Science and Propaganda

By T. SWANN HARDING

IN THE LIFE of Madam Curie by her daughter Eve, published a few years ago, we have an almost perfect example of propaganda written in terms of the popular myth regarding the somewhat dehumanized and almost impossibly self-sacrificing scientific genius. For some reason the daughter chose to develop a picture of her mother that makes her an almost repellent martyr, with complete disregard for all other values life holds aside from science, and possessed of monotonous, nose-to-the-grindstone industry. Her contempt for honors and her refusal to accept the social and economic control of her discovery by patenting it and preventing its exploitation in the hands of business and medical quacks, add to the melancholy picture of psychopathological self-abnegation. Fortunately, in spite of Eve's care to preserve the myth, the true human woman every once in a while peeks humorously through this dolorous tale of shocking renunciation.

That the book was so written and proved so popular indicates merely that we, the public, have been subjected to propaganda leading us to regard this as a proper portrayal of scientific genius. It rarely occurs to any nonscientific reader that the woman described (fortunately not the real Mme. Curie) would possibly have been otherwise than as she appears in this faintly nauseating stereotype. On the other hand most scientific workers, especially those engaged in research, are rapidly disgusted by the book because it departs so aberrantly from what they know to be reality. Walter B. Cannon's "The Way of An Investigator," wherein a great scientist depicts himself, is much more truly in focus. Thus propa-

ganda has much to do with the popular picture of the self-sacrificing scientist always working so nobly for humanity, without thought of prestige or more tangible reward, and every now and then making miraculous discoveries as if by magic.

Discoveries Are Often Fortuitous

ACTUALLY SCIENTIFIC DISCOVERIES are often made more or less fortuitously, but always within the frame of reference established by the methods, instruments, and equipment at that time available. Great chemists no longer make notable discoveries in the kitchen using their wives' cooking utensils and a little homemade apparatus. But discoveries are now as always made because some accidental deviation from the usual procedure occurs, using the methods, instruments, and refined equipment currently available in laboratories.

Every scientist, no matter how low in the ranks, is at some time in his life alert to discover something. He pounces almost instinctively upon every deviation from the normal procedure and trys to wring from it some answer to a secret of nature. At times he lacks the knowledge, the time, the equipment, or the industry to pursue his discovery to its ultimate conclusion. If a biochemist, rather unlearned in organic chemistry, by chance makes a discovery in the field of the latter, he will simply turn it over to an organic chemist to develop, and go on his way.

Marie Sklodowska was no exception. Her husband, Pierre Curie, was already an established scientist and had done worth-while work on the magnetic properties and crystal structure of certain ores. Henri Becquerel had already made the fundamental and accidental discovery that uranium had radioactive properties, and could affect photographic plates even after passage through sheets of metal. Madam Curie was looking around for a subject that would do for her doc-

tor's thesis, just as thousands of students have done since; she came across this announcement by Becquerel and gained permission to follow it up.

Why Becquerel did not himself care to follow it up is not clear, but may be surmised. It would involve an immense amount of hard, tedious labor, and he was already established in other lines of work. Madame Curie made the obvious guess that perhaps some other substance than uranium shed the mysterious rays and that this new substance might be discovered. Through her husband it proved easy for her to secure samples of a wide variety of minerals. These were tested in hundreds and some indeed showed more radioactive power than others, pitchblende finally being selected as the most active. This was logical, as Bohemian pitchblende had long been a rich source of uranium.

The next step was to secure large quantities of pitchblende residue from which the uranium compounds had been exhausted. This was done with the aid of French and Austrian scientists, and Madam Curie faced the final appalling task of working up huge quantities of the ore, by a process of fractionation while using inadequate apparatus in an inconvenient and frigid shed, in order to concentrate the ray-producing substance. This her very obstinacy, her tireless industry, her peasant patience, enabled her to accomplish, and the inevitable discovery of radium resulted.

The rest is history. It was exceedingly unfortunate that the Curies were so constituted as to scorn all the honors and possibilities of controlling their discovery that were later presented to them. Had they patented their process, they could not only have had funds to press their researches along much rapidly, but they could have exercised social control over their discoveries. Their antisocial attitude doomed them to poverty, impeded their researches, and prevented Madam

Curie from keeping her discovery out of the hands of financial sharpers and medical quacks.

Thus because Madame Curie was almost entirely lacking in social consciousness, her discovery was deprived of many of its benefits to humanity. While she could not "afford" to possess much radium, due to her quaint ethics, those who wished to propagandize and exploit the substance ignorantly and heedlessly could procure it. It was many years indeed before a radium institute could be established in her native Warsaw, or before she received a gram of radium as a gift from the United States, whereas she might easily have financed such matters in her active years, had she been so minded. Yet the life of Madame Curie by her daughter portrays a synthetic automaton which corresponds almost perfectly with the popular view of the scientific genius—so effective is propaganda.

Propaganda at the Core

WE TEND EASILY TO FORGET, of course, that science is propaganda at the core. Its entire structure depends on the necessity for assuming the truth of postulates which cannot be proved. But it differs from other systems of belief, such as magic and religion, in adopting its basic assumptions consciously as working postulates, and in knowing that they are not full portrayals of *real* reality. Thus science proceeds to evolve useful principles by the logical process of hypothetic inference. It pursues a method that is little more than an elaboration and refinement of the method of common sense, but scientists must believe in the utility of this method to make it succeed.

From the angle of common sense, everyone believes the basic postulates of his trade, profession, hobby, or sport. If stamp collectors could not believe in the almost esoteric rules and assumptions of philately, the entire structure of their

hobby would collapse at once. Fundamental assumptions are necessary for cooking and horseshoe pitching as for preaching and philosophizing. But once a position is held so tenaciously that the individual is emotionally conditioned to its acceptance by himself and others as the be-all and end-all, science steps out. Yet, because science is based on postulates merely assumed proved, the temptation to propagandize is ever present.

At its best, science consciously accepts particular postulates to be used for specific purposes in order to accomplish certain work; this is done without claim for universality or absolute truth. For no scientific law has ever yet been proved to be absolute, since all the infinite cases of its application cannot be tried in a finite world, and one failure in some untried case would invalidate its absolutism. Science simply uses working hypotheses, and their sole guarantee of scientific truth is the excellence with which they work.

Philosophy has been called a method of adducing bad reasons for what you believe anyway. Another definition runs that philosophy is the systematic misuse of a terminology especially invented for the purpose. Yet another holds it is a system of evolving answers to questions that should never have been asked in the first place. A scientist who does not know that he necessarily deals in propaganda to get his work done is quite likely to regard philosophy as wholly propaganda, and beneath contempt. And it is true that physics does designate as meaningless many problems about which philosophers have disputed for ages, as for instance the existence of an external world.

The scientist says he doesn't care whether there is an external world or not; it appears as if there were one, and he gets results by assuming its existence. He is interested in experimental data and the descriptive features of his theories.

He wants to classify and describe quantitatively the sensations produced by what seems to be an external world. And, in doing this, he so formulates the rules of his game that any question he cannot answer automatically becomes meaningless! Hence he can even find apparent contradictions useful.

Take the length of an object. The physicist says this depends upon the different velocities assumed by the object and its observers. It has different lengths for different observers if they are moving relative to it with different velocities. Hence there is no true length of any object, and one careful measurement, made in full accordance with the overall rules of the game called physics, is as good as another. The length assumed correct depends on convenience. The scientific theory is used to state the connection between the different observations, not to tell *true* stories about *real* reality.

How Science Operates

THAT IS HOW the physicist operates. In a broad way that is how science operates. Thus scientists get into a very different world from laymen, yet they must believe in that world, if they have to propagandize themselves and others to do so, and they do seem to have to do that. The belief that underlies the scientist's conception of the universe is really naive when closely examined. Without getting into any philosophic arguments about the matter, he acts *as if* there were a real world, *as if* its nature could be discovered, and *as if* he intended to make that discovery.

These postulates and assumptions are necessary. Without them science could get nowhere. But it cannot actually prove its simplest basic proposition. Hence science is propaganda at its philosophic core, and the scientist should always be careful to distinguish conscious from unconscious propagandizing. The former is operationally necessary. He can-

not get along without it. The latter is reprehensible and destroys both the spirit of scientific inquiry and the validity of scientific method.

Propaganda affects science in every phase from laboratory to practice. Research is now a regular profession. Scientific publication is often a source of profit to publishers and, as things are at present constituted, every research worker must produce his paper every so often. In one typical prewar year (1937) there were presented at the annual meeting of the American Association for the Advancement of Science 1,681 papers, as compared with 213 in 1890, and a mere 107 in 1871. The Association met in 15 sections, with 47 affiliated and associated societies, in 225 separate sessions held in 48 rooms and 3 laboratories, while 900 of the papers required stereopticons. The bare index of the 1,968 speakers on the program filled 20 double-column pages of the General Program, itself a book of 273 pages.

Thus organized science has become a tremendous propaganda factory. Under ideal conditions, of course, propaganda would not exist within the precincts of scientific research. But, because scientists are human beings with livings to make, it does exist there. From start to finish every research project and every scientific worker thereon is under constant stress of factors which unduly influence the emotions at the expense of the intellect. Many scientists resist these influences very effectively and preserve a considerable degree of detachment and objectivity, but all yield at times, if to nothing more than their own prejudices.

Of course organized opposition to research must at times be fought off. Thus biological and medical research workers must often combat the propaganda of such cults as that of antivivisection, if for no other reason, out of humane consideration for the lower animals which benefit greatly from discoveries made by work on their own kind. Sometimes

religious or political opposition occurs, the latter tending especially to impede research in the biological and social sciences. Propaganda must be met by counterpropaganda, and scientists are sometimes compelled unwillingly to rise in defense of their work when they would much rather be in their laboratories. This occurred especially among those melancholy scientists who moodily produced the atom bomb. Under totalitarian government the free spirit of research is ruthlessly suppressed. This has led in the past to the formation of scientific groups in the democracies dedicated to the task of aiding their brethren who escape from the dictatorship and of preserving the free spirit of inquiry in their own lands.

Selection of a Problem

BUT THERE IS ANOTHER KIND of propaganda within science itself. The first matter to be settled in connection with any research project concerns the selection of the problem itself, of the institution that is to undertake it, and of the specialists to whom it shall be assigned, not to mention the approach to be made. A problem may be selected for a variety of reasons: because it is important and seems to demand solution; because it appears to offer easy solution and a rapid stream of publications; because the particular institution, or the individuals therein, are especially qualified and equipped to attack it; because financial sponsors can be made easily to understand its value or perhaps are themselves interested in it; because it is a fad at the time and many fashionable institutions are attacking it; because it suddenly sprang out of work with another object in view and assumed outstanding importance . . . and so on.

Contrary to the usual propaganda view, outstanding discoveries are accidental only within the frame of certain surroundings, equipment, methods, and knowledge. Rarely do they stand forth full-fledged at once. Usually they are made

very gradually and by the work of many scientists, the living always building upon foundations left by the dead. Once the discovery is made, there is necessity, as we shall see a little later, for any amount of unimaginative plodding by hewers of wood and drawers of water and of "pump-handle" research by hangers-on and those who slavishly follow research fashions.

As a matter of fact it is almost impossible to tell who did discover what, and when, and where. We are all alike victimized by propaganda in this connection. Most Americans think that Thomas Edison invented the so-called "squirted" filament which stimulated the general use of electric lamps, but the British say it was their Sir Joseph Swan. To an Englishman and an American Joseph Priestley discovered oxygen, but a Frenchman would attribute this discovery to Antoine Laurent Lavoisier and a Swede to Karl Wilhelm Scheele.

While Dr. Edward Jenner is normally credited with the discovery of vaccination against smallpox, he was not born until 1749, and similar inoculations were being used in Constantinople in 1713 and in London as early as 1722. There are in the literature papers which demonstrate that the use of liver for the treatment of anemia and of insulin for the treatment of diabetes occurred before "discoveries" by the individuals usually credited with being first. Since most discoveries occur gradually and are initially incomplete, it is very easy for propaganda to do about as it wishes in attributing credit.

Moreover, as the author has found by repeated experience, the endeavor to unearth the real "facts" while those most concerned are still alive results in confusion. One investigator has a very strong tendency either directly or subtly to belittle or disparage the accomplishments of another, even to say that he stole part of the credit he took, or that his students

and associates really did the work. On the other hand each investigator is inclined to take more credit that should honestly be assigned to him.

This is natural, because the outstanding men who make the basic findings are usually leaders of research teams. Their names go on the papers published, as senior author. It is very largely they who decide what names go on, or how the paper shall be written. In any case the paper is usually so constructed as to put the best face on the procedure and findings possible, and there is frequent strong indoctrination with propaganda and even special pleading.

The Sanctioned Myth

HOWEVER, AFTER THE MAIN ACTORS in the drama are dead, an accepted fiction gradually arises which assigns final credit. While facts often exist to correct that fiction, and while energetic research will usually discredit it in part and sometimes as a whole, it is rarely shattered if it has acquired sufficient age to be widely embalmed in the sacred texts. It becomes the sanctioned myth and those who question it are looked askance. Propaganda has done the job and it is all but impossible to undo it.

Nor is personal prejudice absent from the laboratory, as Trigant Burrow remarked in his "Social Basis of Consciousness." All scientists tend to formulate beliefs in terms of their individual needs, desires, and theories. Thus behaviorists made exclusive study of certain motor expressions and have contempt for other psychologists. There are vested rights in scientific opinions and hypotheses, hence the appearance of self-interest and propagandizing within science itself. Proofs of validity are offered. Arguments ensue. Efforts are made to establish priority or to vindicate a theory. "Rightness," even in science involves self-vindication, and soon makes wishes father thoughts.

Fashions rage. Various investigators make the startling discovery that exposure of certain substances to ultraviolet rays will impart thereto vitamin D properties. An epidemic of ultraviolet irradiation research spreads like wildfire throughout science. It enters every field and the propaganda is on every tongue, in every savant journal. Entomologists spray queen bees with the rays and then sell the irradiated queens as being more prolific than normal, and productive of less irritable, sweeter-tempered progeny! This false propaganda is exposed by careful investigation of other entomologists and a brilliant advertising campaign declines.

In *Science* for October 23, 1931, Hans Zinser truly said:

> But in the matter of research there is still much that awaits adjustment. . . . We have developed the habit of judging men for positions by the persual of the titles of their publications, and a list three pages long is more formidable than one of a few lines. There is also a peculiarly sensational and sentimental appeal in medical discovery, and we are living in an age in which cheap performance, skilfully vulgarized, may have an enormous advertising value. And institution rivalry, bidding for support, has had a tendency to foster the submission of results to public and inexpert applause before they have been passed upon in the rigid forum of technical criticism.
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> There has been in consequence, a hot-house forcing of medical investigation which, together with some very brilliant and useful growth, has nourished the weeds of much second-rate material. There has also developed a curious halo about research which has exalted it above other and, in the absence of talent, more useful and less expensive methods of occupying time.
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> These tendencies have been further intensified by the strange circumstance—peculiar to our present development—that, for the time being, available funds have often outstripped our abilities to use them wisely. In the fields of cancer and tuberculosis particularly, high-minded philanthropists have hoped that money could engender ideas, instead of being merely the fertilizer which can aid the sprouting of the living seed of thought. For this reason, today, much work is undertaken merely to justify expenditure; and, in well-equipped laboratories, many a man and woman is patiently sitting on a lifeless idea, like a hen on a boiled egg, or

is spending time and money transporting into complicated notations old tunes that have been adequately played in C major.

Undoubtedly a certain amount of such gnawing at dry bones is inevitable, since pedantry—not strong enough to shove a spade into the rich soil of new fields—has ever been attracted to the dustbin. And also there must be trial and error in regions of thought in which the unknown is so vast compared with the narrow paths of the known. And the most intelligent endeavors may lead into blind roads from which retreat is the only return to the highway.

'Pot-Boiling' Research

WRITING ON "TYPES OF RESEARCH," in his "The Scientist In Action," the British physicist, W. H. George, mentioned what may be regarded as scientific propaganda and what he calls "pump-handle," "saftey-first," or "pot-boiling" research. A major discovery, such as the one that adding certain nutrients to supposedly complete basal diets will keep rats from developing certain deficiency conditions, or that thyroid gland secretions affect the size and composition of rat bones, stimulates any amount of such research.

A thousand different ways of trying out this basic discovery with due allowance for age, sex, and other factors, will occur to any fairly well-trained scientific worker. Let a new physical constant be discovered and there remain over ninety chemical elements and a quarter of a million chemical compounds to be measured. "Given the requisite technical skill, the greater the industry in this kind of research the more the established results (facts) just as, under normal conditions, the water flows so long as the pump handle is worked. There are no risks of getting results difficult to interpret, or difficult to present in a scientific journal, for which reason a scientist who publishes much of this kind of research is called a 'paper merchant' or a 'paper machine.'" Of this, penicillin, the sulpha drugs, streptomycin, radar and DDT all offer recent examples.

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