THE REFORM OF THE MAN OF SCIENCE.

SOME correspondence has recently appeared in the *Morning Post* under the title that stands at the head of this article. Lt.-Col. J. W. Barret, of the Australian Army, a Melbourne doctor, well known for his active participation in the educational world there, writing respectfully of British men of science, laments their exclusiveness. They are, he implies, too much dominated by the idea of studentship; they regard the sphere of science too much as that of the laboratory and the academy; they do not acknowledge brotherhood with men in the greater world, who, in the spirit of enterprise and with the kind of method that prevail in conventional science, are solving great problems of industry, commerce, and national development. Another writer goes further, and would hail as a brother in science the man who elucidates the authorship of Shakespeare's plays or the technique of an old master.

It is not proposed here to enter upon a discussion of the legitimate use of the term science. We may be all for brotherhood, but the circumstances of life compel us largely to separate into groups for purposes of action, and there can be no real complaint if the word science is used in a restricted sense for what is perhaps better called natural science. This should not prevent men of science from recognising their kinship with all faithful workers for the elucidation of truth, in whatever sphere of action.

Let us avoid a controversy about mere words. Lt.-Col. Barret's complaint is a more substantial one—not one of terminology. It is essentially this, that when operations relating to the forces of nature transcend a certain scale they are no longer recognised as science, and that men of science in the limited sense thus lose a great companionship and an invaluable link with the greater world. He gives as an illustration the work of a railroad president whose operations "involve the placing of towns and even cities in new positions, the reorganisation of the agricultural education of districts, the estimation of future markets, and other complicated actions involving scientific imagination of the first order."

It is probable that most men of science would readily admit that some solid advantages would be gained by having in their camp these great operators, with all their intellectual energy, their enterprise, and their influence, and perhaps many would admit their claim to inclusion. There is undoubtedly a tendency for an increased scale of operations to remove a man from the scientific class if he was once in it, or to prevent his accession if he did not originally enter through the usual portal. The case may be well illustrated from engineering. A scientifically trained engineer who betakes himself to great problems of engineering, constructing some almost impossible railway or irrigating a whole parched province of India, seems to be moving away from science. An engineer who has acquired such powers without having received the hall-mark of formal scientific training, will find it hard to get his place acknowledged in the ranks of science.

We may ask, What is really at the bottom of this? Is it merely narrow-mindedness, or is there something more excusable? It is pleasant to think that there may be. Scientific men in their most august society are banded together "for the improvement of natural knowledge." They are by implication a body of students working in the temple of Nature for truth's sake alone, heedless of the world and its rewards. What they garner is their gift to the world: they fill another page in the Revelation that brings men nearer to the angels. Let a man wander into the world with his science as wares to sell for money profit, and he has passed from the true brotherhood. Surely this idea, perhaps here rather fancifully stated, is at the bottom of much of our exclusiveness. It is certainly expressed very often in the privacy of small deliberative councils and in personal intercourse, and it is strongly, though silently, operative in the outer world.

If this were the chief reason for the detachment of men of science we should have to ask whether it be really good and sufficient. That it has elements of good in it, no one would deny. There should be much strength in the union of disinterested people, and the flame of disinterested—that is, unworldly—study is the most sacred light of knowledge. But there is this great fact of history and actuality against an austere brotherhood: natural science has had its roots in the practical avocations of mankind, and from them it has received its chief stimulus. The application of science to the practical arts has not more benefited them than it has benefited science. In this place it is unnecessary to illustrate or amplify the argument. It is therefore not only not unbecoming, but it is vitally necessary that the improvement of natural knowledge should be bound up with solving the problems of the busy world, and the man of science who looks with any kind of disdain on those who are engaged in solving these problems, be they labelled brewer, baker, or candle-stick maker, and be they incidentally making fortunes, is despising his best friends and declaring himself a pedant.

As a matter of fact this disdain does linger. It is the inevitable product of the seminary; it is the fatuity of the cloister, arising, no doubt, from the theological beginnings of our educational system—this notion of keeping science unspotted from the world. It has much to answer for. The neglect of applied science—what is it not meaning now in the fortunes of our nation! It is comfortable for us to blame anyone but ourselves. Have we not long proclaimed the vital importance of science for the service of industry and the State? Industry and the State are doubtless much to blame, but surely no fair-minded person would say that the scientific world is exempt. Rather let us acknowledge that Lt.-Col. Barret is in essence right; the scientific world has been too exclusive; it has not bound itself as much as it might have done to great workers in the world, whose tasks, if not the same, are much akin to those of the

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laboratory, men whose sympathies, already scientific, would be strengthened by association and make broad channels for the flow of science into practice.

Scientific men, we must admit, have often no conception of the real environment and problems of the industrialist; of the accumulated store of empirical knowledge from which he must select what is needed; of the skill and design with which he must apply it under the limitations imposed by men, material, and markets. They too often underrate the extent and importance of what may be called technological science and the new horizons that it opens. The technologist is often ignorantly set in the outer courts of learning; he is not quite of the elect, and antipathies arise. How much have we not sacrificed of the acceptance and efficacy of science in industry by offering young men trained in pure science and knowing nothing of manufacture, to employers trained in manufacture and knowing nothing of science, relying wholly on the manufacturer for a most difficult and precarious adjustment?

The management of our applied science has become one of the great problems of the day, and it brings with it great difficulties. Spurious technology is a hateful make-believe that has already wrought much mischief; a man, however scientific, wholly on the make—to use a concise vulgar term for a vulgar condition—is an unedifying spectacle. But it does not follow that because a man is preoccupied with industrial problems he shall lose his scientific virtue or that his achievements, however remunerative, should rank on a lower plane. It is not so difficult to distinguish the genuine from the base among scientific workers wherever they may be engaged.

We must strengthen the bonds between science and industry by something more than an appeal to the pocket. A real sympathy and interest must be created on both sides; we must open our arms wider. Even if we find difficulty in discovering, in this country, the type of railway president described by Lt.-Col. Barret, there are yet many men in our world of industry and in the service of the State who, without any list of scientific memoirs to their name, have yet been potent in the service of science, and would be more potent still if they were brought more into companionship with the scientific world. The Royal Society has the power of admitting to its ranks at the rate of one each year "persons, who in their opinion have either rendered conspicuous service to the cause of science or are such that their election would be of signal benefit to the Society." Here at least is a limited opportunity of doing something towards introducing into the circle of science the sort of men whose influence might help towards bringing about the reform to which we are bidden by a candid friend. In any of the new associations that are contemplated for giving science its right place in our national life we shall surely do well to cast our net widely and to extend our outlook beyond the conventional circumference of what have usually been deemed scientific circles.

SULPHURIC ACID IN AMERICA.[1]

IN what is known as a "professional paper," Mr. W. H. Waggaman, of the U.S. Department of Agriculture, has recently given an account of the modes of manufacture of sulphuric acid, both by the "chamber" and the "contact" process, with special reference to its production in the United States for the manufacture of fertiliser materials. As the paper contains some features of interest with respect to American practice, a short account of its contents may not be out of place at the present juncture.

The production of sulphuric acid of various strengths in the United States, according to the latest (1913) figures available is stated to be as follows:—

Grades	Quantity tons	Value dollars	Price per ton dollars
50° Baume	1,643,318 ...	9,212,917 ...	5.61
60° Baume	509,929 ...	3,202,528 ...	6.28
66° Baume	797,104 ...	9,282,422 ...	11.65
Other grades	63,158 ...	986,659 ...	15.62
Total and Average...	3,013,509 ...	22,684,526 ...	7.53
Total reduced to 50°B.	3,538,980*...	22,366,482 ...	6.32

* Exclusive of 22,947 short tons of fuming acid, not convertible, valued at 318,044 dollars.

On comparing these figures with those for the two preceding years it appears that there has been a considerable increase in production of each grade with the exception of those classed under "other grades," the decrease in which is probably accounted for by the item "fuming acid," which appears for the first time in the statistics. Presumably, therefore, the manufacture of this form of oil of vitriol has only been introduced into America within the last three or four years. If account is taken of the fuming acid it is obvious that the production of sulphuric acid has very largely increased in the United States within recent years. There can be little doubt that the disturbance in Continental production in consequence of the war, with its effect on the export trade of Germany and Austria in dyes, drugs, and fine chemicals, as well as on a variety of other finished products in which sulphuric acid plays a part, direct or indirect, has given a still greater impetus to American manufacture, and has tended to consolidate certain industries and to initiate others in the States, to the eventual loss of the belligerent nations. German manufacturers are now beginning to realise that the supremacy they have hitherto enjoyed in certain branches of chemical industry is threatened, and nowhere more seriously than in America.

American chemists have not talked to anything like the same extent as we have done about "capturing German trade." Nevertheless, as recent discussions in the American Section of the Society of Chemical Industry unmistakably indicate, aided by their elastic fiscal policy, they have quietly and deliberately set themselves to do it. And, curiously enough, the "hyphenated" Ameri-

[1] "The Production of Sulphuric Acid and a Proposed New Method of Manufacture." By W. H. Waggaman. U.S. Department of Agriculture. Bulletin No. 283. (Washington, 1915.)

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