations.

PHOSPHORUS.

Let me now introduce a different agent. About two hundred years ago, an alchemist, while experimenting upon the properties of the human body, discovered a new and most remarkable substance. It possessed the marvelous property of shining by itself in the dark, and was hence named phosphorus, or the bearer of light. It took fire and burned furiously, exhaling a dense white cloud, which gathered like snow, but, unlike snow, hissing like red hot iron, and when brought into contact with the body, it blistered like fire. The alchemists were transfixed with wonder. It was kept in glass vials filled with water, and in this way precious little bits of it

were circulated about among the initiated. The devout alchemist was often startled in his laboratory at night by the lambent flame of this singular substance. But "what was this terrible fiery thing?" "A demon?" "It was produced from the human body!" Strange thoughts were then abroad. "Had the cunning alchemist at last seized upon the incarnate principle of evil?" "Was it indeed the true diabolic element, and could more of it be extracted from a sinful man than from a holy one?" Perhaps not, they hardly dared to hope that they had caught and caged the devil himself, but that they had captured one of the family was beyond doubt—and so that mysterious thing passed among the adepts under the name of the "Son of Satan."

A thing of the most fiery temper, nimble and crazy, it was an ugly imp, breathing fire and flame as air, and could only be controlled and disciplined by perpetual strangling and suffocation in water; and even yet, with all our knowledge, skill, and care, it is the terror of the laboratory, and there is scarcely a chemist who has not been, in some degree a martyr to its fires. It has the most potent chemical affinities, and when exposed to the air it has a double action, one portion uniting with the oxygen, and forming phosphoric acid, and another portion entering the air and transforming it to ozone. It is a rapid poison, and many cases have been known where children have been poisoned by nibbling the ends of matches, and the workers in match manufactories are liable to have the bones of their jaws rotted away by the corrosive phosphoric vapor. Yet this element is an essential and constant ingredient of the living body. This might puzzle us, but we remember the masquerade of the elements, and the difficulty disappears.

Phosphorus illustrates this allotropic law; it has a six-fold mutation; six disguises which it may assume as circumstances may require; six suits which it may put on. We will confine our attention to two of these. First, is what is commonly seen, and what is called vitreous phosphorus. Then there is a red variety, which is a condition altogether opposite to the common glass-like sticks. So different is this red modification of phosphorus, but though it has been in the chemist's hands for nearly a century, it was only recently recognized as phosphorus. This phosphorus is a placid and peaceful state, a wick-

ed demon converted to a saint; a slashing soldier suddenly become a peace man of the most Quaker like and placid demeanor. It varies from the common kind in that it does not shine in the dark, nor melt in boiling water. It exhales no vapor, and it does not change oxygen into ozone. It is chemically different from the other, it may be handled with impunity, and is not poisonous when administered in doses a hundred times greater than would be fatal with the common form. It is dormant, in a state of slumber, but still it is but the sleep of death. Try the virtue of fire upon it, and as it reaches the heat of five hundred degrees, the slumberer is aroused, and leaps up in a raging passion, and it is now necessary for the intruder to beware. And where is the sorcerer who can bind this furious creature? Again it is the sun. A thin layer of phosphorus is seized upon and exposed to the rays of the solar spectrum; in the violet region the active phosphorus is changed to a passive state again.

PHOSPHORUS IN THE HUMAN SYSTEM.

The crucible of the sun is the green vegetable leaf, the thousand rootlets of the plant gather up the chemical particles from the soil to be worked up in the factory above, and among others is the compound phosphorus. These are carried up the leaf by the sap, and decomposed by the sunbeam, and the phosphorus set free, turned into a passive state, and then laid up for the nutritive substances, destined for the food of man. Now, when in certain oily compounds it is introduced into the system, yet the arterial blood is not acted upon by it—it is neutral and inert.

Among the parts of the living organism the nervous system is the highest in the scale of importance, and that is the destination of this passive allotropic phosphorus. The ultimate nerve filaments are only half the thickness of the finest fibre spun by the silk worm; five thousand of them may be laid side by side in the breadth of an inch, and yet these wondrously thin threads constitute the telegraphic system of the body, and transmits the news in all directions, and in reality these little tubes or pipes are filled with this phosphorus. In the oily, pulpy part of the brains also, this phosphorus abounds, stored away in large proportion. There is one ounce to fifty ounces of brain; the average brain of a man weighs forty-five ounces, so there is nearly one ounce distributed throughout the cerebral region. I said the four organic elements were ele-

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