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Contributed and Selected

EMPIRICISM VERSUS SCIENCE.

JOHN URI LLOYD, PHAR. M.

Whoever attempts to individualize a scientific problem, becomes aware of the fact that, whatever it may be, it wedges into and dovetails with other problems from which no exact line of demarcation can be drawn.

A conspicuous example in this direction, contributed by the writer to the American Pharmaceutical Association Proceedings, 1879, is the fact that percolation and maceration cannot be, in the act of percolation, separated from each other. In fact, the very beginning of the process of percolation includes maceration, and during the process of percolation, maceration is a continuous factor. This, after an elaborate series of experiments and arguments connected therewith, the writer summed up, *American Pharmaceutical Association Proceedings,* 1879, as follows:

"In percolation, from the instant the stratum of menstruum commences to penetrate the material until it escapes we have maceration connected with alteration of the position of the mass of the liquid. There are continually new surfaces of contact formed as the liquid passes downward towards the exit of the percolator, and, as has been shown, in maceration this

phenomenon is also presented. There is no rest within the vessel while solution progresses. Mediums of greater specific gravity than the original menstruum are constantly forming, which, obedient to gravity, seek the lowest portion of the vessel, in turn to be displaced by heavier liquids. In this way during maceration numbers of percolating currents are flowing throughout the capillaries, and between the interstices of the material, as in percolation, while fresh portions of liquid are continually coming into contact with new surfaces, and saturations are giving way with perfect regularity to those not saturated.

"Thus circulation of currents progresses and will continue until an equilibrium is established, as long as there is soluble matter and unsaturated menstruum within the percolator, and afterward whenever the temperature is permitted to change. Therefore, maceration cannot be disconnected from percolation, and as we have seen, percolation must include maceration."

Let us apply the above as a text to "Empiricism versus Science," between which there would seem to be, as some view it, a clearly-cut line of division, but between which, in this writer's opinion, a sharp line of demarcation can no more be drawn, than between percolation and maceration. They, alike, wedge into each other; they dovetail, one into the other, and, each a part of the other, pass into thought and practice, even as scientific thought and study unite with empirical experimentation.

Placing ourselves, even superficially, in the position of the searchers after knowledge in days gone by, it becomes evident that, at an early date, theoretical or speculative processes gradually dominated the then scientific field, including chemical and therapeutic activity. In this direction, also, there seems to be no doubt that a connected religious process was injected, as a dominating influence, into all "material" problems, (even into such a study as entomology) in days gone by. Indeed, one needs go but a few centuries back, to discover that religious thought and complications dominated those engaged in the experimenter's field of that day, in a direction which even today is, by some, considered wholly materialistic, as though there could be any separation of matter and force, spirit and substance.

Be that as it may, there came a time when a section, at least, of the searchers in scientific directions rebelled against what were then considered ethically correct precepts, demanding that whatever was theoretically announced, must be practically demonstrated. It seems to be apparent that some of these revolutionists went even further, and proposed to establish the reverse of existing methods, by demanding that theory be subjugated to experiment, arguing, probably, that experiment established fact; that seeing a thing, was knowing that the thing existed; that touching an object proved that the object was there; that reactions between different materials were self-evident facts, and that the processes known as "Sensuous Experience," were the sole source of all ideas and knowledge. In other words, mental philosophy and theory were, by these reactionists, subjugated to what might be called the mechanical phases of elementary reactions. Thus, the therapeutic *experimentalist* demanded that all theory must be based upon experimental fact, and in contra-distinction to what in medicine might be defined as an entrenched, dogmatic school, he became, himself, a dogmatic skeptic.

"Their chief point of view was that of practical observation, as opposed to the theoretical speculations of the dogmatic school."—*Encyclopedia Americana.*

Thus came into the early field, as resisters of theoretical "dogmatism," a class of men who, scarcely less dogmatic, demanded that experiment be made primary, and theory secondary. To these people were given the name "Empiricist," de-

fined by the *Century Dictionary* as "one who believes in philosophical empiricism; one who regards sensuous experience as the sole source of all ideals and knowledge," a definition yet employed by many authorities in the world's literature.

To state it briefly, although Locke is by some regarded as the father of modern empiricism, it is evident that from a very early date, perhaps from all time, the principles involved in what is known as empiricism, have threaded the processes of dissenters less conspicuous than Locke.

We need scarcely refer to the fact that when empiricism in medicine and connected problems wedged itself into conspicuity, it became necessary to attack the entrenchments of previously established philosophical doctrines. The resistance that naturally followed created friction, and parties often needlessly became rivals, when, in this writer's opinion, they should have been allies, engaged in a common cause, but in different lines of thought and action. Be this as it may, in the time of Celsus and Galen, physicians became antagonistic to professional methods of the past. They laid great stress on physical changes, and often illogically excluded all-important theoretical study.

Thus the pendulum swung from a dogmatism in one direction to a dogmatism in the opposite direction, although, unquestionably, thinking men of all times profited by and gave credit, knowingly or otherwise, to the practical result of the combined efforts of all concerned.

Following the dogmatism of past theoretical doctrines, came a tendency on the part of the devotees of entrenched empiricism, to be not less overbearing than had been their predecessors. Remedies were so illogically described and prescribed, by reason of isolated individual experiences, as to bring discredit on the cause of the empiricist, to such an extent that, at a period perhaps impossible to determine, the name itself began to degenerate from its original meaning. The experimenter, or empiricist, unquestionably became hopelessly lacking in the direction of systematic, reasoning opportunities. The empiricist physician, relying too implicitly on the "unprejudiced observation of Nature," and believing that such observations must lead to unalterably perfect prescriptions, thereby lost his opportunity. Once more the pendulum swung back. The name "Empiricist" carried now with it the thought of an inadequate experimenter, whether in pharmacy, chemistry or medicine, and thus, rightly or wrongly, degenerated from the ideals of the past.

Having thus touched, briefly and superficially, a few of the changes that came through great periods of time, this writer does not hesitate to declare that, for himself at least, the name "Empiricist" has no terrors, nor can the word "Science" rightfully exclude experimentation. The man of science needs be gifted in experimentation, and the man who experiments needs be trained in scientific thought and action. As the man who percolates according to modern methods unites his efforts with those of the man who macerates a drug according to preceding processes, so does the true man of science today depend upon the experimenter of yesterday.

The man involved in pure scientific reasoning, foreseeing an opportunity by reason of his theoretical knowledge, devises a theoretical process that, without having yet been instituted, he accepts must give a satisfactory, experimental end-reaction. And yet, his theoretical knowledge is probably based upon previous observations by the experimenting chemist or pharmacist, whose reports concern-

ing changes observed, give to the advancing scientist his theoretical opportunity. Had not Sir Isaac Newton followed the line of reasoning instituted by the apple that before his eyes fell from the tree, perhaps for some time the study of gravitation would have been neglected. How could the astronomer of today predict with exactness the period of eclipses of moon or sun, but for the disjointed observations made by empiricists of times gone by, who noted and recorded the coming and the passing of the periodical eclipses? Did Madame Curie theorize in advance that the waste earth experimented with in her laboratory would yield the marvelous substance, *radium,* or, with a ray of experimental light before her, did she discover that substance through careful and thoughtful experimentation? And, without subsequent experiments, could the man involved in reasoning science, have given or accepted a theoretical explanation for the wonderful phenomena that radium presents to humanity?

Thus, in any line of reasoning or of experiments, we find that one dovetails into the other; that as one advances, so does the other; that the materialist, if so you will call him, and the theorist, are dependent, each upon the other. The theorist ventures into untried, experimental fields, with the suggestive thought, based upon past experiences, that such and such an action will follow. The materialist, following his lines of systematic experimentation, in turn presents to the theorist (perhaps himself) opportunities for mind research and explanation. But, above all, each should be ready, with an open mind, to catch the unexpected, for accidental discoveries may accrue, (as in the case of Madame Curie), and be of the greatest service to humanity, as well as of the greatest interest to the theorist. Together, they become "Science."

When La Place, reasoning from calculations made by observing the motions of the heavenly bodies, directed astronomers to point their telescopes to a certain part of the heavens where never a planet had been seen, predicting that there a planet would be found, did he not, mathematically, utilize the results of empirical observation, with the same certainty that the scientific man of today utilizes the results of the recorded observations of the empiricist who brings to him the report of experimental phenomena not before observed? This writer then asks, if there be a line of division between Empiricism and Science in chemical, pharmaceutical and therapeutic action, that each should regard the other as a friend and as an ally, in the cause of professional advancement.

In the opinion of this writer, as has been stated, rational experimentation cannot be separated from systematic thought and theories, nor can theoretical science separate itself from reactions observed in materialistic directions. No opprobrium should therefore be cast upon the man whose line of activity leads him into unknown fields of experimentation, nor should any touch of satire be cast by such a man upon him who, without experimentation, moves the world onward, by his scientific reasonings and deductions.

As one who comes into close touch with many men in advanced science, but whose field of activity is largely engrossed by empirical experimentation, this writer believes that the utmost cordiality exists today between advanced men engaged in these different spheres of activity, and that the true scientist no less regards the usefulness of an experiment that for the present may seem to be fruitless, than does the thinking empiricist deny the fullest credit to the man who perhaps never practically touches a materialistic, experimental object.