may be restrained and again developed by addition of water.

Methyl orange, cyanine and coralline were similarly demonstrated.

A letter was read from the General Secretary stating that "at the closing session of the mid-winter meeting at Columbia University, December 28th, by unanimous vote, the cordial thanks of the Society were extended to the New York Section for the bountiful hospitalities of the Section, which were so heartily enjoyed by the members of the Society during the eighteenth general meeting."

DURAND WOODMAN,
Secretary.

DISCUSSION AND CORRESPONDENCE.

REPLY TO CRITICS.

SUPPOSE a house just finished is empty; suppose that it is painted inside and out so as to conceal from vision everything but the paint. Suppose I come upon such a house for the first time and consider it a body of paint, for paint is the only thing that appears at first. In time I discover that it is made of bricks. At first it had the appearance of paint; now it has the appearance of paint and bricks. After further investigation I find that it is partly of wood, for wood appears in its structure. Now, I conclude that it is paint, bricks and wood. By further investigation I find that it is composed partly of iron. Now, I consider it as paint, bricks, wood and iron. Then I might investigate paint, bricks, wood and iron to discover their chemical constitution and the biological history of wood, and new facts would appear. I might go on indefinitely to show how new things are discovered in the building, both in structure and in purpose, and the new things discovered will appear to me. Those already mentioned are enough for this illustration.

Common sense says that paint is paint. The metaphysician says that paint is appearance; that there is no paint as paint, or at least all we know about it is appearance. The same may be said with regard to the bricks. Common sense says bricks are bricks, whether they appear or not; the metaphysician says the bricks are only appearances. Common sense says there is wood, whether it appears or not; the metaphysician says no, it is only appearance. When we discover the iron, common sense says there is iron in this structure, whether it appears or not; the metaphysician says no, there is only appearance.

Let us get a learned name for appearance. Let us call appearance 'phenomenon,' for that is the Greek word meaning appearance. Now, common sense says that paint, bricks, wood and iron are paint, bricks, wood and iron, respectively, and that appearance is appearance; but our metaphysician says that all of these things are only appearance and we call appearances phenomena; therefore, this house, with all its appearance, s only a concatenation of phenomena. Ofttimes it is asserted that the world is a phenomenal world. Those who make this assertion believe that the world is only appearance. Common sense says that all things of the world exist and manifest themselves by appearance, but that they exist whether they manifest themselves or not. Metaphysic says that the things of the world do not exist as they appear, but that their substrates exist, and that these substrates manifest properties which are not the things themselves. The properties are only illusions—there is no iron, but there is a substrate of iron which manifests certain attributes which are illusions.

In modern times there are two ways in which these supposed illusions are explained. In one way the attempt is made to show that the substrate of things is psychosis or abstract mind; the other is the attempt to explain that the substrate is force or motion. Thus, metaphysicians may be classified as idealists and not materialists.

Common sense says that we may know a body imperfectly and by investigation cognize more and more about it, and, however, simple a body it may be, we may, by investigation, learn very much about it and still not know all.

The idealist says this is true, but by further investigation everything will turn into appearance until we resolve the body into a substrate, and its substrate will be found to be psychosis, which is timeless and spaceless.

The materialists say we know more and more about a body until we resolve it into motion or force, some holding that force creates motion, others that force is a mode of motion; so that

this school is divided into two classes—those who believe force to be the substrate of bodies, and those who believe motion to be the substrate of bodies. Those who believe that force is a substrate believe that force is attraction and repulsion; those who believe that motion is the substrate believe that attraction can be resolved into repulsion and hence that force is a mode of motion.

The idealist believes also that force is attraction and repulsion, for this seems necessary to his doctrine that psychosis is the substrate of phenomena.

In SCIENCE for January 27th two eminent men review my little book on 'Truth and Error.' One seems to be an idealist, for he is marked with the paint-pot of this philosophy, though he repudiates it. The other seems to be a materialist as the term was defined in the book. Of course, the terms used do not characterize their theology or their religion, but only their philosophy. The philosophy of the second writer would be characterized better if it were called dynamism; but the popular designation is materialism, and the use of the term dynamism would probably offend Mr. Ward. Mr. Ward is the most illustrious champion of this philosophy in America, and he has written a work on this subject, entitled 'Dynamic Sociology,' which is dynamic philosophy applied to sociology.

During the last decade of this century great activity has been developed in scientific psychology. The new science is confronted with this problem, which is solved in the way I have tried to indicate. All psychologists are drawn into a whirlpool of disputation, and those scientific men engaged in other departments of research often drift into it.

Usually the idealist sneers at a philosophy of science, for 'science deals only with phenomena,' mere appearance—and philosophy deals with the substrate, the thing in itself—psychosis. Dynamism always advocates a mechanical philosophy when its votaries attempt to philosophize, as Ward has done and as Spencer did before him.

In the same number of SCIENCE to which reference has been made there is a review of Mivart's book, probably from the standpoint of a dynamist, but perhaps from the standpoint of an idealist, for this philosophy is of many kinds. Notwithstanding the denial by the idealist of a possibility of a philosophy other than idealism, the warfare between the two philosophies is rife, and at the present day is the subject of disputation, as evolution was the subject a few years ago. Every new publication on the broader aspect of science takes up the gauntlet for one or another of these subjects. Now, I believe that these metaphysical philosophies are mutually destructive, like the cats of whom Mr. Brooks speaks; yet I believe that both contain an element of truth, and that the Kantian doctrine of antinomies, which was elaborated into a doctrine of contradictories by Hegel, is a fallacious logic.

Of course, I do not expect to please the idealist or the dynamist, nor do I expect to kindle the love of those who believe that all philosophizing is in vain, but of this class there are comparatively few. There are engaged in scientific research many men who cultivate a special field and who attempt to harmonize opinions only within that field. There are others who survey larger fields and make wider attempts to arrive at congruities, and there are still others who attempt to make all fundamental doctrines of science congruous, and this is what I have attempted to do in my book.

Consciousness and choice, as the fundamental judgment, certainly inhere in animals, and I have proposed as an hypothesis worthy of consideration that all particles have these elements of judgment. Besides animals there are other bodies in the universe; these are molecules, stars, rocks and plants. In the science of chemistry it is universally recognized that there is a phenomenon in chemical reaction which is called affinity and which eminent chemists believe to be choice. The late T. Sterry Hunt was an advocate of this doctrine. If there is choice of one particle for another there must be consciousness, and this is the doctrine held by Hunt. I merely cite the example and affirm that there are many such chemists. Chemistry is not my special field of investigation, but the doctrine which I learned from chemists and which has been advocated by many others, especially physicists, like Herschel, is taken by

me as an hypothesis to be applied in the new science of psychology, which I do try to cultivate.

I have already set forth that choice is the relational element which corresponds to the essential element—consciousness. Now, by this hypothesis, consciousness inheres in every particle of matter. It does not inhere in bodies themselves as such, but only in their several particles, unless they are animals, for both require an organization for the faculties of mind in order that they should have judgments and concepts. The faculties of mind do not exist in molecules, stars, rocks and plants as bodies. The element of consciousness, together with the element of choice as inference, is exhibited only in the particles of what I call mechanical bodies to distinguish them from animal bodies.

In molecules we have the affinity of the particles, but the particles themselves are incorporated only as numbers. The many particles constitute the organ of the one molecule. Hence chemistry is the science of kinds, but of natural kinds as distinguished from conventional kinds employed by man in the arts. In the molecules we discover a discrete degree of incorporation and organization, because in nature incorporation or evolution is accomplished in stages by properties.

The molecule has not consciousness as a body or kind, but it has consciousness in its several particles. Here we must understand the distinction between organization and incorporation. When we consider incorporation we consider the one body; when we consider organization we consider the many particles of the one body. Organization and incorporation are thus reciprocals. When we consider organization we consider the relation of parts to one another; when we consider incorporation we consider the whole body. The incorporation of a molecule is by the affinity of its particles, and the particles are the organs of the molecule, and they make of the molecule a new kind of substance. Modern chemistry recognizes this fact, for it is taught that when molecules combine with molecules to make molecules in a higher order or kind, the combination is of ultimate particles and not a mere juxtaposition of constituent molecules. So I interpret the teachings of the new chemistry. For example, solution is now held to be chemical action and to involve affinity, and is not a mere mechanical mixture of the matter held in solution. This molecule is a body with organs; as particles they perform the function of incorporation for the molecule.

The nature of incorporation and organization may be illustrated. A hundred persons may meet to organize themselves into a society. They organize by first electing a president, the executive officer who governs the body; then they elect a secretary, who is the memory of the body; they may elect a treasurer and other officers; I need not extend the subject beyond the president, secretary and treasurer. Now, a group of members constitute a body organized with a president and secretary. In this manner the hundred individuals become one body. In the same manner in every body of nature—molecules, stars, rocks, trees or animals—there is an incorporation which is effected by organization.

The particles of the society are its individual members; every one has consciousness, but the body itself has no consciousness; so the molecule has consciousness in its particles, but there is no consciousness by the molecule. In nature all the particles of a body are organized; but in social bodies all the members become the body, and every one is an organ of the body.

In stars, kinds of molecules are incorporated into forms as globes; the kinds thus become the organs of form. Here we have another discrete degree of incorporation or evolution. While the forms as bodies or stars are considered when we consider the incorporation, the parts of the body as molecules are considered when we consider its organization. In the stars there are no organs of mind, but there are organs of form which are molecules, and in the molecules there are organs of kind which are the particles. So the star body has consciousness and choice only in its ultimate particles, for it has as a body no organs of mind.

In rocks, forms are incorporated as forces in which stresses and strains are produced. The forms are organs of force. Here we have a third discrete degree of incorporation and organization. To see how this incorporation is

effected by organization we must consider the spheres of geonomy. They are the centrosphere, lithosphere, hydrosphere, atmosphere and ethrosphere. These are organs of stress and strain which cooperate with one another in producing a succession of changes. Strains are set up in one geonomic sphere which produce stresses in another, and thus we have organs of force. These organs of force are forms, so that incorporation implies organization, and organization implies incorporation. Here we have no organs of mind; but we have organs of force, which are forms, and organs of forms, which are kinds, and organs of kinds, which are ultimate particles.

Plants are incorporated as causations in which an antecedent is followed by a like consequent. The child, or consequent, is like the parent, or antecedent, thus developing heredity. The forces now are the organs of causation, and we have a fourth discrete degree of incorporation and organization. Still, there are no organs of mind, but only organs of force. The forces have organs of form, the forms have organs of kind, and the kinds have organs of particles; consciousness and choice, therefore, still inhere only in the particles.

Animal bodies are incorporated as minds, and the organs of minds are causations. Here we have a fifth degree of incorporation and also of organization. With bodies incorporated with organs of mind, which are causations, and with bodies of causation incorporated with organs, which are forces, and with forces incorporated with organs, which are forms, and with forms incorporated with organs, which are kinds, and with kinds incorporated with organs, which are particles, all of the properties of matter are incorporated. Now, the animal body has consciousness because it has organs for the function, while the particles themselves have consciousness. Thus the body has consciousness as a body, as well as the particles, severally, of which it is composed. All of the mechanical bodies have consciousness and choice, but only in their particles; but animal bodies have organized consciousness, which is mind.

This is the conclusion we reach: Molecules, stars, rocks and plants have consciousness and choice only in their particles, but in animals consciousness and choice are organized as mind.

Hegel taught in his *Phenomenology* that every word, whenever used, has all its meanings, and he proceeded on this theory in the development of his logic. Mr. Ward seems to hold the same doctrine. I hold that whenever a word used in science is fundamental it should be used only in one sense, and this one sense should be retained throughout the discussion. Let me illustrate this: In metaphysic the word *quality* is used as synonymous with *property;* sometimes it is used to signify all of the properties and sometimes only one of them. Kind, as I have shown, is one of the properties, and it is very often used as a synonym for kind. I have tried to show in this book that it is used also to show the relation of bodies in their properties to human purposes, which relations are always either good or evil depending upon the point of view. Now, I have attempted and succeeded, as I believe, in using three terms for these three different meanings: *Properties* for the name of attributes that inhere in the object; *kinds* for the name of one property in all its degrees of relativity, and *qualities* to designate those attributes which arise through the relation of properties to purposes. I use the word *attribute* as a generic term which has two species—qualities and properties; and each of these species is again composed of five subspecies. This is offensive to Mr. Ward, not only in this particular case, but in all similar cases. In the book under consideration I have coined very few words, but I have tried in all fundamental cases to use a word always with the same meaning. There cannot be a science of psychology until its terms are used with constant meanings.

In folklore we often find seven to be a magical number; in the same manner we find nine and other numbers are considered magical—that is, they have occult meanings. The origin of these meanings goes back to savage cosmology. Now, Mr. Ward supposes that I use the number five as if it were magical. But let me assure him that the magic is not in the number. If I pay five dollars to every one of a hundred men because of labor performed, I shall not be accused of using five as a magical number, but

my conduct will be interpreted as my judgment of compensation. The significance of the terms used depends on the fact that there are five essential constants of matter found in every particle of the universe; these are unity, extension, speed, persistence, and consciousness. If the hypothesis that affinity is consciousness and choice fails, and affinity is still unexplained and consciousness is found only in animal bodies, then there are but four essentials in inanimate matter, while there are five in animate matter, and whenever a new animal body is evolved a fifth essential is evolved.

If the five essentials of properties are found in every body this should appear not only as affinity, but it should appear in a series in all bodies. This I have tried to show. I have called the essentials *concomitants*, and this term seems to offend Mr. Ward, but the term concomitant is used in the same sense in all modern and scientific psychology. Again, I have tried to show the nature of reciprocality; as, for example, when I set forth that quantities or properties that can be measured are the reciprocals of categories, or properties that can be classified. When I come to the second volume I shall greatly multiply these series and shall then systematize them into an argument; but I shall try not to make a pentalogic series where none exists, as Mr. Ward has done in the tables which he thinks he has compiled from my book. I find scientific men marshalled in three camps—one as champions of idealism, another as champions of dynamism, and a third rejecting all philosophy as vain. I have begun on the attempt to propound a Philosophy of Science.

J. W. POWELL.

ARTIFICIAL DREAMS.

TO THE EDITOR OF SCIENCE: Maury and some others have, to a certain extent, experimented on artificial dreams, but, at my instance, my students, Messrs. Matthews and Morley, undertook a series of experiments which may have some value in further illustrating the subject and pointing the way to further work. The method employed was for the one at an early hour in the morning to stimulate sensation in the other for a brief period, often 30 seconds, and then waken the dreamer, who at once recorded the dream. In general, the dreamer did not know beforehand what stimulus was to be applied.

The olfactory element in dreams being little recorded by experimenters, particular attention was paid to this point. Smell was slightly stimulated with heliotrope, and visual images mostly resulted, but in ten cases the dream was also olfactory, twice the dream being of a bunch of *Violets* and of smelling them. In a very strong stimulation of heliotrope the dream was of being choked with smell of perfume. This dream was in its early part composed of remarkable and vivid visual images. The dreamer flew on an air-ship through a snow-storm, and then over a country covered with white enamel and filled with white elephants, one of which pulled down the air-ship but soon released it, and then the whole herd flew off 'like so many butterflies.' This imagery has the characteristic quality of opium dreams.

In taste stimulation by salt and water there was a dream of eating olives.

In stimulating hearing repeatedly with a middle C tuning fork, within an interval of two weeks, a visual-auditory dream was repeated in 'every detail.' A fork in a lower octave gave dream of hearing fog horn, but no visual image. Another time it was the roar of a lion, but no visual image.

The record gives for temperature stimulation 2 pure temperature dreams, and 3 visual and temperature; for pressure stimulation 2 visual and pressure, for smell stimulation 1 pure smell and 6 pure visual and 10 visual and olfactory; for hearing stimulation 7 pure auditory, 6 visual and auditory.

These reports suggest that artificial dreams may be divided into three classes: First, the simple dream, where the stimulus is removed at the least sign of reaction, and the consequent dream is usually vague and momentary. Second, the cumulative dream, where the stimulus is continued and made to increase to even the highest point of excitation, and the dream has a definite intensifying development till the waking point. (An interesting dream would probably be produced by a metronome brought nearer and nearer, either directly or through a tube connected with the dreamer's ear.) The