

EXTRACTS.

Address by Dr. Wiley.

Mr. President, Members of the Association, Ladies and Gentlemen,

I reciprocate the sentiment which has just been expressed by your president, namely, that of mutuality. I should not think this was a proper occasion unless I had the privilege of being here. I believe I hold the unique distinction of never having missed a meeting of this Association. I hope I can continue to hold that distinction for several hundred years to come, as I knew of no event in my public life to which I look forward with more interest than this annual assemblage. I believe I am the one poet, of world-wide repute, who has devoted a volume to the songs of this Association*. I wish you would sing more of them than you do.

I think it is appropriate that I should speak to-day for a short time upon the theme which is uppermost in the minds of the citizens of Washington at this time—cancer week. I have had the opportunity of making several addresses during the week, and I hope it will not be considered out of place to say just a few words here.

It is peculiarly appropriate that one should address a company of chemists on the subject of cancer, because one of the remedial agents which is now in the public mind, as well as in the medical mind, has been provided by the activities of chemists. I doubt whether any informed physician in the country ever thinks of cancer without associating it with the idea of radium. Although radium is not regarded as either a certain preventive or a certain cure for this disease, it cannot be denied that it has some therapeutic value. In a disease which seems to be so resistant to every kind of curative treatment, any agent that gives any reasonable hope of help must be regarded with great consideration. So, the chemist stands very close to the doctor in this Cancer Week which is being observed all over the country.

I am not going to tell you of the symptoms of cancer or of any of the methods which may be provided for its elimination. I can only say that if there be any hope at all for one afflicted with this dreadful disease, it is in its early ascertainment. If you wait too long, there is no remedial agent known to medical science which can be relied upon as at all hopeful.

*Song book of Agricultural Chemist, illustrated by Coffin. Privately printed 1893.

The normal attitude of the individual towards cancer is this: to have a suspicion of every sore of every kind, of every mole or lump, or of any irritated portion of the epithelium. because most cancers are epithelial. While an irritated condition of the skin may not be and probably is not cancer, it is always worth while to give your attention-not only your attention as will lead you to consult your physician in regard to the nature of the irritation. Cancer is a chronic disease and is produced, if we know its cause at all, not so much by a violent wound as it is by continued irritation. You smokers will be glad to know that there are eighteen cases of cancer on the lips, on the tongue, and on the throat of men where there is one in women. Why is this? Every doctor will tell you that it is the smoking habit of men. Now that women are striving after equality, they are learning to smoke, and they will gradually achieve the same distinction in epithelioma that men have already attained. That one organ of the body that is common to men and women, the stomach, is of all organs the most subject to cancer because it is of all organs the most constantly and continuously irritated by improper diet and especially by improper temperatures of the diet. That part of the lining of the stomach through which a very cold or a very hot drink passes is usually the part of the mucous membrane in which cancer has its place. If you will read a poem, in "Beverages and their A~~ff~~eration", you will see a poetic description of one of the great causes of cancer of the stomach. I have the permission of the author to quote it:

"Full many a man, both young and old,
Has gone to his sarcophagus,
By pouring water icy cold
A-down his hot œsophagus"

Avoid extremes of temperature in your food. Avoid the eating of substances which irritate the mucous membrane of the stomach, and thus preserve that organ from its very frequent attack of cancer.

What I think about most on an occasion of this kind is the progress our science has made since we last met. I will confess that with the partial obliteration of my vision it has been difficult to keep up with the progress in chemistry, and naturally I do not try to keep up with its progress in every department. Even if I had as good eyes as I have had, it will be almost impossible. However, I do try to keep abreast with what is going on in my particular line of agricultural chemistry, and just now when I am endeavouring to write the third edition, of the first volume of 'Principles and Practice of Agricultural Analysis', my attention has been called to another very great step in the progress in chemistry, and I want to say a few words about that to-day.

Our ideas of the nature of matter have undergone most remarkable revolutionary changes in my lifetime. When I first studied chemistry it was the old chemistry of Liebig and Lavoisier and the old masters. What they knew was a mouthful. We hardly realize what progress those old masters made, not only in the practice of chemistry but in its theories. Among other things, we learned Prout's theory of the atom. According to Prout, the atom was composed of an indivisible particle of an elementary nature, to which he gave the name protile. Prout assumed that as atoms were made up of increments of like matter—namely, atoms of hydrogen, which was taken as unity—their atomic weights ought to be whole numbers. That was Prout's original hypothesis, but as we learned to determine atomic weights with greater precision, we found that many were not whole numbers. Some were nearly whole numbers and might be regarded as such by the chemists, but others were decidedly not whole numbers. These distinctions were not due, evidently, to lack of scientific accuracy in the determination, and so Prout's hypothesis did not account for existing phenomena in a manner to be generally acceptable. But now, what have we discovered in the history of the evolution of the atom? In the first place, the idea of the atom is inconceivable, as no finite mind can conceive of a particle of matter so small that it is incapable of further division. Literally, an atom is an uncuttable substance, that is, from its Greek derivation. But still the word atom perhaps will remain, though the conception of it, as has already been shown in the books you have read, has undergone a wide evolution. We are taught that the atom is made up of two kinds or manifestations of matter, a push and a pull. There are only two kinds of matter in the whole cosmic universe. And when you can conceive that the diameter of one of these particles may be represented by 2.7 micromillimeters multiplied by 10 to the minus 13th power, that is about as small as you can conceive. Yet we can conceive of that mass without doing violence to our imagination, but it is so minute that no microscope can ever bring it into view, so it is intangible to the optic nerve. Therefore, you do not have to pay any tax on it unless you live in the District of Columbia—the tax collector here can tax the intangible. This kind of matter has been named, and the names are very generally accepted. From Prout's name of protile came *proton*, the positive particle. The negative particles are called *electrons*. That is the modern theory of the atom. For a long time we disregarded the corpuscular character of the atom. I remember having made considerable fun, some 40 or 50 years ago, of a philosopher by the name of A. Wilford Hall who upheld this theory of the atom. I guess he was about right, and that I was wrong, for these particles that constitute the atom are said to be really particles of matter. They can be projected into space when the atom parti-

cle disintegrates. Therefore, they must be something more than a push and a pull. They are called 'pellates' in the new nomenclature, when they push Electrons or the other kind of matter. They are pellates among themselves but when they come near together, one proton or two protons and one electron, they become tractates when they pull. It is the old idea of electrical attraction and repulsion expressed in a different way. Then there is great discontent in the atoms and molecules of many substances. They are not satisfied. If we regard the union of protons and electrons as a matrimonial union—the married men can understand what that means—there is a great deal of domestic infelicity, and we know what that means, too. This is followed by divorces without going to the courts. These atoms degenerate and disappear and throw out particles called *alpha* particles. Oh! what would we do without the Greek alphabet? We would not be able to name anything we did not know anything about. The alpha particle is said to be composed of four protons and two electrons and it is a nucleus of an atom. Now, I understand that the protons are the male elements, because they are always on the outside and want to leave home, except those that are united in the nucleus; there are always more protons in a nucleus than the electrons and if the number of electrons in the nucleus increased, then the discontent and domestic infelicity increase to the extent that these particles are ejected from the atom, thrown with tremendous velocity through space equal almost to the velocity of light and as they go they are imbued with the idea that they ought to get remarried. That is quite human; in fact the history of the atom as it is presented to-day is the history of humanity—discontent, dissatisfaction, seeking something better and farther away. I believe after all that probably the Bible is the best book on chemistry. As I have said once before in speaking of colloidal chemistry, it is the first book on colloidal chemistry ever published, and when the Bible says, 'Male and female created He them', God did not think so much of the Adam and Eve we think of, as He thought of the protons and electrons, and it fits in exactly with this new theory of matter. The new alpha particle consists of four protons and two electrons and as the alpha particle is projected into space it wants to become settled again. After I got married, I was asked to address a Parent Teachers Association. I went. An amiable teacher said that they had been trying to get Dr. Wiley for a long time and had been unsuccessful, but now that he was married and settled down, they had been able to get him. I appreciated the teacher's compliment, but I said, "The first thing I had to do when I got married was not to settle down, but to settle up". So when this alpha particle is projected into space, it seeks more electrons to become stable, and then it becomes that very useful substance we are seeking to produce in great quantity, known as helium. The helium,

which we now find with natural gas or water under the earth, is forming constantly whenever an atom displaces an alpha particle, which is projected into space. Now, this bombardment has many other functions, as we know. It is probable that it forms the healing element in radium by projecting this particle into space so that it penetrates the human organism and strikes the cells of the cancer, destroying their vitality. But this remedial agent, while useful in cancer in its early stages, is frequently very dangerous and produces burns and sores by unscientific handling. But the atom also throws out a *beta* particle. Here comes the Greek alphabet again. It is an electron pure and simple that is being thrown out as a bombarding agent, but it throws out another thing which is not a particle. It is an emanation. They call it a *gamma* ray. Hurrah again for the alphabet! So there are three kinds of energy, you may say, in this atom which nobody has ever seen or felt except as the result of bombardment, that is when it disintegrates, and it does constantly disintegrate and does throw out two particles of corpuscular matter a particle of negative electricity, the beta particle, and a positive particle in the case of the alpha particle. This emanation is probably identical with the X-ray emanation, a force and not a particle.

This is the present conception of the constitution of matter. When I read of the wonderful work which has been adduced to explain this theory and which does coincide with all the requirements of the theory, I have an additional admiration for the chemist's calling. It is certainly a triumph of our great science to think that this wonderful theory, which is probably correct, can be determined by analytical and experimental ways, which show that these things are always taking place, that these particles are actually flowing from this disintegrated atom, and that this bombardment actually occurs. I have not time here, if I could by memory repeat these determinations, but they are thoroughly scientific easily repeated by those who have the skill, and they give evidence which is quite convincing. But I never attach myself to a theory so strongly that I can not break away. When I accept a theory, it is only a tenable theory as long as it explains the phenomena we are observing.

Another thing attached to this theory is extremely interesting. It supports Prout's old theory that all matter is alike, that the whole universe is composed solely of protons and electrons and they are the same wherever they exist, one and indivisible. In that sense the proton of gold is the same as the proton of hydrogen, and that of chlorine the same as of sodium, and the electrons in the nucleus are always the same wherever they exist. Then the question comes

"How do they explain the wonderful difference in the chemical and physical properties of matter"? That is yet to be solved but the nucleus theory seems to be pretty well established.

That reminds me of the nucleus theory of the evolution of living beings. This poem was not written by W. J. Bryan. It is a song supposed to be sung by a protozoan of some kind.

I was a rhizopod with protoplasmic cells
 I had a little nucleus and I had nothing else,
 Since then a man I've grown by evolution's power,
 But Oh! my little nucleus, I miss thee every hour.

I have taken sufficient time to relate some ideas and impressions of what we consider to be the great progress of the science to which we belong. As I was listening to our President's paper, I was wondering, after all these years of activity, what there could be for this association to do, but when I heard him say that there was no uniformity nor likeness of activity in regard to that one little thing, the determination of calcium requirements of the soil, I felt that the task before this association is still just as great as it was at the beginning. In other words, the field of knowledge is so broad, compared with that which we know, that no matter how rapidly we progress or what distinguished attainments we reach in this science, the unknown will always be before us, offering still endless fields and opportunities for investigation. So there is no end to the good which this association may do. It is boundless in its activities and in its field of endeavour, and so I want to say that we should never be satisfied to think that we have learned it all but keep that humble attribute which is the characteristic of a scientific mind, perfect humility even in the attainment of the great progress which we have made. That is the reason why the really scientific man is never proud of what has been accomplished but always bows in humility before the Great Unknown—whether he calls it God or Jehovah or Nature or by any another name.

The Moon in Agriculture.

Although the influence of the Moon over Agricultural and similar operations has long been recognised in a general sense, and a complicated and more or less mystical lore and tradition built up from it appears very doubtful whether sufficient devotion has been paid, especially in this country, to the study of how this influence can best be turned to good account, and to what extent and on what operations it actually prevails.