CLASSICS OF SCIENCE: Science and Human Life

Many of the things said by Dr. Slosson very justly merit inclusion in a series of Classics of Science, because of his genius for finding the abiding significance of events and trends in the endless procession of new things—"news"—that passed his editorial lookout post. To crystallize in arresting and rememberable sentences the value "sub specie aeternitatis" of things seen only for the moment was his great contribution to science and to the life of the commonwealth as a whole. Therefore some quotations from a few of his well-known books and from other of his writings are given here.

CREATIVE CHEMISTRY: The Century Company. 1921. Page 11:

Chaos is the "natural" state of the universe. Cosmos is the rare and temporary exception. Of all the million spheres this is apparently the only one habitable and of this only a small part—the reader may draw the boundaries to suit himself—can be called civilized. Anarchy is the natural state of the human race. It prevailed exclusively all over the world up to some five thousand years ago, since which a few peoples have for a time succeeded in establishing a certain degree of peace and order. This, however, can be maintained only by strenuous and persistent efforts, for society tends naturally to sink into the chaos out of which it has arisen.

It is only by overcoming nature that man can rise. The sole salvation for the human race lies in the removal of the primal curse, the sentence of hard labor for life that was imposed on man as he left Paradise. Some folks are trying to elevate the laboring classes; some are trying to keep them down. The scientist has a more radical remedy; he wants to annihilate the laboring classes by abolishing labor. There is no longer any need for human labor in the sense of personal toil, for the physical energy necessary to accomplish all kinds of work may be obtained from external sources and it can be directed and controlled without extreme exertion. Man's first effort in this direction was to throw part of his burden upon the horse and ox or upon other men. But within the last century it has been discovered that neither human nor animal servitude is necessary to give man leisure for the higher life, for by means of the machine he can do the work of giants without exhaustion. . . .

Man is the tool-using animal, and the machine, that is, the power-driven tool, is his peculiar achievement. It is purely a creation of the human mind. The wheel, its essential feature, does not exist in nature. The lever, with its to-and-fro motion, we find in the limbs of all animals, but the continuous and revolving lever, the wheel, cannot be formed of bone and flesh. Man as a motive power is a poor thing. He can only convert three or four thousand calories of energy a day and he does that very inefficiently. But he can make an engine that will handle a hundred thousand times that, twice as efficiently and three times as long. In this way only can he get rid of pain and toil and gain the wealth he wants.

Gradually then he will substitute for the natural world an artificial world, molded nearer to his heart's desire. Man the Artifex will ultimately master nature and reign supreme over his own creation until chaos shall come again. In the ancient drama it was deus ex machina that came in at the end to solve the problems of the play. It is to the same supernatural agency, the divinity in machinery, that we must look for the salvation of society. It is by means of applied science that the earth can be made habitable and a decent human life is made possible. Creative evolution is at last becoming conscious.

SERMONS OF A CHEMIST: Harcourt, Brace and Company. 1925. Page 16:

Continuously, in and out, over and under, circle the elements; never at rest, never the same, all bent on the mission appointed them before the creation of the world. Never faltering, never deviating, each atom follows the path through empty space marked out for it millions of years ago; a path so complex that no mathematician can calculate it for the thousandth part of a second, yet so regular that no variation can be detected in years. Back and forth without stopping moves the shuttle of matter, eternally weaving the living garment of God. No eye can follow its swift movement, no imagination can conceive it, but all that is, is what it seems to be.

As Jacob on his pillow of stone saw in his vision a ladder with angels ascending and descending on it, so we, with our vision clarified by science, can see the atoms as the angels of Almighty God, ascending and descending through the scale of life, now carried about by the air, then washed down by the rain, then buried in the soil, then caught up by the hungry rootlets and carried through the sap and stored in the seed or the fruit; then rising to a fuller life in some animal; then caught up and made part of the mechanism of thought and feeling in man; then cast out with the breath to begin again their wanderings; obedient to God's laws, whether in high or low estate, equally doing God's service whether in the brain of a philosopher or in the body of a microbe or buried in a rock, apparently useless and forgotten for thousands of years. So forever is repeated the miracle of the Garden of Eden when God first formed man out of the dust of the ground, and breathed into his nostrils the breath of life and man became a living soul.

EASY LESSONS IN EINSTEIN: Harcourt, Brace and Company. 1920. Page 102:

In all such discussions we must bear in mind that "law" in the scientific sense of the word means, not a commandment or a rule, but merely a way of working. It is a concise description of how things behave. There are no laws in Nature; there are only laws of Nature; that is to say, laws drawn out of Nature (or, if you prefer Latin to Anglo-Saxon, laws deduced from Nature) by man for his own convenience in thinking. Physical laws are therefore essentially psychological; mere memory schemes, calculating machines. The law of gravitation is no more gravity than the funny wriggles that my stenographer is making in her notebook are the sounds I am uttering. To change geometries does not require any such effort as to change cars. It means merely changing our minds. But this is harder for some of us than it ought to be. Here is where the theory of relativity will be of use to us. Poincaré, the French mathematician, cousin of the late President, said: "These two propositions, 'the earth turns round' and 'it is more convenient to suppose the earth turns round' have the same meaning. There is nothing more in

the one than in the other." If Galileo and his inquisitors had understood the Principle of Relativity it might have saved them both trouble: the former temporary imprisonment and the latter everlasting disgrace. A revolution in science is simply a change in mental attitude. Maybe a political revolution is no more.

KEEPING UP WITH SCIENCE: Harcourt, Brace and Company. 1924. Page 1:

Modern complex industrial life plunges every one into a scientific environment so that no one can escape the deluge of scientific terms. But he may get them wrong. . . .

Some of these notions are false, some are hypotheses which may or may not be true, some are truths badly expressed or placed in a misleading context. The result is that the layman either becomes skeptical of all science or credulously falls victim to the first faker who can manipulate imposing catchwords. . . .

Unfortunately those who trade on the name of science for profit, or who are fanatically sincere about some absurd theory, are better advertisers than the real scientists. They make more noise, assert themselves more dogmatically, make more sweeping claims and get attention first. They are not handicapped by the hesitations, uncertainties, shyness, professional caution of the true man of science. Reservations and qualifications make dull reading, and the necessary complexities of the scientific vocabulary frighten away the casual reader. Moreover, it is to be feared that some scientists are intellectual snobs and do not care whether the layman understands or not. They leave the field to pseudoscience without a struggle.

On the other hand, in the long run real science prevails over what the Bible terms "science falsely so-called" because it can prove itself by its works. "By their fruits ye shall know them," is the experimental method. Only real chemistry can provide the basis for the big industrial inventions which the public demands and appreciates. Only real medicine can in the long run lower the municipal deathrate.

There is another test of real science; its honesty. Fake science always tries to create mystery, to use long words for the purpose of creating confusion, to rely on occult forces and secret processes, because only so can it remain a profitable monopoly. Real science relies on tests and experiments that any one can duplicate and does not add artificial difficulties to the real mysteries of nature. In a word, the real scientist and the faker are both talking to the layman in unknown tongues, but the real scientist is trying to make himself understood, the faker is trying to make himself misunderstood.

THE SYNTHETIC KINGDOM: Proceedings of the Second International Conference on Bituminous Coal. 1928. Page 94:

Modern history can be told in many ways, and all of them true, though only when combined are they the whole truth. We can write in terms of sea power with Mahan, in terms of climate with Huntington, in terms of race with Lothrop Stoddard, in terms of class with Karl Marx. But surely one of the most significant ways of writing it is to write it down with carbon pencil in some such terms as this:

Historians generally concede that the human race has more greatly changed its habits of daily life, thought and action in the last two hundred years than in any previous two thousand. This new Carboniferous Era has been based on natural energies, most of them found in fossil fuel.

SNAPSHOTS OF SCIENCE· The Century Company. 1928. Page 88:

Ignorance of the laws of nature excuses no one. We have to live in accordance with them if we are to live at all, and the more we know of them the better we can live. The unprecedented expansion of civilization in the last two centuries, the immense increase in wealth, and the general diffusion of the comforts and conveniences of life must be credited chiefly to applied science, and especially to the physical sciences, since the biological, psychological, and social sciences have not yet developed to a point where they exert so powerful an influence upon mankind.

It is interesting and important to learn about things far away and long ago, such for instance as the habits of the auks of the Arctic or life in Egypt in the time of the Pharaoh Tut-ankh-Amen; but after all, we can live and even be happy in complete ignorance of these things. But we cannot carry on our work for a day without making some use of the laws of the physical sciences, whether we are conscious of them or not.

Fortunately, we are forced to learn a lot about them in our infancy, long before we go to school. It is pounded into our brains by hard knocks. We have to acquire a practical knowledge of the law of gravitation in childhood before we are able to walk, and we learn a good deal about chemistry during that period by the experimental method of putting everything into our mouths and so testing it by taste and smell, which are the two senses that distinguish substances by their chemical constitution.

So every grown person, though he may never have been to school, gains through his daily life and occupation a considerable knowledge of the physical sciences. He gets, for instance, a certain familiarity with the physical principles of machinery, and with the chemical properties of metals and foods. But the knowledge so accidentally acquired is fragmentary and often fallacious. The information that he has so picked up is not connected, and he cannot apply it to new problems. Such a man knows more than he knows he knows, but he is not able to make full use of it because he has never connected his facts or generalized his ideas. In short, such a casual collection of fragmentary facts is not science but merely the raw material for science. What such a man needs is to read some simple systematic book on the physical sciences, and he will then find that the practical points he has picked up will fall into their proper places in the general laws, and that these laws will extend his vision and throw new light on all that he sees and does ever after. To study physics and chemistry is like giving sight to a blind man. It opens to him a new world of undreamed-of beauty, meaning, and possibilities.