made in the position of certain spectrum lines. In point of fact, he wished to try whether light could be weighed. We believe the Admiralty will assist in the investigation, and that before long a ship will carry the instrument to some appropriate place. There are only two probable suppositions with respect to light, heat, and so-called "imponderables," either that the ether whose vibrations they are supposed to be, could be weighed if apparatus of sufficient delicacy were contrived, or that gravitation is not an essential quality pertaining to matter under *all* conditions, but uniformly making its appearance under *certain* conditions. The inquiry is full of interest, and when conducted to a successful issue, will open the way to some of the widest and grandest of investigations that science has reached.

Chemistry opens before us very curious questions of identity and sameness. It shows us instances of the same substances having widely different properties in different conditions. The chemist recognizes two singular classes of bodies, the one he terms *isomeric* and the other *allotropic*. The isomeric consist of substances differing widely in appearance and properties, and yet composed of the same proportions, of the same materials. In some of these bodies the quantities of the elements are the same in actual weight, in others the proportion is kept, but the quantities may be twice as great, or even thirty times as great. The separate bodies of an isomeric series receive separate names, but allotropic bodies of the same pair or series have only one name, being considered as the same thing in two or more different states. Phosphorus is known in several states. Professor Miller says, "Phosphorus assumes several different forms under the influence of causes apparently trifling. The transparent variety when kept exposed to light under water assumes a second form, which is white and opaque, and somewhat less fusible. (1) It has a specific gravity of 1,515, while phosphorus becomes reconverted into the vitreous variety by a temperature not exceeding 1220. A third form is obtained by suddenly casting melted phosphorus; it is perfectly black and opaque; while a fourth, or viscous modification, analogous to viscous sulphur, may be obtained by heating very pure phosphorus to near its boiling point, and suddenly cooling it. A fifth form occurs in the shape of red scales, which are obtained by the spontaneous sublimation of phosphorus in the Torricellian vacuum (2) when exposed to the rays of the sun."

This red phosphorus may be obtained by other means, and has been extensively used in the manufacture of lucifer matches, a most unhealthy business when common phosphorus is employed. It is not soluble in some liquids, like bisulphide of carbon, which dissolves common phosphorus. Instead of catching fire in the open air, as common phosphorus does at a comparatively low temperature, it must be heated to 3000 before such action takes place, and instead of acting like common phosphorus as a powerful irritant poison, it may be swallowed with impunity.

It is impossible to place limits to the variety of substances that may be produced by different modes of arranging the same quantities of the same elements in various patterns. We recognize boundless diversity, but when does the identity stop? Is there only one ultimate substance capable of existing in different states? It is obvious that speculations concerning identity and change have a wide field in the regions over which chemistry presides. We have merely indicated some of the simplest, and with these for the present must be content.

The astonishing changes which animals undergo from the egg to their complete form illustrate other phases of the same theme. All creatures that we know of originate in a bud or an egg. Probably the egg always appears at some part of the series, and it is now certain that the most developed creatures, the mammalia, thus commence their being. Thus man and the silkworm both spring from eggs. In the higher forms of animals the hatching process precedes birth, in the lower the egg is born into the world, and changes take place within it which eventuate in the appearance of the infant stage of the creature that is hatched.

Natural history abounds in remarkable illustrations of the diversity of appearance presented by the same animal at different stages of its existence. In the insect world we know the caterpillar, the chrysalis, and the butterfly. The young Cyclops, a well-known water flea, common in all ponds, and with which our microscopic readers must be well acquainted, differs greatly from the adult form in the shape of the body, the absence of the long tail, the want of antennæ, and many other particulars. Still more remarkable are the differences between the young crab, in shape like a helmet with a tail to it, and the adult individual, and between the young star-fish, beginning life like a painter's easel, and the full-grown form.

What constitutes the individual identity of creatures that have no continuous consciousness, or no consciousness at all, and which in their separate stages differ as much as if each stage constituted the existence of a distinct being? At one time it was thought by some philosophers that all the organs and apparatus developed in subsequent life-stages existed in the first stage in a rudimentary form. This notion is untenable. The egg-stage of animals, widely differing from each other, may be indistinguishable, and yet in each egg some special arrangement of forces and materials exist which determines the kind of development that shall ensue; and in animals that pass through many changes of form and aspect, the form that precedes is, in effect, the parent of that which is to follow.

Are we to regard the seed and the plant as belonging to one individual identity. We cannot do otherwise; and in this case we have to note that from the seed the infant plant really grows, and the adult plant grows from the infant germ. The entire plant, at any one time, is continuous in its structure. But there are differences between buds and eggs, and must we take all the beings that arise from animal or vegetable buds of the same individual as partaking of its individuality? A bud may be, for example, a portion of an individual plant, and may be developed into a similar plant—aphides or plant-lice produce numerous offspring by buds as well as others at certain periods by eggs. Such cases are rather multiplications of the individual, than the production of fresh individuals.

We are accustomed to regard an animal as something complete in itself; but what shall we say when an organ of reproduction moves about as a separate thing from the creature of which it is a dissociated part? Natural history presents these curious problems. Facts of this kind have appeared, and more will appear from time to time, in our pages. They suggest profound and interesting thoughts. In this paper we have only approached the threshold of great questions. We have skimmed over a wide surface, hoping rather to stimulate inquiry in many directions than endeavouring to satisfy it in any one.

Intellectual Observer.

(1) M. Baudrimont affirms that white phosphorus is not an allotropic form of common phosphorus, and that it only varies from the latter by having its surface corroded through partial combustion. If this be so, the general argument is not affected. M. Baudrimont's paper is in *Comptes Rendus*, 13th Nov., 1865.

(2) The upper and empty part of a barometer tube is a Torricellian vacuum. The air can only press up into the tube a column of mercury equal to its own weight. The tube is filled in the first instance, and the mercury falls till the air column is balanced.

Are there other Inhabited Worlds? (1)

Are there on any of these globes which seem to be moving around us beings formed like ourselves, or animals, or any plants? Do people on the Moon contemplate our Earth, a glorious orb in their firmament, and spy out our actions through telescopes as we attempt to spy out theirs? Before the evening is finished I hope to be able to answer these questions in a satisfactory manner.

Let us examine, in the first place, the conditions essential to the existence of the organized beings with which we are familiar, and then we will try to discover wether such conditions are found on any other celestial body. It will only be necessary to investigate a few of these conditions, because if we find any that are absolutely essential to life, whether animal or vegetable, missing on other globes, our purpose will be fulfilled. They can not be inhabited.

To sustain the life of an animal three things are necessary. It must have air, water, and food. Why is this the case? We all know how soon life is extinguished if the supply of air to the lungs be cut off; the person turns of a livid blue, becomes insensible, and soon dies. Or by breathing the noxious gas that arises from the burning of charcoal the same result occurs. One of the elements of the air, a fifth part of its bulk, is a gaz—oxygen. It possesses the power of sustaining the operation of burning. In a stove, for example, if we desire the burning to be accelerated, we increase the draught and let in more air—that is, more oxygen; if we desire to reduce the rate of combustion, we diminish the access of air. If we shut off the supply of air altogether the fire goes out.

So it is in a human being. A burning is continually going on in him, and this it is that enables him to keep warm in spite of the cold of winter or of the night season. No animal can possibly exist without a supply of air to carry on combustion in its body. When we are about to die, and our interior production of heat is ceasing, we grow cold. That air is essential to the life of even the lowest animals is shown by the fact that, if water be taken in which animal-

(1) A Lecture delivered before the Young Men's Christian Association of New York by Henry Draper, M. D., Professor Adjunct of Chemistry in the University of New York.