Civilization & Science

in Conflict or Collaboration?

Ciba Foundation Symposium 1 (new series)

1973

Elsevier · Excerpta Medica · North-Holland

Associated Scientific Publishers · Amsterdam · London · New York

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The Ciba Foundation for the promotion of international cooperation in medical and chemical research is a scientific and educational charity established by CIBA Limited – now CIBA-GEIGY Limited – of Basle. The Foundation operates independently in London under English trust law.

Ciba Foundation Symposia are published in colloboration with Associated Scientific Publishers (Elsevier Scientific Publishing Company, Excerpta Medica, North-Holland Publishing Company) in Amsterdam.

Associated Scientific Publishers, P.O. Box 211, Amsterdam

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First printing: 1972
Second printing (paperback): 1973

ISBN Excerpta Medica 90 219 4027 2
ISBN American Elsevier 0-444-15096-x

Library of Congress Catalog Card Number 77-188826

Published in 1973 by Associated Scientific Publishers, P.O. Box 211, Amsterdam, and 52 Vanderbilt Avenue, New York, N.Y. 10017.
Suggested series entry for library catalogues: Ciba Foundation Symposia.

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Printed in the Netherlands by Mouton & Co., The Hague

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The problem defined

HUBERT BLOCH

The establishment of research priorities, the evaluation of scientific projects, science policy in the context of various social and political systems, and policies affecting research institutions were among the important issues raised and exhaustively reviewed at the Ciba Foundation symposium on *Decision Making in National Science Policy* held in 1967.[2] Today, not only are these issues still with us but newer and more disturbing problems are giving the decision makers for science policy, and the rest of us, more to review exhaustively than any experts can manage.

In most countries, science budgets have not received the expected increases but have even been reduced, rendering the competition for funds fiercer and the need for guidelines for intelligent policy decisions more acute. Also, a world-wide anti-science movement has since emerged, which contrasts our technological world with all its shortcomings and imminent dangers with a romanticized view of the past seen as a bucolic golden age ruined by the advance of science.

The question of the worthwhileness of scientific activities was almost taboo when it was mentioned at that meeting in 1967.[9] But now powerful voices from scientific as well as non-scientific quarters are saying that scientists should become more socially responsible, that science should be tolerated and supported only as long as its results are socially relevant, and that science must be constitutionalized and controlled if it is not to destroy our civilization.[3, 5, 7] It is said that the scientist's lack of values has left him helpless to prevent science from being used for exploitation and destruction.[1] And in the minds of many, science, all the way from nuclear physics and engineering to biology and medicine, has become a most dangerous evil.

This is the framework for the present symposium, and clearly we must address ourselves to the more elusive questions before we can continue the

discussion on decision-making. What is the impact of science on the quality of life, on our work and leisure, on our environment, on human values—in short, on civilization? How does scientific progress influence civilization and how do the two interact to determine each other's course? To what extent is science involved in, or even responsible for, present world crises? Where does the scientist's responsibility for the consequences of his efforts begin and end? To whom is he responsible? How free is he, or should he be, in choosing his subjects and carrying out his work? And who should tell him what he can and what he cannot do?

Surely the new antagonistic forces alone, and all the turmoil they produce, are sufficient reason to hold this symposium and ask such questions. And indeed meetings of a similar character are now continually being arranged by many types of concerned groups. It is irrelevant whether the recent Pugwash Conference at Frascati on *Social Aspects of Technological Change* was one where scientists could relieve their remorse—like the Victorian businessman's attendance at church on Sunday, in Dr Shils' words[8]—or whether the Weizmann Institute's symposium on *The Impact of Science on Society*, which is taking place in Brussels at the same time as we are meeting here in London, was similarly motivated. It is a fact that in the world today such topics appear to be uppermost in the minds of scientists as well as non-scientists, and they will be pursued until some answers are found.

What, then, are the actual problems with which the scientific community must concern itself? Many of us are confronted with them in our everyday lives:

As university teachers we are faced with student militancy and forced to justify an activity that for centuries was unchallenged and came to be regarded as one of the most highly respected and most securely protected ways of life.

As science administrators and members of research councils we are confronted with the impossible task of wisely allocating funds that are in too short supply to satisfy all legitimate needs.

As scientists in industry we are accused of wilfully contributing for the sake of profit to the destruction of our environment and the exhaustion of the world's natural resources.

As scientists in government we are accused of lending our professional competence to helping to achieve military goals aimed directly at destroying whole populations.

As doctors we are accused of abusing our skills by not penetrating to the real causes of our patients' illnesses, but merely treating them for their symptoms in order to return them as soon as possible to a disease-producing society.

As biologists we are accused of plotting to use our recently acquired fundamental knowledge for the perversion of the human race by biomedical and genetic engineering.

These are some expressions of the antagonistic forces with which the scientific community is faced. We may find that some accusations have a base in reality and some have not. We may find answers to some and none to others. But where can we begin our search?

We could start by asking, what are the yardsticks by which the value of scientific projects is measured? Quality is probably the first, and everyone agrees that only good scientists and scientifically sound projects ought to be supported. But our agreement probably ends there. By what criteria are we to distinguish between good projects belonging to different disciplines? Clearly, the inherent quality of research project A is an insufficient criterion to rank it before or after an equally good project B, if A, for example, belongs to astronomy and B to enzymology. Ways must be found to compare the value of research of the A type and research of the B type. But immediately we come upon other questions. The value for what and for whom? For the promotion of knowledge? For the advancement of science? For the good of a particular university? For the power of a nation? For the health of mankind? For our happiness and well-being? And to whom should it be left to answer these questions? To the scientific community? To governments? To supranational bodies?

These are not new questions. They are indeed difficult. They reflect an ill-defined but strongly felt *malaise* about the role of science in society and about the scientist's responsibility for the technological application of the results of his work. It behoves us to recognize this *malaise*. Its aetiology is clear: it lies in the contribution of science to the deterioration of our world—or rather in the uncontrolled application of scientific technology that leads to the now well-known problems of environmental pollution, the use of science for war and destruction, and the social implications of the by-products and side-effects of medical progress—and in the fact that science and technology have failed in many people's view to make our lives happier and more meaningful.

But while the diagnosis of the *malaise* and its aetiology are clear, its therapy is much less obvious. I have thought about three areas in which the scientific community could rally its own resources and begin to work on some therapeutic measures. They are the elaboration of a practical system to evaluate scientific projects, the creation of mechanisms permitting the relative significance of scientific results to be assessed and the construction of safeguards against the growing dangers of specialization.

Evaluation of scientific projects

Wherever science is supposed to serve specific interests, such as industrial or military goals, bodies and procedures exist to evaluate progress and review the significance of research at regular intervals. Such bodies and procedures are, however, almost non-existent for so-called basic research projects. Here every scientist individually tries to sell his projects as best as he can to the granting agency to which he applies. True, the quality of his project is reviewed, but its significance is usually much less considered. I am often surprised at the discrepancy between the short time spent on reflecting on the significance of a planned piece of research and the length of time that is afterwards required to execute the work. A serious attempt ought to be made to rank all publicly supported research projects in order of importance according to criteria such as their originality, their contribution to knowledge, their social significance, their applicability in agriculture or in medicine, their potential industrial value and their practical effects, good or bad, on the so-called quality of life. Where such value scales exist on national levels, they are subject to frequent reclassification according to political and emotional pressures. Here an international, less variable and less vulnerable scale of values might be formulated and defended by appropriate multidisciplinary groups, perhaps under the sponsorship of UNESCO. In spite of working on a world-wide scale, such bodies could still adjust their priority listings to regional needs.

Relative significance of scientific results

A continuing ranking of the relative significance of scientific results appears necessary because individual scientists are rarely able to judge the consequences of their work beyond the narrow limits of their fields.[11] However, an elite of the international scientific community could be charged to carry out a continuing interdisciplinary evaluation of the practical implications of all scientific progress. Conclusions could be published regularly, so that government agencies and the public would be informed of the possible consequences of the work they sponsor and be guided in making decisions.

Such regular evaluation would be merely informative but the considered judgement of independent groups of experts might carry enough weight to make scientists themselves, as well as their sponsors, conscious of the long-range implications of research. Here I should like to emphasize that although the evaluation of the consequences and social effects of science is a task for

scientists, including social scientists, the implementation of their findings is a political act and calls for decisions by the representatives of the public—government executives, city mayors, politicians. Implementation requires in addition the willingness of the citizenry to foot the bill for decisions that place a greater financial burden on individuals and on their community. In the end it is always the citizen who pays the bill, be it as taxpayer or as consumer.

Safeguards against specialization

It is obvious that, like most other occupations, science is becoming increasingly specialized and fragmented. Scientists, just like assembly-line or office workers in large organizations, are physically and emotionally separated from the end-product of their work. To many of them its usefulness remains unclear. This is particularly true for scientists in government and industry. They may lack the pertinent information and the necessary understanding and, what is worse, they are not even clearly aware of these shortcomings and therefore make no attempt to remedy them. I submit that it is the task of the universities not to foster specialization but to resist it, to train their science students in such a way as to prevent them from becoming assembly-line workers. Every single teaching subject can be put into its broader context, even at the expense of specialization. This would have the added beneficial effect that the professors would be forced to think about and answer questions relating to the wider significance of their own endeavours.

One might object that these three suggestions, if implemented, would lead to censorship and *dirigisme* and that they could curtail the freedom of science and hamper its progress. I do not think such a fear is justified, because already under our present system no scientist, unless he finances his research from his own independent means, is entirely free to do what he wants. The implementation of these suggestions would, however, give the scientist a greater awareness of the social and cultural significance of his work.

Although scientific research is wasteful by nature and research projects—in contrast to development projects—cannot be accurately planned and justified in detail, scientists cannot escape the responsibility of justifying their social role. Scientists have taken their own infallibility and the paramount importance of their work for granted for too long, and much wasteful nonsense has been produced in the name of science.[6] Every scientist who uses public funds for his research should be prepared to defend his expenditure, not only within the scientific context but also in terms of the contribution he

hopes to make to the social well-being of his country and the world. This should not be interpreted as a call for applied as opposed to pure science. It is a claim, however, that scientists should be requested to defend their work on social grounds, just as they are traditionally used to doing on scientific grounds, as long as they are using public funds.

Many of us are engaged in the battle of defending science, perhaps to keep it on its traditional lofty pedestal and save it from the bloodier battles below. We are defending science essentially by extolling its past achievements and by telling people that thanks to science 'they never had it so good'.[4, 10] But in defending science should we not use a different approach, not starting from the axiomatic position that science *must* remain as it is, must continue to be supported, must concern itself with the same areas as hitherto, must give the scientists complete freedom to do what they want, or that we must *a priori* agree that *all* scientific subjects and disciplines are equally worthy of support? Perhaps after discussing the subject we may conclude that there are other and better ways of defending science than those we have used so far, and that perhaps even the curtailment of funds and the questioning of the wisdom of some of the past performances of science may not be as bad as they seem.

Finally, a short word on 'secrecy and science', because this has some bearing on the contribution of science to civilization. In essence and in the long run, secrecy and science are mutually exclusive, because non-secrecy is one of the essential and vital characteristics of science. However, a certain degree of short-term secrecy is common to all scientists. Most of them keep their results to themselves until these can be published or patented. Also, in the present social and political context, some secrecy will always overshadow certain projects belonging to either military or industrial and even academic research. Curiously enough, this is as true in the socialist as in the capitalist world, or perhaps it applies even more in the former. This state of affairs will not change as long as scientists are willing or can be compelled to undertake classified work, or as long as the prevailing system of academic prizes, recognition and promotion rewards those who are first to come forward with scientific results. It is therefore entirely up to the scientific community itself whether secrecy in scientific matters is tolerated and accepted—the scientists themselves are the only ones who could, if they wished, force their establishments to change.

Because of the various points just mentioned, science policy-making will be under scrutiny for some time to come. The main goal, as I see it, of any science policy should be to reintegrate science into our civilization, to place it exactly where it belongs in the scale of human values—not too low and

not too high, to construct solid safeguards that should prevent science from destroying the very society which supports it and to instil in the scientists a refreshing and much-needed measure of humility.

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Some reflections on science and civilization

P. B. AND J. S. MEDAWAR

At present we are going through a bad period in the relations between science and civilized society. People generally have become increasingly aware and resentful of the havoc that may be wrought by a technology that develops without social censorship. Worse still, a new mood of despondency and helplessness has descended upon us, for the equal of which we should have to go back to the early days of the 17th century.[5]

It has come to be felt that there is some *essential* malefaction about the progress of science and technology: that they lurch forward like some great Behemoth trampling down in its pathway almost everything that makes for civilized life. We have been given the privilege of thinking aloud on this subject and told that some measure of overlap between what we say and what others may say later is not necessarily undesirable. Our plan is to discuss some of the psychological elements that enter into the present tendency to repudiate science and all its works, and then discuss the shape of possible solutions to these embarrassments.

Relations between science and society in the 17th century

If we say that the relations between science and society are now going through a bad period, we are under an obligation to say when we think the relationship was a cordial one. The first period in which it was so was in the 1620s when Francis Bacon most winningly and indeed irresistibly talked people into believing that science was something that would work for 'the merit and emolument of man'. The second, surely, was during the 19th century—the epoch of the great civil engineers when it was taken altogether for granted that science was the principal agency of progress and that

science and civilization stood shoulder to shoulder. But even then there were rancorous voices. Magee[3] has wittily reminded us that the proposal in 1848 to lay London's first main sewer was vehemently opposed by much established opinion, notably by *The Times* which appeared to feel that to die in one's own way without civic interference was one of the elementary liberties of mankind: 'We prefer to take our chance with cholera and the rest than to be bullied into health. England wants to be clean but not to be cleaned by Chadwick'. (We can take it that the Prince Consort, who died of typhoid in 1861, did not share this bizarre preference.)

Let us now consider some of the psychological elements that enter into the present anti-scientific mood—we say 'psychological' to distinguish them from the sense of resentment people justifiably feel about the ecological depredations of modern technology. The first we shall call 'Mumfordry', by which we mean nothing more serious than a certain propensity to think the worst about science and technology.

In an article published in 1966 Lewis Mumford[6] quoted a lengthy passage from Edward McCurdy's translation of Leonardo's notebooks (London 1908, p. 266), a passage which describes the fearful and irresistible rampaging of a black-faced monster with swollen and bloodshot eyes and ghastly features—a monster from which the populace defended themselves in vain:

'Oh, wretched folk for you there avail not the impregnable fortresses nor the lofty walls of your cities nor the being together in great numbers nor your houses or palaces! There remained not any place unless it were the tiny holes and subterranean caverns where after the manner of crabs and crickets and creatures like these you might find safety and a means of escape. Oh, how many wretched mothers and fathers were deprived of their children, how many unhappy women were deprived of their companions! In truth . . . I do not believe that ever since the world was created has there been witnessed such lamentation and wailing of people accompanied by so great terror. In truth the human species is in such a plight that has need to envy every other race of creatures.

' I know not what to do or say for everywhere I seem to find myself swimming with bent head within the mighty throat and remaining indistinguishable in death buried within the huge belly'.

Lewis Mumford surmises that this nightmare represents the 'reverse side of Leonardo's hopeful anticipations of the future'. It is Leonardo's premonition of the despoliation that the advances of modern science and technology may wreak upon the earth and its inhabitants. But 'there is no way of proving this', Mumford concedes, and we therefore diffidently submit an alternative interpretation: that in this passage Leonardo is describing the devastation

consequent upon the spread of a bubonic plague of Levantine or, perhaps, Libyan origin. For justice's sake it must be added that the advances of science and technology have virtually eliminated bubonic plague from the western world.

The kind of attitude which Mumford's interpretation of this passage from Leonardo illustrates can only be sustained if we systematically neglect the benefactions of science—for example, being alive and well instead of ill or dead—and pay attention only to the miscarriages of technology. Advances in medicine and the possibilities of human happiness created by the relief of suffering are a great embarrassment to those determined to think nothing but evil of science and technology. Their only recourse is to point to the population problem as the direct consequence of medicine and medical technology and to say or imply that modern drugs cause as many ailments as they cure. In spite of these dissonant voices, most people believe as we do that medical science has a moral credit balance.

Science and the mastery of nature

A second element in the revulsion of many thoughtful people from science —and a factor which has had a thoroughly mischievous effect for reasons we shall try to explain—is the ideology of the mastery or domination of Nature. 'Bacon's fundamental maxim' said an 18th century philosopher 'is that knowledge is power: every accession man gains to his knowledge is an accession to his power; and extends the limits of his empire over the world which he inhabits'. There are passages in Bacon which fully bear out this judgement. However, in the context of Bacon's own thought the ideology of mastery and domination is not particularly offensive because it is bound up with his own special concept of experimentation as an alternative to the passive contemplation of the information that nature spontaneously proffers us. The idea of mastery makes a brief appearance in the writing of Marx[4] and of Freud.[1] The 'conquest of infectious disease' is fair enough, because bacteria are indeed inimical to us. On the other hand the 'conquest of space' rings quite false. The main objection to the ideology of mastery and warfare is that it dulls the sensibilities and seems to condone or in some perverse way even to justify the worst excesses of environmental despoliation. One hopes that these unpleasant figures of speech have not taken so deep a hold that they cannot be uprooted from popular writing and popular thought. It is *understanding,* not mastery, that should be the declared ambition of scientific research.

Does science pay?

Another factor which makes for uneasy relations between technology and civilized life is the tendency, especially prevalent in England, to make economic return or cost-effectiveness the ultimate measure of the worthwhileness of any enterprise. (The password into this area of thought is 'does it pay?') A purely economic system of mensuration is not conducive to the welfare of the environment. The purification and the safe disposal of toxic effluents are costly obligations and the cost-effectiveness of many manufacturing procedures is greatly improved when these obligations are disregarded or circumvented.

Is society sick?

Some thinkers of the 20th century have professed to discern a serious social ailment in modern civilized society. Both Keynes and Freud have had civilization on the couch. J. M. Keynes[2] diagnosed 'a nervous breakdown' and Freud [1] 'a neurosis'. Keynes believed of mankind that we had been 'expressly evolved by Nature with all our impulses and deepest instincts' for the purpose of solving the economic problem, the problem of keeping our heads above water in a hostile and competitive world. The economic problem was approaching solution, so Keynes goes on to say, 'I think with dread of the readjustment of the habits and instincts of the ordinary man bred into him for countless generations that he may be asked to discard within a few decades. . . . Must we not expect a general nervous breakdown?' Keynes likens the plight of civilized society to that of a suburban housewife who has been relieved of economic and of some domestic cares by a prosperous husband and for whom the enjoyment of a nervous ailment is now the only remaining métier.

Keynes's argument is a relic—the last, one hopes—of social Darwinism and Freud's is based on a misunderstanding, forgivable because at that time widely prevalent, of the true scope and significance of Haeckel's recapitulation theory. Both arguments are unconvincing. The idea that civilized society can suffer from an ailment is a figure of speech which can easily lead us astray. It is fair enough to speak of society suffering from a 'disorder' because orderliness is one of the defining characteristic of a civilized society but we shall depress ourselves unduly if we see ourselves as sitting anxiously by civilization's bedside. It really makes no more sense to speak of civilization suffering a nervous breakdown than to speak of it having a

headache or a bad back. The disorders of society are peculiar to and distinctive of society, e.g. an unfavourable trade balance, unemployment or overpopulation. They are particular disorders, moreover, for which we should seek particular remedies. The misuse of the organismic conception of society must bear some part of the blame for the current feeling of helplessness and despondency about how matters can be remedied.

Utopia and Arcadia

Let us now consider the shape of possible solutions of our present dilemma, which is that we have become increasingly dependent on science and increasingly resentful of the fact that we are so. In the early 17th century, when people in England got fed up with the state of the nation and the quality of life they could and did emigrate to America, but no one today would have recourse to such a solution because America is in a worse plight than we are in most matters to do with the bad relations between science and civilized life.

From the 16th century onwards, however, imaginative writers and philosophers have entertained purely notional solutions of the dilemma. These notional solutions or daydreams of a better world are roughly speaking of two kinds: Utopian and Arcadian.

The old Utopias—Utopia itself, the new Atlantis, Christianopolis and the City of the Sun—were ectopic civilizations discovered by chance in far-off seas. In Utopia man has become the landlord of the domain in which he was formerly a mere tenant. He arranges matters in such a way that people live in amity and under the protection of justice and enjoy all the benefactions that an enlightened technology can bestow upon them—though a technology still so rudimentary that it could not have the grievous side-effects we now deplore. It is worth remembering that the old Utopias did not repudiate science and technology but on the contrary put them to work for the common good. In Utopia it is assumed that men improve themselves by their own exertions and that the qualities of character and mind that make for civilized living will eventually become second nature.

Scientists are Utopian by temperament. If asked why they do what they are doing one suspects most of them would answer that they hoped their work would one day make the world a better place to live in. And that is the essence of Utopianism. A civilized world is not 'given', but something men can make for themselves—an audacious and irreverent idea in its time.

Arcadian thought is closely bound up with the legend of a Golden Age in

which human beings lived in a state of natural happiness and innocence, tranquillity and peace—a state from which they have since undergone a grievous decline. In Arcadia human beings retreat into a tranquil pastoral world where peace of mind is not threatened, intellectual aspiration is not called for and virtue it not at risk. But an Arcadian society is anarchic (a fatal objection). Everything that is implied by authority is replaced by everything that is implied by fraternity. Arcadia is a world without ambition and without accomplishment. Anarchy is perhaps the sociological equivalent of solipsism. Just as it is normally regarded as fatal to the pretensions of any theory of knowledge to show that it leads to solipsism, so, it seems, is it fatal to the pretensions of any social system to show that it leads to or implies a state of anarchy.

Practical remedies

Let us therefore turn away from notional solutions to practicalities. If we can agree that civilized society is not the victim of any one ailment, we shall not look for any one remedy. It is not one thing that is wrong with modern society but a multitude of particular things and for these we must find a multitude of particular remedies. Pollution, for example, is always pollution of something by something at some particular time and place. Each individual contribution to pollution must be sought out and remedied. If a town is intoxicating itself with smoke then smokeless fuel must be introduced borough by borough until the nuisance has abated.

Sweden has set a notable example of 'piecemeal social engineering' in its conservation programme for Lake Vättern, which was being slowly polluted out of existence and rendered progressively more unfit to supply water to the municipalities round its shore or to sustain a char fishing industry. The major sources of pollution were identified as sewage from holiday camps and lakeshore holiday homes, fermentation liquids from silos and effluents from the regional paper and pulp industry. At considerable expense each source of contamination was studied and as far as possible remedied.

It is a heartening story because it shows how evils of technological origin can be mitigated by technological means. This applies even to the greatest evil of all, the overpopulation problem. We believe that one day a medically inoffensive means will be found of preventing conception and that in spite of administrative difficulties and doctrinal barriers it will come into general use. Nevertheless, we fully concur with Professor Paul Ehrlich's judgement that our entire economic system, based as it is upon overproduction, over-