control lower levels of causation in two ways, with and without overriding the laws of conservation.

We are, however, without any evidence as to the conditions under which creative causation comes into action, and particularly under what conditions the barriers between different strata of reality cease to act as barriers. We would expect particularly deep causation to come into action on such occasions; but the dematerialization of mass into energy when an electron and a positron collide would hardly fit in with such an hypothesis.

G. A. DE C. DE MOUBRAY

Le Marais,
St. Mary,
Jersey, Channel Islands,
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PHILOSOPHICAL NOTES

On Motion as a Cause

For many years Swedenborg's *Principia* was unique in that only in its pages could be found an explanation of the substantial particles in terms of motion. For example, the existence of the first finite is given in terms of the motion of first natural points. Today it has become commonplace among modern physicists to attribute the existence of particles to motion, and, further, to ascribe mass to the particles as due to this motion.

For example, in an article in the *Scientific American* for July, 1957, on "Elementary Particles" by Gell-Mann and Rosenbaum we read: "The photon always travels with the velocity of light (denoted by the letter C); it can never be at rest. Because of its motion it possesses energy. It therefore also possesses mass, according to the famous relation $E = mc^2$. But the mass exists only by virtue of the motion. The electron, proton and neutron, on the contrary, can be at rest. Each has a mass when at rest and a corresponding rest energy. (When in motion, of course, they have additional energy and mass.)"

"Our Principia in a Nutshell"

In his *Principia* Swedenborg says: "I would observe, then, that in every bubble of water is contained all that had previously existed from the first simple; every genus of finites, actives and ele-

mentaries of which we have treated in the course of our present work; so that in a small bubble is latent the whole of our visible and invisible world. We have thus the macrocosm in the microcosm; the world in a particle; the whole of our *Principia* in a nutshell" (Part III, X:5). In another place in the same work he says: "There is not a particle in our globe, with the thousandth part of whose nature we are acquainted" (Part III, II:3).

An example in modern science is the hydrogen atom. The combination of hydrogen with other elements results in the whole chemistry of acids. The presence of the free hydrogen ion in solution is the basis for voluminous studies in applied chemistry; its combination mainly with oxygen and carbon is the basis of the vast subject of organic chemistry. It was the study of the spectra of hydrogen that was the principal basis for atomic theory for many years. More advanced studies in this field dealt with lithium, sodium and potassium as "hydrogen like" elements; and now, in nuclear studies, the nucleus of the hydrogen atom is not only one of the most important particles, it is also one of the very important tools of research in that field. Known as a proton, it is accelerated under high voltages and used as a projectile to bombard other particles for the purpose of studying them. All this! and yet we have not mentioned the action of the negative electron that, in the normal hydrogen atom, rotates about the nucleus. The electron forms the basis for much study in a vast field known as Solid State Theory. Nor have we mentioned the positive electron which is ejected from the proton together with a more recently discovered particle (massless?) called the neutrino. Neither have we mentioned the study of the possibility of the so-called creation and annihilation of matter through the formation of electron pairs and their combination, respectively, nor the possibility that the proton is a portion of the neutron. This listing could be extended.

If we understood the hydrogen atom, we would surely understand a large percentage of modern physics and chemistry, and many questions would be answered that are posed by physicists today. Careful consideration of this would give some feeling of the momentous significance of Swedenborg's words: "There is not a particle in our globe, with the thousandth part of whose nature we are acquainted."

E. F. A.