

THE LABORATORY:

A DEVIL'S SMITHY OR A SANCTUARY?

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THE noblest causes have had their detractors. It always is difficult to see things or movements clearly; to see them as a whole. Both the poet who but a generation ago referred to the laboratory as a devil's smithy and contemporary controversialists who speak of it as a "shamble" or "den of iniquity" illustrate this difficulty. Both would also seem to exemplify the doctrine of Melissus that we "neither see nor know what is."

Man's first laboratory—the laboratory of the old regime, if you will—was the great world about him. The advice, "Go to the ant, thou sluggard" could only apply to it. Indeed, some things can only be studied there now. Other things must be considered under particular conditions in a smaller workshop, but the methods and the task, and also the spirit, remain the same whether the inquirer of nature works in some cramped, stuffy garret or under the "broad and starry sky." Yet there are those who think of the laboratory as something apart from the world of life and things familiar to them. The laboratory worker often is charged with concerning himself with questions remote from human problems; with star-gazing and with living in monastic seclusion wholly unmindful of the many vexing problems which deeply engross the thoughts and sorely try the souls of his fellow men. When he speaks, which is seldom, his words may remain unintelligible to all save his colleagues in a narrow field. He seldom uses the language of the street and very often too, in the words of the Chinese proverb, "Those who know do not talk and those who talk do not know."

One still hears people speak of the secrets of the laboratory as though its devotees monopolized the fruits of their labors or used

them for selfish purposes and denied earnest aspirants admission to their holy of holies. Yet its doors always stand open, laboratory workers always have welcomed disciples and rejoiced in revealing their findings. In the past they have done this at great, yea, even at the greatest cost. That is the noblest legacy which the laboratory has. The names of Copernicus and Gallileo are sufficient to illustrate this. It had secrets only in the dark and early days of astrology and alchemy, not in the time of astronomy and chemistry. Today only the laboratory pretenders—the quacks—still boast of secret powers and exploit a credulous public.

The laboratory really does not need prompting to herald forth its discoveries. Most searchers need a restraining spirit lest the enthusiasm of their search or, perchance, the sparkle of fools' gold, mislead them into rash words. Interpreters the laboratories need, but unless these follow such exemplars of exposition as Arnold and Huxley they will awaken many a false hope. "Many are called but few are chosen" holds especially here. One need only recall the rash and misguided public discussion of twilight sleep, a decade ago, to realize what mischief as well as the misconceptions, ignorant popularization implies. The current discussion in the public press, on rejuvenation, though different in temper, is no more intelligent or innocuous. Let the public beware of what Shorey called "the science of the talking delegate of science"—of pseudo-science. The truth, true science, will hurt no one, least of all them who needs it most. Half truths not only mislead the uninformed but may actually be dangerous to the public.

Few laboratory workers have the gift of cautious exposition requisite for public discussion and unless democracies will refuse to further support inquiry without it, there would seem to be no valid reason why productive workers should be assigned to the role of town criers. Although it is self-evident that truths which remain unknown cannot be applied and that truths which cannot be applied cannot increase human happiness, the pioneers always are the rarest and their energies should be conserved wisely. They are indispensable agents of progress. The discovery of new facts regardless of their implication, is the primary consideration. There are no insignificant facts. It is only our ignorance that leaves them so. On the morrow these so-called insignificant facts may be pregnant with the deepest meaning for surely all of them must have an appointed place in a universe of law and order.

The difficulty usually lies in the discovery of new facts, not in the application of them. Moreover, whenever the application of newly-revealed facts affects the social order, it is social attitudes that determine whether the "humanizing" of the work of the laboratory is possible. The individual worker is quite helpless in this matter. His has often been a voice crying in the wilderness or if not that, then like the cuckoo in June, he was heard but not regarded. Not infrequently the message he carried was ignored because his competence was questioned, for was he not a mere theorist? Nothing could better illustrate these things than the attitude of the public and unfortunately also of many persons of considerable education and even of wide report, upon some matters of public health, personal hygiene, and human architecture. Adequate knowledge upon the structure of the human body has been available for centuries, yet even some university professors and their college-bred wives, hold and defend the most grotesque views regarding the mechanism of their own bodies. Are our bodies, after all, not like an automobile, the "nuts and screws" of which "may become loosened," thus needing the magic hand of some charlatan for instant adjustment? The shape of the human foot long has been well known but the public pays little heed to the requirements of nature in the footwear it uses. Although this is an old story it is well to enforce the lesson of it upon those who complain that scientists have been remiss in taking the public into their confidence.

Whenever the laboratory findings are remote from public interest it would be both futile and unwise to divert the energies of some laboratory worker for their elucidation and popularization. Those who can do this work in due season, are far more numerous than those who can break and till new ground. Moreover, the world will apply new facts only when it has the temper to do so. New facts often are surprising and it is easy to forget that they are not made but merely revealed in the laboratory. Laboratory workers merely try to reveal the laws which govern the forces of nature in order that they who choose may observe and apply, instead of ignore and be hurt or crushed by them. Only the uninformed ignore or oppose nature's laws, sometimes—alas—at the greatest cost, that of life itself. But since this is a lesson the public is slow to learn the laboratory worker must possess his soul in peace, continue to hew to the line and let the chips fall where they may. For the world often has resented the despotism of newly-found facts. It often has sacrificed the apostle of a new truth rather than abandon time-

worn and lifeless beliefs. An active laboratory of necessity is a disturber of our intellectual slumbers. It compels us to re-examine old opinions and constantly reminds us that:

"New occasions teach new duties, time makes ancient good uncouth,
They must onward still and upward who would keep abreast with
truth."

New truths may demand changes in accustomed ways of thinking and entail difficult and painful readjustments. It is pleasanter to live on undisturbed. We seldom regard the disturbers of our intellectual peace and security more kindly or more highly, than the disturbers of our physical peace and security. Yet all of us know that our dead selves are but the stepping-stones to better things and that:

"From ruins like these rise the fanes that shall last,
To build up the future heaven shatters the past."

The vintage of the laboratory is not all lees. It also knows Falernian wine. No one can rob us of our bows of promise. The glory of their colors remains even after we have learned by experience that the mountain cascade—or the lawn sprinkler—can call them forth. It is true that the sweat of the brow is sometimes upon us and as Stevenson said, our lamps sometimes smell terribly of oil, but let it also be conceded, as did the Penny Piper of Saranac, that our lamps nevertheless, may burn with exceeding brightness. Indeed, revelations are not uncommon in the laboratory and if much of the work there seems prosaic to others it is well to remember that such was also the lot of Empedocles when he drained the soil of Silenus to free the city of a dread pestilence. Idealism come to earth always has a prosaic role to play. All humanitarianism has a seamy side. We may agree with Isaak Walton that "It remains yet unresolved whether the happiness of a man in this world doth consist more in contemplation or action," but contemplation alone has never helped the starving or freed mankind from disease or squalor.

Science and scientists have been reproached severely for their special role in the War, quite forgetful of the fact that the same charge can be brought as justly against religion and ministers of the Gospel and even the militarists. Scientists who served the causes of the War in their respective countries, no more prostituted their knowledge of and their control over the forces of Nature than the soldiers in ranks prostituted their physical strength through use of

the rifle, the hand-grenade, the bayonet, or the sabre. It undoubtedly would have been incalculably better for all if humanity realized that appeal to force is a very unwise and also a very inhuman way of trying to settle difficulties.

The laboratory has had the vice of curiosity. It too has heard even if it has not always followed, the command, "Seek and ye shall find." It not only has laid many "apparitions of a day" but also has disposed of a "host of superstitions upon which the dust of ages had gathered." Sometimes, no doubt, it forgot that humanity loves mysteries. This is unfortunate for humanity is surrounded by and its very origin shrouded in them. Mystery still lies at the root of all things—living and dead. Indeed, it is the existence of mysteries that makes our day-dreams possible, and who would rob us of one of our keenest satisfactions and incentives? Reverie and day-dreams, no doubt, have been the source of inspiration ever since mankind outgrew its brutish past. No laboratory worker would part with this inestimable privilege but since few dreams come true they of necessity are followed by disillusionment. Whenever the rude awakening comes through the inevitable course of events it is quietly accepted as a mandate of fate, but whenever our castles in air are shattered by human hands our resentment is keen and deep. Who ever could feel grateful to him who destroyed his belief in the sled and deer? Dispelling such cherished beliefs often brings one of the most poignant griefs of childhood. But even today we are as children among the endless mysteries of a limitless universe. In the words of Newton, we are playing on the seashore with a great ocean of truth lying undiscovered before us.

In the absence of exact knowledge upon many things we answer the endless queries of the mind as best we may and pass our doubts on to future generations, just as other generations before passed them on to us. Nor can this story ever end as long as finite minds are confronted with the infinite. "Never the gods showed mortal everything from the beginning," said Xenophanes, "but they search for themselves until they discover the better."

I know that scientists have been taken to task for failing to explain their own existence quite unmindful of the fact that true scientists do not presume to be able to explain the existence of any living thing, but prefer, with Locke, "to sit down in quiet ignorance of those things which upon examination are proved to be beyond the reach of our capacities." Science reveals laws, not ultimate causes. To the laboratory worker, "the world is so full of a num-

ber of things" that his attention often is rivetted to details regarding them to the exclusion of ultimate explanations. He knows that ultimate explanations often are impossible and takes his own existence—and that of many other baffling problems—for granted. He may be a poor metaphysician but perhaps no poorer than the philosopher is a scientist. The solution of many things seems too remote to him at present to seriously engage his attention. They are the stuff for dreams! He fully realizes that he must await a fuller and large knowledge before consideration of many problems can be more than fruitless speculation. If the laboratory has not been able to "Sweep away the old world with a breath of God" as Michelet put it, it has, nevertheless, enforced belief in a universal kinship and in the reign of universal law. It especially holds that:

" . . . through the ages one increasing purpose runs,
And the thoughts of men are widen'd with the process of the suns."

The activities of the laboratory have profoundly widened the horizon of humanity. The breadth of view attainable by the individual at present depends solely upon his opportunities and his intellectual stature. No one can venture to cover the whole latitude of science for the vista is broadening daily but, "Every true Science is like a hardy Alpine guide that leads us on from the narrow, though it may be the more peaceful and charming valleys of our preconceived opinions, to higher points, apparently less attractive, nay often disappointing for a time, till, after hours of patient and silent climbing, we look round and see a new world around us. . . . A new horizon has opened, our eyes see far and wide, and as the world beneath us grows wider and larger, our own hearts seem to grow wider and larger, and we learn to embrace the far and distant, and all that before seemed strange and indifferent, with a warmer recognition and a deeper human sympathy; we form wider concepts, we perceive higher truths."

By adopting the experimental method, the laboratory worker would but seem to be following nature in her own workshop. The oldest philosophers could observe and reflect. The modern philosopher, like the scientist, may experiment as well. Inquiring into the seen—or unseen—mysteries of the universe need not dull the sympathies or quiet the aspirations of anyone. No one need part with rosy dawns or sunset glows. Whoever thought of accusing the kindly poet who fondly plucked the little flower from the crannied wall, *root and all*—for the purposes of rhyme and meter—of being

callous or blind to its mysteries? Then why should the laboratory worker, of necessity, be blind to them or be regarded as more unfeeling than the poet? Familiarity need not breed contempt nor blunt our sensibilities to the hidden or larger meanings. A larger and deeper knowledge stimulates our interests in and engrosses our thoughts with these meanings. To hold otherwise would be to claim that eyes that see are blind and ears that hear are deaf.

The great laboratory workers have been devout and humble souls. Their sincerity has been so deep that it may well be called religious. They too were inquiring of God. Their workshops were sanctuaries in which, as Agassiz said, he would have nothing done unworthy of the great Creator. They, above all others, fully realized that "no one has attained complete certainty in respect of the gods and to that which I call universal nature, nor shall anyone ever attain it." It is but natural that some of us should be intoxicated with our own achievements. Easy generalizations are common and we too sometimes mistake mere speculation for established fact. However, a sleepless critical spirit prevails and a

"Sober sense of honest doubt
Keeps human reason good and stout."

Experimenters of necessity must be men of action but they also are tied to the past. Sometimes, "even if a man light on the truth he would not know that he did so, for appearance is spread over all things." Since scientists move more in an objective world; in an empire of fact, they also may become dogmatic. Not infrequently they forget that their so-called cold facts have been warmed—or warped—by their own personalities. They, too, being human they cannot wholly suppress the mystical element in their natures. All this can be admitted freely but it should be remembered that assumption and arrogance are the earmarks of ignorance and weakness—of littleness—not of greatness.

The true searcher for truth in science as elsewhere is always looking for stronger light to guide his footsteps, for dominion over what Sir Henry Maine called the blind forces of nature, not for power to enslave others. Surely, no harm can ever come for using the powers of the mind with the greatest freedom. "Know the truth and it shall make you free" is an old saying which has lost nothing of its force. If there are truths which it is dangerous for men to know then the possession by man of an inquiring mind is a tragic thing indeed. It were sad to find that a beneficent Creator

had endowed man with an instrument of enlightenment which he dare not use with freedom. Surely, "so long as a man is in accord with the truth the gods will hear him even if he do not pray."

It is strange that there are those who reproach scientists with a desire to reveal supposedly sinister facts even if a knowledge of them destroyed mankind itself. If such biological facts exist then their discovery must be a part of the design of nature. Surely they, too, must be part of the eternal order of things and their disclosure is merely a matter of time. Man is helpless in the matter. It is fortunate that laboratory workers are not deterred by such specters of the imagination as these but are pressing onward and also upward. They well might confront their accusers with the Christian phrase: "Oh you of little faith."

No one need be charged with "plunging into the unseen" and with "prying into things," for it is in the power of no one to circumvent nature. "True reverence does not consist in declaring a subject, because it is dear to us, to be unfit for free, and honest inquiry; far from it! True reverence is shown in treating every subject, however sacred, however dear to us, with perfect confidence, without fear and without favor; with tenderness and love, by all means, but before all, with unflinching and uncompromising loyalty to truth." . . . "Whatever value we may attach to our most cherished convictions, there is something more cherished than all of them, and that is a perfect trust in the truth."

It may be admitted that undue haste and lack of circumspection have marred many products of the laboratory. To such the words of Horace, "Redde ad incudem" could well apply. It were a happy thing, indeed, if a feeling of true craftsmanship could always be present there. The laboratory naturally shares the defects of all things human and needs the deliverance which the fine arts and the humanities can bring. Being human, we sometimes crave for fame or fortune instead of the truth, and alas, when we find the latter, we do not always live in conformity with it. But if those who decry the fruits of the laboratory could be placed upon some Robinson Crusoe's island and be compelled to live without them, they would have a rude awakening indeed. For next to honor, duty, love of kith and kin, what does a man love more than life itself and happiness? Under modern conditions most of us owe the preservation of our lives very largely to science and unless we regard the African or Melanesian native—or the ox in the stall—as happy, then our happiness too is largely dependent upon the achievements of the

laboratory. From it have come most of the things that have made modern civilization possible; at least so thinks one of our foremost philosophers. "Scientific inquiry," said he, "has been the chief instrumentality in bringing man from barbarism to civilization, from darkness to light; while it has incurred, at every step, determined opposition from the powers of ignorance, misunderstanding and jealousy." Hence in the words of Pasteur, "Take interest, I implore you, in those sacred dwellings which one designates by the expressive term: laboratories. Demand that they be adorned; these are the temples of the future—temples of well-being and of happiness. There it is that humanity grows greater, stronger, better."

Although the role of the scientific laboratory in modern life has been increasingly large, the individual rewards have been pitifully small. The chief compensation always did and always must, lie in the joy of the seeking. Its chief triumphs always will remain the birth of new ideas and the substitution of knowledge for ignorance. Not all laboratories have been sanctuaries nor all its devotees saints, but the doctrines of the Pharisees and Sadducees find no refuge there. A passion for doing good and a striving for perfection prevail. It lays no claim to infallibility but rejoices in a constant search for error. Let us hope that its work may continue untrammelled save by the shortcomings of its own devotees. Much will depend upon how it will prosper. It should have no vacant chairs, yet it has many. The future cannot live upon the past, and if the work of interrogation seriously lags, the lamp of knowledge will begin to flicker and night perchance shall again overtake us.