

shall have to live in their midst like that of fish in water. So these are not cause but the effect, take the opportunity of the weakness of some organ and lodge in them. Thus the disease is in the vitality which keeps the body and soul and makes the soul to work harmoniously and systematically with every atoms and molecules of the body. Any derangement of this vitality is disease.

(To be continued.)

Physics of High Dilutions

GUY BECKLEY STEARNS, M. D., NEW YORK.

FOR

THE FOUNDATION FOR HOMŒOPATHIC RESEARCH

Scientific knowledge of the ultimate nature of matter is purely conceptual. High dilutions, which term refers here to homœopathic high potencies above the 200th (100/200), probably represent one of the manifestations of matter in its ultimate form and they offer an unique and possibly the most direct means of investigating the ultimate. Probably the physical laws governing high dilutions differ from those which govern crude solutions as much as the laws governing high-frequency electricity differ from those governing low-voltage direct currents.

Since the laws governing them are not known, a discussion of the physics of high dilutions must be merely suggestive. On the other hand, concepts of the ultimate of matter which are arrived at by other methods can be questioned, unless confirmed by the facts related to high dilutions.

CONCEPTS OF PRIME MATTER.

Mankind has always wondered about the nature of

prime matter. There have always been philosophers who were keen observers with great intuitive insight. There were the earlier myths of two or three thousand years ago in which prime matter was thought to be a solution from which the earth crystallized out. There was the concept of Democritus over 400 years B. C., wherein matter consisted of discrete atoms with empty space between. Aristotle did not accept this, so for many hundred years prime matter was classified under four heads—Earth, Air, Fire and Water—with water as the most important element, because it was thought that it could be transmuted into all of the others. The Atomic Theory was again revived about 300 years ago. The discovery that there are many simple elements followed, and the relationship between them was formulated into laws until the simple liquid of the Ancients, and the four basic elements of the Greeks had expanded into the 92 elements which we know today. Until the discovery of Radium, the atom was conceived to be the smallest particle of matter, but during the last 30 odd years there has developed the present concept: that matter consists of electrons and protons. All electrons are conceived to be alike, the different elements being made up of different numbers of electrons revolving in planetary orbits around a central nucleus. Today we are guessing as to the ultimate nature of electrons and protons, just as humanity, from time immemorial, has been guessing as to the nature of things.

By some, the electron is conceived to be a particle, whilst others believe it to be so much energy in the form of an electric charge. Lately, the electron has been shown to have not only the characteristics of a material particle but also the characteristics of a wave. This paradoxical structure does not fit into anything with

which the human mind has had experience. Another paradoxical fact has to do with the orbit which an electron occupies in an atom: for each kind of atom there is not only a definite limit to the number of possible orbits but there is a definite and uniform distance between all possible successive orbits. The paradox lies in the fact that an electron can jump from one orbit to another, and does so, in no time at all, without occupying any space between the orbits. For the reason that we cannot know the true nature of these so-called ultimate particles, our conception of electrons are necessarily only symbols for the entities which they represent. Even less is known concerning the nucleus of the atom. It is known to be much smaller and much heavier than the electron and the distance between the nucleus and the revolving electron of the atom is relatively as great as the distance between the sun and its planets. Thus the mass of an atom is mostly empty space. Regardless of its ultimate characteristics, in every day life matter has very real qualities and states which are obvious to our senses.

STATES OF MATTER

In the Earth, there are three common states of matter—solid, liquid and gaseous. Temperature and pressure determine the state in which matter shall be. Water is the one substance which appears in all three states at the pressure and temperature normal to the surface of our earth. Boiling water can be subjected to a pressure which changes it to the solid state and this is just as much ice as the solid water in our refrigerator is ice, and an egg encased in this hot ice would be cooked just the same as though it were in water in the liquid form at the same temperature. If the pressure of water be reduced sufficiently, such as it may be on the top of a

high mountain, water boils and enters into the gaseous state at too low a temperature to coagulate an egg. Because the earth's surface is solid, matter in the solid state is apt to be accepted as its most usual form. As a matter of fact, the gaseous state is the most usual state of matter throughout the whole universe and matter in the solid state is one of the rarest. The billions of stars, including our own sun, are composed of the same elementary substances as the earth, only in the form of gas. However, star-gas and earth-gas have markedly different characteristics. When we think of a gas, we think of something tenuous, with a consistency something like that of our atmosphere. Really, the density of gas varies with the conditions under which it happens to be. Some of the stars have the mean density of the atmosphere in which we live, while others have a density equal to or greater than that of platinum and yet are supposed to be gaseous. This last puzzling fact is explainable by the conditions within the stars. The difference between a gas and a liquid or a solid has to do with the closeness with which the atoms are crowded together. In order to be a gas, there must be room for the atom to move freely about. On this earth, when gas is sufficiently compressed to impede the freedom of motion of the atom, matter assumes a liquid form and when the molecules are crowded closely enough together to stop the motion of the individual molecules, matter assume the solid state. When matter is subjected to pressure it becomes heated ; the greater the pressure, the greater the degree of heat. When compared with the earth, the mass of a star is enormous. This means that the gravitational pull toward the centre of a star is proportionately enormous and the pressure within the star becomes so great as to cause a temperature of millions of degrees.

This great temperature is accompanied by an enormous expenditure of radiant energy which in turn prevents the electrons from remaining in their orbits around the protons. Since nearly all of the bulk of an atom is empty space, only a minute fraction of an atom is occupied by the nucleus. When most of the electrons are stripped off, the small emasculated atoms can be crowded into very much smaller space and still have the freedom of movement which is necessary for the gaseous state. It is computed that, if all the atoms comprising the earth were stripped of all their electrons and the nuclei were crowded together, they would occupy a space only the size of an orange. Atoms which have lost part of their electrons are known as ions. The whole of the sun is composed of three states of matter: ionized atoms in the form of gas, free electrons and radiant energy. It sounds strange to speak of radiant energy as matter but modern physicists conceive matter and energy to be manifestations of the same thing. Whatever form matter assumed before it began to condense into star-form, when it does so condense the great heat caused by condensation transforms a part of the star-material into radiant energy. During every second of time, the sun is radiating away four million tons of its substance. The earth receives the minute fraction of one hundred and sixty tons a day of this energy, in the form of radiant energy. This is partially represented by the light and heat which we receive from the sun. All forms of life, all rain, all winds, in fact all the conditions necessary for life are dependent on the radiant energy coming from the sun.

It is generally accepted that the matter which is constantly radiating away from the sun and the stars is lost for ever and that it is only a question of time when the whole universe will have run down and become dead.

Milliken thinks differently because of the following fact. A form of radiant energy having a much shorter wavelength than the radiant energy coming from the sun reaches the earth. Milliken has investigated this and finds that it comes from the far reaches of interstellar space. He believes that the radiant energy resulting from the annihilation of star-matter recombines into matter somewhere in space and that the cosmic rays are the result of this rebirth.

The foregoing brief resume of the various state assumed by matter, together with some of the successive concepts of the essence of matter, shows how inadequate are our senses to reveal any of its ultimate qualities or even to make contact with many of its protean forms. Each concept has been related only to the imperfect knowledge of its day and new knowledge has necessitated each successive concept.

Although the materials of the earth and its atmosphere are basically the same as those in the sun and stars, they are on the earth in a much more complex state. The mass of the earth is such that the internal heat resulting from its gravitational pressure is low enough to allow the atoms to draw to themselves their full complements of electrons and to retain them in their orbits. The heavy elements condense to the liquid or solid form while the lighter ones remain as gas. The atoms of most elements have, in their outer orbit, either too many or too few negatively charged electrons to neutralize the positive charge of the nucleus. The elements with a deficiency of electrons seek those with a corresponding excess and join with them, thus forming the various chemical compounds which compose the earth. A few elements, such as helium, have just the right number of electrons to satisfy the proton, so they are inert, because

they can never form compounds with other elements. The heavier material goes to the centre of the earth and the lighter floats on the surface as slag floats on molten metal. In fact, nearly all of the land above water is slag. The gases form a layer outside of all the rest. Because of the great affinity between oxygen and hydrogen, these two elements unite as water when the temperature becomes low enough and this later condenses and runs into all the depressions of the outer crust. It is only when matter assumes the liquid state that solutions can occur.

SOLUTIONS.

Scientists are not agreed as to whether a solution is the result of a chemical or of a physical process. For the purpose of discussion of high dilutions, this problem has no significance. It is enough to say that substances having a certain kind of affinity for each other can enter into a solution.

When a solution consists of a solid dissolved in a liquid, the liquid is called the solvent and that which is dissolved is called the solute. Only a certain amount of the solid can be dissolved by a given amount of the liquid and when all that the liquid can hold has been dissolved, the solution is said to be saturated. Certain liquids, such as alcohol and water, can come into a solution with each other in any proportions. Heat will hasten solution and increase solubility. For the sake of clarity in this discussion, consider temperature, pressure or other factors (except the one under discussion) to be standard.

Everybody is familiar with water and with ordinary salt and, as water is one of the most common of solvents, and as, between water and salt, there is a marked attraction, a solution combining the two can represent the principles of solution in general.

There exists between substances in solution and gases a far-reaching analogy. Between the molecules of gas there exists a mutual repulsion which keeps them constantly in motion and uniformly dispersed throughout the volume of a containing vessel. The molecules of a substance in solution are also dispersed uniformly throughout the solvent, although the mechanism of their diffusion is different. There is an inherent expansive force within the gas which causes it to expand but, between water and salt, there is a mutual attraction stronger than the cohesive attraction of salt for itself. The result of this attraction is that the salt is dispersed through the water exactly as if there were, within it, an inherent dispersive force.

Another analogy between a gas and a solution has to do with the mathematical laws regarding density and pressure. To wit, the density of a gas at a given temperature is in direct proportion to its pressure and the density of a solution is in direct proportion to its osmotic pressure.

DILUTIONS.

A dilution is made by adding more water to a saturated solution. Although the amount of salt that can be dissolved in a given body of water is limited by the saturation-point, the proportion of water that can be used to dilute a saturated solution is unlimited.

The homeopathic method of making a dilution by the centesimal scale is to dilute one part of a saturated solution with 99 parts of water. This is agitated and succussed which quickly brings about complete dispersion. The second dilution is made by adding to one part of the first dilution 99 parts of water and this is vigorously shaken. Each succeeding dilution is made from the previous one in the same way.

Going back to our analogy between gases and solutions, if we assume the expansion-force inherent in a gas to be 10 units, 10 units will represent the force which the gas exerts against the walls of its container. If we assume in a standard dilution of salt and water that the cohesive attraction in a salt crystal is 5 units and the mutual attraction between the salt and water is 10 units, the result in expansive force exerted by the water on the salt will be the difference between the two, that is, 5 units.

Now let us take two vessels, one containing gas and the other containing a saturated salt-solution. If a suction-pump be applied to the opening of the vessel which contains gas and 99% of the gas be withdrawn, there will be brought about a negative pressure in the vessel which is known as a vacuum. In a vacuum, the molecules of gas, which remain in the vessel move with greater freedom and increased speed and the space within the vessel has different properties as regards electric currents, etc., than it had when the gas was at its original pressure. If, to the vessel containing the saturated salt solution, enough water be added to dilute it 100 times, in such dilution there remains only one one-hundreth the amount of salt necessary to satisfy the attraction which the water has for the salt, and we have, between the salt and the water, a state analogous to that between the suction-pump and the gas within its containing vessel. The pump causes a vacuum within a group of gas-molecules, while the water causes a vacuum within a group of salt-molecules.

In the salt-solution, that which, at the saturation-point, was a mutually satisfied attraction between salt and water, becomes a 100 to 1 leverage of expansion exerted by the water on the salt, and each succeeding

dilution increase by 100 this leverage over the preceding one. Whereas there is a limit to the degree of vacuum which can be produced, the analogous state in a dilution can be carried up to any desired degree.

The question is at what dilution does it become impossible for us to demonstrate effects attributable to salt? By spectroscopic and other physical means, the limit is somewhere around the 13th dilution.

The experiences of thousands of homœopathic physicians with high dilutions during the last hundred years, both in provings and in clinical prescribing, do not indicate any limit to the degree of dilution which remains effectual. This experience is based on reactions occurring in individuals who were especially sensitive to the drugs being used. Since no two living beings in the whole world are exactly alike, it is evident that a person used as a re-agent in an experiment is necessarily a variable quantity. However, drug-provings reveal that there are type-groups which show similar susceptibilities to a given drug, and, if experimental or clinical results have any scientific value, results based on special sensitiveness should be more valuable than those obtained from heterogeneous groups, many individuals of which yield symptoms only when forced by heavy dosage.

Psychic factors enter into experiments involving the human re-agent. To eliminate these, the Foundation for Homœopathic Research conducted a set of experiments with high potencies; one on guinea-pigs and another on fruit-flies, which have been reported at previous times.

The guinea-pig experiment were continued over a period of two years, the animals being dosed with ordinary salt in potencies of from the 30th to the 2000th. Altogether, 212 animals were used and the experiments were under strict control. The experiments were begun with

animals about two-thirds grown. There were definite general effects, the most marked being a slowing of the rate of growth, a lessening of the frequency of birth, and the final abolition of virility. All this resulted in a progressive slowing of the normal increase in numbers of the proving-group until there was no longer an increase, and then a gradual decimation until there remained only a fraction as many as there were in the original groups, in contradistinction to the steady geometrical increase among the animals of the control-groups.

The fruit-fly experiments were conducted by Dr. Mary Stark. There is a strain of fruit-fly (known as *Drosophila Melanogaster lethal No. 7*), the members of which are hereditarily affected by tumour-growths. The tumours occur in one-half of the males, making their appearance in the larval stage and killing the larvæ before they emerge into the following state. These growths have the characteristics of cancer.

Various colonies of these flies were dosed by Dr. Stark with *Arsenic* in the 30th and 200th potencies and other colonies were dosed with the 30th and 200th potencies made from a triturate of the tumours themselves. Both the 30th and 200th potencies of *Arsenic* freed certain colonies of their hereditary manifestations. Potencies of fly-tumours did the same, only not in as many instances.

What studying in Germany, Dr. W. J. S. Powers—one of our own I. H. A. members—interviewed many research men of that country. One experimenter was able to demonstrate material substance in dilutions of colloids as high as the 30th and concluded that not enough is known about high dilutions to fix any limit. Dr. Powers interviewed one of the research-workers in the Eppendorf Hospital in Hamburg. This man was experimenting with the effects of the tissue-salts on paramecium. On

these animalculæ, he was able to cause effects with succeeding dilutions up to the 12th, above which point they ceased to occur. After repeating the experiment many times, he one day decided to carry the dilutions a few points higher and was astonished to find that effects appeared again at the 17th dilution and that they continued to occur with each succeeding dilution until he reached somewhere above the 30th, without reaching the limit. But he was working alone and the amount of labor involved in sterilizing receptacles, etc., compelled him to stop while results were still being obtained.

Another approach to the problem of high dilution is furnished by phenomena first discovered by George Starr White of Los Angeles, who claims that, in his boyhood, he observed that carrier-pigeons seem to possess a sense of orientation which enables them to find their way through the air at night. Later, after year of experimenting, he found that a change from facing East-West to a position facing North-South causes a change in the human body and that this alteration in the body can be demonstrated by the alteration in pitch of the sound produced by percussion upon certain parts of the body. Also he noted that the same phenomena occur when drugs and other substances are placed in a metal container and the container and the human body are connected by a length of wire.

Abrams, of San Francisco, learned of these facts through White, and found that he could modify the effects by introducing resistance-coils between the person and the substance which caused the effect, and that the effects occurred in different areas of the body when different resistance-coils were introduced. He also claimed that high dilutions of drugs would cause the effects. He experimented with blood and disease products, and

developed a diagnostic system and nomenclature which received a type of publicity that aroused so much opposition from the conservative part of the medical profession, that attention was diverted from the basic discoveries, and, in fact, led to the rejection of his claim that the basic findings were valid.

Around 1920, W. E. Boyd of Glasgow who, under the auspices of the Beit Foundation, was doing research in connection with the nature of the activity in a high dilution, read of Abrams's claims. He obtained Abrams's diagnostic coils and observed results which convinced him that Abrams was dealing with realities. In 1922, the International Hahnemannian Association, without knowing of Boyd's work, appointed a committee to investigate Abrams's claims and this committee arrived at the same conclusion that Boyd reached. Both Boyd and the workers of the I. H. A. committee had difficulty in duplicating experiments with the coils which Abrams had devised. After a time, the I. H. A. investigators dropped the use of Abrams's or any other apparatus and continued to experiment with the basic phenomena. Abrams's apparatus was constructed of a series of coils wound for resistance. Boyd, over a period of years, devised an apparatus having a combination of inductance and capacity, which was introduced into the circuit between the subject and the specimen with which he was working. He then introduced elaborata screening and developed a technique which enabled him to control his findings.

Members of the British Air Ministry became interested in certain of Abrams's claims but failed to find satisfactory substantiating evidence until they came upon Boyd's work. A committee, composed of the members of the Physical Research Department of the War Office, a medical adviser to the Director of Civil Aviation, the

head of the Wireless Research Air Ministry, and a member of the Physical Department of the Air Ministry with Sir Thomas Horder, M. D., chairman, entered into an investigation of Boyd's experiments which they continued for more than a year.

The final crucial tests were repeated at two different dates. In one of these tests, two vials were used, exteriorly identical, one containing granules of sugar impregnated with a drop of the ten-thousandth centesimal dilution of *Sulphur*, and the other containing an equal amount of plain sugar granules. Under strict control, Boyd was able to distinguish between the two vials with a degree of probability of thirty-three million to one in favour of the physical reality of the phenomena.

This test is mentioned here because of other less competent investigations in which there was failure to obtain evidence convincing to the investigators.

The following two quotations from the committee's final report sum up the fact-finding element of their investigation :

"Certain important experiments were carried out in which homœopathic drugs happened to be used as test-substances."

"Certain substances, when placed in proper relation to the emanometer of Boyd, produced, beyond any reasonable doubt, changes in the abdominal wall of the subject, of a kind which may be detected by percussion."

In the meantime, the I. H. A. Committee had continued its investigations until the Foundation for Homœopathic Research took it over. The Foundation's research has been directed to the relationship of the basic phenomena to potentized homœopathic drugs. Twelve different types of reactions have been confirmed as resulting from the presence of a drug (crude or in high potency) which

in a corked vial is bought within a certain distance of an individual. These will be published at another time. Only the report of the Horder Committee will be taken as evidence in this discussion.

(To be continued.)

Department of Indigenous Drug Proving.

NYCTANTHES ARBOR-TRISTIS.

(SEPHALIKA)

BY SARAT CHANDRA GHOSE, M. D. CALCUTTA.

INTRODUCTION.

Nyctanthes Arbor-tristis is now a listed homœopathic remedy of our Materia Medica. It has been prepared from fresh leaves of *Sephalika* (*Siuli*). This new homœopathic remedy was proved by me and it has now turned out to be a valuable homœopathic remedy.

A short Materia Medica concerning *Nyctanthes* was written by me and published in the *Homœopathic World* of January, 1901. Another article relating to this drug was contributed by me to the *North American Journal of Homœopathy* of June, 1901. I was requested by the eminent French Homœopath, Dr. Leon Simon, of Paris, to write an article on this drug for the French Homœopathic Medical Society and complied with his kind request. That article was translated by Dr. Simon and presented to their Society and subsequently published in the *Revue Homœopathique Française* of July, August and September, 1902. Another contribution from my pen regarding this drug was published in the *Cleveland Medical and Surgical Reporter* of July, 1903. A full account of the provings and clinical verifications of this drug was