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Permanent Achievements of Science

W. H. Kadesch
Iowa State Teachers College

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PERMANENT ACHIEVEMENTS OF SCIENCE

A very delightful man whom I once knew often said that he was deeply grateful to science for all its invaluable gifts to humanity, but that he would have more confidence in scientists if only they would change their minds less frequently. His indictment of science for its instability was a long one, and took a wide range. A favorite count was on the treatment of disease. Time was, he said, when practice was simple. Whether the ailment was fits or fever, sunstroke or apoplexy, raving madness or gentle decline, bleeding by knife or leech was the prompt and universal remedy. Then came pills and herb tea—white pills, pink pills, big pills and little pills, plain pills and sugar coated, ginseng and camomile, swamp root and sassafras. Nowadays we do not try to cure by bleeding, and do not turn so universally to pills or tea. But we are constantly shifting from one alleged cure to another, and with what reason, my friend wishes to know.

In the matter of diet, prescriptions have been less venerable but not less variable. Our frontier ancestors were brought up on food—when it was to be had—no questions raised and no theories advanced. Our parents throve on pork and potatoes, corn bread and garden sass. In our own generation we have been more exacting, especially in choosing a diet for the young. Time was when Willie's older brother waged a futile fight against the spinach. Now Willie may have lettuce and cabbage instead. Baby's older sister took milk at one time and orange juice at another. Baby may have them together. She also seems to thrive on bacon and potatoes—a diet once thought fit only for adults and hardy school boys.

"Science is fickle," my friend has said. "There is no knowing how soon the most cherished beliefs of today may be abandoned for some new fangled idea, hardly conceivable and not yet conceived."

In answer to all these charges science submits a disclaimer to most of the specific details, but a proud admission to the general indictment of variability. Science at some time has doubtless suggested that green vegetables are a wholesome ingredient in the diet of both young and old. It has never stipulated spinach as a daily dish for either. It has often specified certain drugs for certain specific ailments. It has never at any time offered a cure-all. The fads that come and reign and disappear are not the contribution of science, but of unfettered hope and imagination, to which science is diametrically opposed.

But variable science surely is. Science is a dual combination—an unceasing search for still undiscovered secrets of nature, and a continual effort to fit all available knowledge, both new and old, into the simplest and most plausible rational systems. Science accepts nothing on authority, but only on evidence. At every stage it formulates its beliefs on the basis of the best evidence then at hand. Meanwhile, in every field, the search for more new knowledge goes diligently on. It is therefore inevitable that the new will frequently be at variance with our conceptions formulated on the basis of the old. When this occurs our ideas have to be modified to harmonize with new as well as old. Science is proud to admit this kind of variability. It never closes its eyes to new evidence, but always and everywhere carries on an earnest search for it, no matter how revolutionary it may seem to be.

It is easily understandable why

this variability is very discouraging to a certain type of mind. Among the ancients, in order to clinch an argument, it was only necessary to be able to assure the adversary that "Ipse dixit," the master himself has said it. Present day ancients accept their beliefs in the same way. To them the things that were accepted as true a few decades or centuries ago must still be true. But that is not the way of science.

And yet it is a fair question whether, after all these years of intelligent research, something permanent, something true in an absolute sense, has not yet been brought to light. This, of course, is a question that can not be definitely answered. We can however say that some of the achievements of science have thus far successfully stood the most rigid tests, and seem only to become the more firmly established with every new discovery. Reference to a few of these will constitute the remainder of this paper.

1. Our conception of the solar system.

Up until about three hundred years ago the earth was believed to be the center of the universe. The sun and moon were bodies of some importance, but insignificant as compared with the earth. All others were objects of beauty and mystery, but otherwise of little consequence. According to ancient mythology the sun drove his chariot across the sky by day, and somehow returned to the east by night to be ready with the dawn to begin another trip.

The first attempt at a scientific explanation of the phenomenon of day and night was made by Ptolemy, who lived in Alexandria in the second century. According to the view of this great Egyptian astronomer the sun revolved about the earth, making the round in a day and a night, the earth meanwhile remaining stationary. The moon also revolved about the earth, but a little more slowly than the sun. The few other heavenly bodies that showed individuality of motion, the planets, were thought to revolve about the sun. This view of the universe was accepted without question for nearly fourteen hundred years. Then Copernicus concluded that the motions observed could be better represented by assuming that the sun is the dominating object of the planetary system, about which the planets, earth included, all revolve, at the same time rotating on an axis. As a result of the work of Galileo and Kepler the Copernican ideas, modified in some minor ways, became firmly established. In the hands of the great Newton the relationships discovered by Kepler received a rational explanation, which remained without the slightest modification until less than twenty years ago.

2. Atoms and their relationship.

Among the ancients it was a mooted question whether material objects are composed of very fine indivisible particles, or whether with sufficiently refined instrumentalities the division of a particle into smaller and smaller parts could be carried on indefinitely. With the rise of science the evidence began more and more to accumulate that the former view is the correct one. The particles which were regarded as indivisible were then called atoms.

In this conception it was implied that the atoms of different elements are wholly unrelated to each other. It was soon found, however, that the atoms of many of the elements have weights which are almost exactly integral multiples of that of the lightest atom, hydrogen. This led the English Physician Prout, in about 1800, to suggest that the heavier atoms may all be complex, and built up of different numbers of atoms of hydrogen. This idea appealed very strongly to scientists because of the simplicity it would introduce into chemical relationships. It also appealed to certain non-scientists who saw a hope of using artificial methods for bringing about the combination of just the right number of hydrogen atoms to make silver, gold, or other precious elements.

All such hopes as those last mentioned were doomed to early disappointment. The more carefully the weights of atoms were determined the more evident it became that many such weights were not integral multiples of that of the hydrogen atom at all, and Prout's idea was abondoned. Relationships among the atoms did however most certainly exist. In 1868 the Russian chemist Mendeleef discovered that the properties of the different elements vary in recurrent manner with increasing atomic weight. This was a new clew, which started many an investigator off on a renewed search for the nature and cause of the relationship among the atoms. Nearly half a century later the brilliant young English physicist Moseley showed that this relationship is much more accurately represented by atomic numbers than by atomic weights. About the same time W. H. and W. L. Bragg, father and son, found, by methods much more accurate than any that had hitherto been known, that what we call an element may be composed of more than one kind of atom. In particular, they found that elements whose atomic weights are not integral multiples of that of hydrogen are mixtures of two or more kinds of atoms which are identical in their chemical properties and so can not be separated by chemical methods, but which have different atomic weights, each of which is practically an integral multiple of that of hydrogen. This led at once to the restoration of Prout's idea, though in a slightly modified form, and this idea now seems destined to hold a permanent place in science.

3. Bacteria.

About 1857 the wine and beer industries of southern France were suffering great loss from the souring of their product. There was at that time a young professor of chemistry at the University of Lille who had recently gained a great reputation because of his successful solution of a problem which had baffled all the old and famous chemists of the country for years. The growers appealed to him in the hope that he might be able to discover the cause of the trouble and the means of preventing it. Microscopic study of the tainted and untainted beverages led Pasteur, for he it was, to conclude that the spoiling was due to the action of living organisms. He also concluded that these destructive organisms are present in the air, and that if they are either excluded or destroyed deterioration will not take place. By following Pasteur's directions the growers were able to prevent the deterioration entirely. The same principles are now employed everywhere in the canning of fruits, vegetables and milk, in the packing of meats, and even in refrigeration, for the germs do not thrive in either a very low or a high temperature.

A few years later, about 1865, another important industry was almost ruined. This was the silk industry, and the trouble was diseases of the silk worm. Pasteur was again called upon for help. He was very reluctant, for it is doubtful whether he had ever seen a silk worm. At length he yielded to the persuasion of friends, and undertook the task. The problem proved a very hard one, but by 1868 Pasteur believed that the solution had been found. He announced the discovery and isolation of two kinds of organisms, bacilli they were called, which were responsible for two distinct diseases in the worms. He also announced a method of detecting the diseased stock, and of preventing the contagion. Thus the silk industry was also saved.

In 1877 an appeal was again made to Pasteur, this time to save the cattle and sheep, which were dying of anthrax by thousands. Again Pasteur found the trouble to be due to an organism. He also found the preventitive, which was by inoculation of the animal with a weakend strain of the same organism.

Up until little more than half a century ago mortality due to blood poisoning in cases of open wounds and surgical incisions was appalling. Pasteur's discovery of the action of bacteria in causing fermentation, the diseases of the silk worm, anthrax and hydrophobia led the great English surgeon Lister to investigate the possibility of preventing infection in wounds. By promptly applying chemical means to destroy the germs that had entered the breach, and by excluding new ones, he was able to reduce mortality enormously.

Perhaps no single individual ever made a greater contribution to the welfare of humanity than did Pasteur. And none has ever found his conclusions more completely confirmed by his own and succeeding generations.

The mere mention of such matters as electrons, X rays, radium, organic evolution, stellar evolution and inheritance suggest that this paper,

(Continued on page 5)

earthed something of great value to the human race?

And as he thought over these things he was comforted.

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PERMANENT ACHIEVEMENTS OF SCIENCE

(Continued from page 3)

which is already long, might be greatly extended. Space does not permit further discussion. Suffice it to say that in every field of science there is already an imposing structure, a large portion of which may well prove permanent. Even a casual survey of any field will show that there is not stagnation, but change, and that the more frequent course of events is development rather than revolution. The announcement of a new and important discovery is followed by additions or alterations as the disclosure of new facts may require. In this respect science resembles not the potter who discards a broken or misshapen vessel and begins anew, but it is rather like the tailor, who, in fitting a coat which lacks a little of perfection on the first trial does not throw away the piece and begin all over again, but cuts away a little here, lets out a seam for slightly greater fulness there, and so at length brings forth a garment which fits the form with reasonable correctness everywhere.

W. H. Kadesch

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NARCOTICS

The law requires that the nature and effects of both stimulants and narcotics be taught in the public schools. A short time ago the writer asked a dozen college students to describe the nature of the effects of narcotics, and to give the extent of their use. The replies were all much alike. All seemed to have a hazy idea that narcotics put a person into a stupor and that while in this condition the addict dreamed rosy dreams and had a pleasant time generally. Likewise most of the dozen seemed to have the impression that the use of narcotics was largely limited to movie stars and hoboes. Apparently the law was not much observed when these people were in the elementary schools. With this in mind, and with the hope of being of some assistance to the teachers of the state who try to teach the effects of narcotics, the following brief discussion of the subject has been prepared.

Narcotics is a general term for substances which in healthy animals produce stupor that may pass into unconsciousness with complete paralysis and end in death. In man, any drug which produces sleep or stupor and at the same time relieves pain is known as a narcotic. The continued excessive use of them will cause a mental paralysis and finally death. Most of the narcotics used at the present time are derivatives of opium. Opium is produced from the opium poppy. About 350 tons of opium are required each year for legitimate medicinal use. Statistics show that over 8,000 tons are manufactured yearly so there must be approximately 7,650 tons that go into illegitimate trade. In addition to this, narcotics from sources other than opium swell the total to a rather staggering figure.

Practically all the civilized nations of the world manufacture some opium or its derivatices, and all except the United States and Soviet Russia have some for export. The principal opium poppy growing countries are Persia, China, and India. The people of Persia apparently depend upon the sale of opium for a considerable portion of their income so are naturally unwilling to discontinue its growth. Some attempts have been made to limit the growth of poppies in China and India but with indifferent success. The number of factories making narcotic drugs is quite small and the location of practically all of them is known. It is quite generally greed that if we are going to limit the sale of narcotics it must be done by preventing its production and manufacture, rather than by trying to prevent smuggling and private sale. The value of a small quantity of narcotics is so great that means of bringing them into the United States and selling them will be found as long as willing purchasers with money to pay for them can be secured. This is an international problem, but its solution can be hastened by education.

In general, the narcotic habit is more serious and more difficult to overcome than the habit of using al-