we find it sending down rootlets into the earth and stems and leaves upward into the air. After the leaves have been fully expanded we shall find the tuber entirely exhausted. nothing but a skin remaining. The same effect will take place if the potato be placed in a warm cellar, it will continue to grow until all the starch and gluten are exhausted when it will cease to increase. If, however, we now place it in the light, it will commence to grow again and increase in size and weight. If we weigh the potato previous to the experiment and the plant after it has ceased to grow in the dark, we shall find that the weight of the latter is a little

more than half that of the original tuber. The question then is, what has become of the material which filled the sac of the potato? The answer is, one part has run down into carbonic acid and water and in this running down has evolved the power to build up the other part into the new plant. After the leaves have been formed and the plant exposed to the light of the sun the developed power of its sap decomposes the carbonic acid of the atmosphere and thus furnishes the pabulum and the power necessary to the farther development of the organization.

The same is the case with wheat and all other grains that are germinated in the earth.

Besides the germ of the future plant there is stored away around the germ the starch and gluten to furnish the power necessary to its development, and also the food to build it up until it reaches the surface of the earth and can draw the source of its future growth from the power of the sunbeam.

In the case of fungi and other plants that grow in the dark, they derive the power and the pabulum from surrounding vegetable matter in process of decay or in that of evolving power.

A similar arrangement is found in regard to animal organization. It is well known that the egg continually diminishes in weight during the process of incubation

and the chick when fully formed weighs scarcely more than one half the original weight of the egg. What is the interpretation of this phenomenon? Simply that one part of the contents of the shell has run down into carbonic acid and water and thus evolved the power necessary to do the work of building up the future animal. In like manner when a tadpole is converted into a frog the animal for a while loses weight, a portion of ~~the~~ its organism, its tail has been expended developing the power necessary to the transformation, while another portion has served for the material of the legs.

What then is the office of vitality? We say that it is

analogous to that of the engineer who directs the power of the steam engine on the execution of its work. Without this on the case of the egg the materials left to the undirected force of affinity would end in simply producing chemical compounds sulphuretted hydrogen, carbonic acid &c. There is no special analogy between the process of crystallization and that of vital action. In the one case definite mathematical forms are the necessary results, while in the other, the results are precisely like those which are produced under the direction of will and intelligence, evincing a design and a purpose, making provision at one stage of the

process for results to be attained at a later, and producing organs intended evidently for locomotion and perception. Not only is the result same as that which is produced by human design but in all cases the power with which this principle operates is the same as that with which the intelligent Engineer produces his result.

This doctrine was first given in a communication to the American Philosophical Society in December 1844 and more fully developed in a paper published in the Patent Office Report in 1856.

The publication in full of three of the series of investigations herein described

was made in the Transactions of the American Philosophical Society. Others were published in Silliman's Journal and both these are noticed in the Royal Society's Catalogue of scientific papers, but the remainder of them were published in the Proceedings of the American Philosophical Society and are not mentioned in the work just referred to.

In 1846 while still at Princeton, I was requested by members of the Board of Regents of the Smithsonian Institution, which was then just founded to study the will of Smithson and to give a plan of organization by which the object of the bequest might be realized.

My conclusion was that the intention of the donor was to advance Science by original research and publication, that the establishment was for the benefit of mankind generally and that all unnecessary expenditures on local objects would be violations of the trusts. The plan I proposed for the organization of the Institution, was to assist men of science in making original researches, to publish these in a series of volumes and to give a copy of these to every first-class library on the face of the earth.

I was afterwards called to take charge of the Institution and to carry out this plan which has been the governing policy of the Establishment from the beginning to the present time.

which has been the governing policy of the establishment from the beginning to the present time.

One of the first enterprises of the Smithsonian Institution was the establishment of a system of simultaneous meteorological observations over the whole United States, especially for the study of the phenomena of American storms. For this purpose the assistance of Prof. Guyot was obtained who drew up a series of instructions for the observers which was printed and distributed in all parts of the country. He also recommended the form of instruments best suited to be used by the ob-

servers and finally calculated with immense labor a volume of meteorological and physical tables for reducing and discussing observations. These tables were published by the Institution and are now in use in almost every part of the world in which the English language is spoken. The prosecution of the system finally led to the application of the principles established to the predictions of the weather by means of the telegraph.

Prof R. S. McCulloh during his connection with the College made an extended series of observations and experiments on the condensation of water

and alcohol in order to determine by the use of the hydrometer the amount of spirits in a given quantity of the mixture for the purpose of collecting duties and these investigations were published by the Government in a series of Tables. He also made a series of elaborate investigations of the amount of crystallizable sugar contained in various syrups for the excise operations of the Government.

Joseph Henry

Washington, D.C.
Dec 4. 1876