sonance among workers in the field of chemistry."

The report also contains a directive for the Soviet scientists. "Soviet chemists and physicists should collaborate intensively to develop a theory of the mutual influence of the atoms in the molecule. Here special attention should be paid to uprooting the remnants of the influence of the resonance theory."

The aspect of the theory of resonance to which the Russians so violently object is essentially the following :‡

> "From the foregoing discussion we see that resonance is a man-made concept in a more fundamental sense than most other physical theories. It does not correspond to any intrinsic property of the molecule itself, but instead it is only a mathematical device, deliberately invented by the physicist or chemist for his own convenience."

In view of this, one cannot object to the great stress laid on the physical non-existence of resonance structures, but what is surpising is the vehemence with which the criticism is voiced and the manner in which it is linked with political ideology. It appears that after the Lysenko controversy the Soviet scientists are now busy in "uprooting" the theory of resonance.

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‡ Quotation from Wheland's *Theory of Resonance and Its Application to Organic Chemistry.*

SCIENCE AND ENGINEERING*

THERE have been few attempts to appraise with impartiality the liaison between science and engineering. On the one hand, the natural sciences have developed in the last quarter century a program of propaganda which, however essential in securing the support which research in science not only deserves but must have, has resulted in establishing in the popular mind the notion that engineering is merely a commercialisation of science—is, in fact, simply "applied science". Many people have assumed, therefore, that expanded research in science is all that is necessary to insure our continued technological and industrial supremacy. "The pure science of to-day," it is said, "becomes the applied science of to-morrow." On the other hand, engineers have been too busy "doing" to worry about what they regard as largely an "academic" question.

Probably the basic fallacy in this campaign of misunderstaning has been the statement, made and spread by many able scientists, that engineering is simply an outgrowth of and development from modern science, born of scientific research and still completely nourished by its parent. Important as the present liaison between science and engineering is, no more completely untruthful and dangerous statement could be made.

The case of Britain offers a striking example of the sterility of science alone as a prime factor in our industrial and economic life. From Faraday to Maxwell and Kelvin, from Darwin to Huxley and Tyndall, Britain had produced some of the greatest leaders in modern science. Yet, in the last fifty years—years which have marked such an extraordinary era of material progress in the United States—Britain, the motherland of the Industrial Revolution, has been steadily declining in her industrial and economic position. If pre-eminence in science, as the propaganda of science so confidently proclaims, is all that is necessary to continued industrial leadership and technological progress, why has Britain fallen into what has been described as technological and industrial stagnation and decay ?

It would be unrealistic indeed to ascribe this British decline solely to the high-hat attitude of British Science and the low estate to which engineering has fallen in Britain. To begin with, the British economy, based on the export of manufactured products and necessitating the import not only of basic materials but of essential food supplies, is clearly precarious and vulnerable to foreign competition. During the Victorian period when Britain almost stood alone industrially speaking, and ruled the waves, all was well. But, with the turn of the century, it became apparent that Britain no longer held an industrial export monopoly. The difficulty appears to have been that her industrial leaders did nothing about it. Adopting a self-satisfied, complacent attitude, she failed to follow up her earlier triumphs with continued developments and improvements—to realise that it is impossible to maintain a static position in a world based on technology and industry. Progress and change are not, as we have said, merely desirable—they are essential

* Abstract of an article by F. K. Finch, *Jour. Fra. A. Inst. Sci.*, **1932**, **253**, 201.

to survival. A stable, static economy is impossible—it is but the prelude to decline and decay.

This is not perhaps the place for an analysis of all the influences which have led to industrial and economic collapse in Britain. But certainly, one of the factors which has contributed to her unprogressive attitude has been the fact that science in Britain has succeeded in establishing the idea—as science in America seems latterly bent on doing—that engineering is merely cheap, applied science, and such applications can be left to those whose interests are vocational rather than professional and whose minds are directed solely to commercial pursuits—in short, given science, applications will take care of themselves.

Engineering is regarded as a "navvy", a laborer's pursuit in Britain—it is not a recognized profession. Engineering education is still largely a matter of rather narrow vocational technical school instruction—it is not a recognized university activity. There also appears to be a notion that the engineer deals only with science, with the materials and the forces of nature. The fact that his task is production and that he must work with and direct men is ignored. Here is a washing of the hands of any connection with machine skills or engineered production, with the direction of labor. Here is a complete failure to realise that design is not an end in itself but merely a means to intelligent production.

The light has now begun to dawn, however, for, more recently, Sir Ewart Smith, in a paper reprinted in *The American Scientist*, clearly stated the truth, namely: "Any real basic knowledge which is evolved is broadly and relatively quickly available to all, and it is therefore upon technological skill in application that the progress of industry and, consequently, the economic position of the nation will mainly depend". Scientists not only do not possess this skill—there is every reason why it should not be one of their interests—but it would be a grave mistake if they should deny that the technique of application is, in itself, a subject of special knowledge, study and research. Indeed, it's what we do with knowledge—all available knowledge—that will determine a country's strength and progress. Science alone is not enough.

ARTIFICIAL COSMIC RAYS

IT is reported that the giant cosmotron at the Brookhaven National Laboratories, New York, is able to accelerate protons to energies of the order of 1360 million volts, which is more than three times greater than what has been possible till now. Also it appears that the range attained recently is only half that for which the machine has been designed. At full capacity it is expected to deliver atomic projectiles with energies of the order of 2,500 million volts.

By all standards, this must be considered as quite a remarkable achievement: for, as the energies associated with cosmic rays are almost of the same order as those produced by the cosmotron, this opens up the way to their being generated artificially in the laboratory, with a view to study their properties under controlled conditions—a feat considered as rather impossible till now.

INTERNATIONAL UNION FOR THE PROTECTION OF NATURE

MAN'S responsibility for the progressive formation, first of semi-arid regions, then of arid regions and finally of deserts being what it is, it a pleasure to welcome the formation of an International Union for the Protection of Nature. We hope and trust that facilities will be made available to the Union in generous measure to enable it to fulfil the aims and objects set out in No. 2, Vol. 1 of its *Official Bulletin, viz.*, to examine critically the multifarious dangers with which nature is confronted consequent upon the constantly heavier pressure exerted by technicians upon biological cycles, to devise protective measures against wastage on the countryside, and to consider ways and means of extending the same over the widest area possible.