

WORKERS OF ALL COUNTRIES, UNITE!

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and
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**SCIENCE FOR
PEACE AND
SOCIALISM**

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SCIENCE AGAINST WAR

J.D. Bernal

INTRODUCTION

The plan of this article is to deal in the first section with the long-term aspects of the economic and political situation of the world as it affects science, bringing out the special roles of the United States as a centre of world capitalism and the Soviet Union as a centre of world socialism. The second section considers the short-term aspects of the crisis of capitalism involving the Marshall Plan, the building up of German and Japanese industry, the danger of war, the politics and strategy of atom-bomb warfare, and the political and economic effects of these on Britain. These two sections form the general background. The third section deals with specific effects of these factors on science in Britain and throughout the world, with the diversion of science to private profit and military research, and with the effect of these both on the individual scientific workers and on scientific activity as a whole. The fourth section deals with the responsibilities of the scientist to take action with regard to these developments and to secure cooperation with other progressive forces so that science can be

used for social welfare and peace.

The problems of science could never be solved at any time without reference to the current political and economic situation. That was true even when science could be effectively used only in a very small sphere of human enterprise. Now that there is a scientific aspect to every major economic, political and military question it is more than ever necessary for the scientists to take stock of the world situation and to recognize the interactions between that situation and their own work.

The world we live in is changing rapidly, often more rapidly than our ideas can adapt to it. At the same time the current political changes are only symptoms of much longer term trends which must be understood before these changes can be seen in their true perspective. The major underlying factor is the general crisis of capitalism. This began to show itself at the turn of the century after imperialism had shown its inability to cope with the results of overproduction, it has run through two world wars and major economic crises, and has seen in the Soviet Union, in the new democracies and in China, the first appearance and the subsequent growth of socialism as a stable alternative to capitalism.

Our present difficulties mark one phase of the transition from capitalism to socialism; a phase in which the forces of reaction, after suffering the defeat of their fascist storm troops, are attempting to reorganize and reopen the

conflict. At the same time the war itself and its social and economic effects have not only enlarged the areas free from capitalism, but also have enormously weakened it and increased its internal contradictions.

The major contradiction, the central feature of the general crisis of capitalism, is that between the gigantic development of the powers of production, principally in the United States, and the poverty of the working classes throughout the world, especially in the colonial and semi-colonial countries. The impossibility of finding an outlet for productive capacity that is at the same time useful and profitable is the prime economic cause of imperialism and war.

Britain is placed in a particularly vulnerable position in relation to the threatening economic crisis because of the technical backwardness of British industry arising from the old parasitic imperialist character of British economy. For the same reason she remains extremely dependent on overseas supplies and now that she has lost her overseas investments, a process accelerated though not caused by the war, she is in a most unfavourable position particularly relative to the USA in competition for a limited world market.

The Labour government is doing nothing to minimize these dangers. On the contrary, in the hope of buying temporary alleviation, it is pursuing a policy which is certain to lead to their aggravation. This policy, which is the

traditional policy of British capitalists, is one of restriction of working-class consumption, not for the purpose of building up the basic industries on which the future prosperity of the country depends, but only to produce the maximum of goods for immediate export. At the same time it is attempting to intensify the effective exploitation of colonial areas, crushing popular independence movements so far as it is able and supporting reactionary elements where, as in India, Burma and the Near East, it has been unable to check movements of national independence.

This continuation of old British imperialist policy has been far beyond the means of the country. It has necessarily involved reliance on continuing and ever-increasing provision of aid from the United States. As a result Britain has effectively lost its national independence and is being subordinated economically and politically to the policy of American big business, one of hostility to the Soviet Union and the new democracies. The role of Britain is that of furnishing an advance base in a third world war involving a rearmament program which would itself make the economic recovery of the country impossible

Scientific workers are specially liable to be affected by these developments. As workers they must inevitably suffer from the general attack on living standards which is being made now and face the ultimate threat of catastrophic reductions when these policies lead to

the inevitable economic collapse. It is as scientists, however, that they are more specially concerned, for the present trends are leading to a distortion and limitation of science, in using it for military objectives and to palliate the intrinsic inefficiency of a scarcely modified capitalist system. All the time a greater and greater proportion of scientific effort is being diverted from the service of human welfare and devoted to the preparation of ever more horrible and militarily futile weapons of mass destruction such as the atomic bomb and radioactive and bacterial poisons. The scientific worker is made, therefore, to collaborate with human exploitation in peace and with human destruction in war. In so far as he will not do so, he is being subjected to ever-increasing political pressure which, in the United States and already in this country, is taking a more and more open form of persecution. There is no hope for science under such a regime. Only by a radical change towards a real socialist economic policy, checking instead of abetting the power of capitalism; only by a policy of solidarity with the colonial peoples and of international cooperation instead of a "Cold War" against the Soviet Union and the new democracies is there any hope of building an effective international science that can operate for the benefit of humanity.

I

BACKGROUND TO THE WAR DANGER

THE RISE OF AMERICAN IMPERIALISM

The thesis outlined above is a general one and it needs much elaboration and concrete detail to be fully effective as a guide to action. It is not possible here to do this, but at least some indication can be given of the more significant details both of the underlying factors and their present-day manifestations, viewed in relation to the role of science.

The major feature underlying the present phase of the decay of capitalism is the extremely rapid growth of productive capacity in the United States together with the intrinsic inability of a capitalist economy to share out the benefits that would normally accrue. In 1948 the industrial production of the United States was roughly 60 per cent of the total world production, while the population of the United States, 140 million, is about 7 per cent of the world population. Nor is the value of this enormous production of goods evenly shared among the American people themselves, some 33 per cent going to 10 per cent of the population. One-quarter of the population get less than half the average income. Thus the major beneficiaries are a small group of American capitalists while the control of the whole vast machine of production is in the hands of eight financial monopoly groups.

The reasons for the present location of concentration and control in the United States are partly geographical and partly political. American capitalism has hitherto been isolated from, or more strictly has been able to pass on, those most violent effects of the contradictions of capitalism that by now have made more than half of Europe socialist and have gone far to awaken and liberate the semi-colonial countries of Asia. This is shown in a striking way if we examine the comparative productivity of America and Europe over the last hundred years. As an index we may take that key factor in productivity, steel production. The trend of steel production over this period is shown in Figure 1. This graph is an eloquent witness to the effects of economic crises and war in the development and use of man's productive powers. It can be seen how much these purely economic and political consequences of capitalism, the intrinsic law of its uneven development, have prevented the utilization of technical capacity. Here, however, what is most relevant is that while in the early days of the century Europe's production slightly exceeded American, a lead was gained by the latter during the First World War which destroyed a good part of European productive capacity while creating new productive capacity in the United States.

The great crisis of 1931 which brought American steel production below the European figure showed how capitalism could quite

easily wipe out its own gains. But the situation was saved for the United States, first, by the preparation for a second world war, and then to a larger extent by the war itself, which drove American production to enormous heights while physically crippling much of the production of Europe.

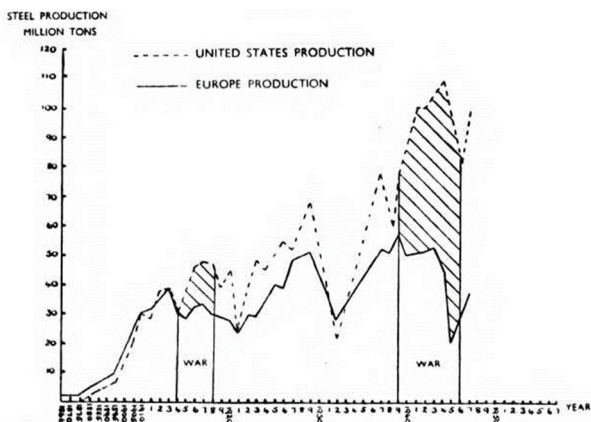
THE SECOND INDUSTRIAL REVOLUTION

The United States now occupies, with regard to the rest of the capitalist world, much the position that Britain occupied with regard to the whole of the world in the nineteenth century. Just as Britain was able to benefit, on account of its security from invasion and its progressive economic structure, freed from feudal restrictions, from the results of the industrial revolution, so the United States has been able to make use of the second industrial revolution of our days. This revolution differs from the first in that it is based, not on the applications of mechanics to handicraft industries, but on the extensive application of science to mechanical, electrical and chemical industries. It is a revolution exemplified most conspicuously by the atomic bomb, radar and penicillin, but it is actually something much greater than these. It is the application of science to formulating and solving production and organizational problems.

The second industrial revolution cannot, however, fully get underway even in the most developed capitalist economy, any more than could the first under feudal conditions. It requires as a necessary initial condition a scientific, conscious, fully integrated and planned economy essentially incompatible with capitalism. Of course, even the first industrial revolution, as Marx pointed out, was in the long run incompatible with capitalism but it could flourish for a time. The second can now only be fully exemplified, as at Oak Ridge, in a distorted form devoted to that one reliable investment of decaying capitalism — war.

Even the partial and piecemeal use of sci-

FIGURE 1



ence and the well capitalized introduction of new industrial techniques has, however, made possible in the United States a rate of

productivity of labour far higher than that of the rest of the capitalist world.¹ This, together with the availability of ample and cheap raw materials, the stimulus of war production and the immunity from war damage, has led to a total production of goods on an unprecedented scale.

THE SEARCH FOR RAW MATERIALS: OIL

One important effect of the scale of American production combined with the extremely wasteful nature of American economy has been the rapid using up of current as well as permanent sources inside the United States. This has not only dried up the former exports

¹ An interesting comparison between the United States and this country in the immediate pre-war years is given by L. Rostas, *International Labour Review*, September 1948. He shows that though the output per man hour in manufacturing industries in the USA was as much as 284 per cent of that of the British worker and the output per man employed was 224 per cent (allowing for shorter hours worked), the overall estimated output per worker was only 170 per cent, and allowing for the smaller ratio of the working population and for unemployment the actual production per head of population was only 125 per cent, approximately equal to the ratios of the national incomes per head of the two countries. This showed, incidentally, both the technical strength and the economic weakness of unrestricted capitalism.

of food and raw materials but has led American capitalism to reach out for sources of supply outside the United States.

The wastefulness of American economy is due primarily to the capitalist nature of its exploitation. It is not an intrinsic feature of the scientific transformation of industry; quite the contrary. A fully scientific economy would be much more economical in the use of materials both by reducing the amounts required for any purpose and by a planned system of recovery and re-use.

TABLE I
ANNUAL CONSUMPTION OF OIL PER
CAPITA IN THE UNITED STATES AND
IN SELECTED COUNTRIES OF EUROPE
(in kilograms)

<i>Country</i>	<i>1938</i>	<i>1946</i>
United States	1,263.8	1,658.9
United Kingdom	254.8	284.6
Denmark	236.6	153.1
Norway	234.0	n.a.
Sweden	216.9	272.8
France	199.6	134.4
Netherlands	198.6	178.5
Switzerland	104.0	92.9
Belgium	94.0	80.9
Germany	92.9	n.a.
Finland	73.8	38.7
Italy	60.9	36.9

Austria	58.8	n.a.
Greece	48.4	n.a.
Czechoslovakia	33.2	26.1
Hungary	27.6	n.a.
Poland	15.2	n.a.
Bulgaria	15.1	n.a.
Yugoslavia	11.8	n.a.

The figures are calculated on the basis of production and import data from *Moniteur du Petrole Roumain* and on population figures from the UN Bulletin of Statistics, June 1948.

The effects of this aspect of American economy are shown most clearly in the case of oil, which is a characteristic consumption commodity of the modern industry, just as steel is its characteristic production commodity. The total consumption of oil products in the United States is shown in Table I, in comparison with European consumption. It will be seen first of all that the consumption in the United States per capita is of an altogether different order from that of the rest of the world: roughly six times as much per head as in Great Britain, ten to fifty times as much as most countries in Europe, and a hundred times as much as that of the less-developed countries. Secondly, as can be seen, this disparity has been growing greater and greater in recent years and is actually one of the major technical factors in retarding the development of less industrialized countries.

The rapacity of the United States oil interests in buying up available oilfields is one of the most effective ways of denying oil to the rest of the world. The Standard Oil Company of New Jersey, for instance, extracts twenty-five million tons of such products from foreign sources annually, more than the consumption of several European countries put together. Another factor is the artificially high price charged by American oil interests for oil products, especially for fuel oil which has increased by three times its price since 1940. It is this combined with the relatively extremely low extraction cost of oil, as of other raw materials such as rubber, thanks to the use of underpaid colonial labour, that more than anything else drives American monopolists to ransack the world for profit.¹

CAPITAL INVESTMENT: EXPORTING THE CRISIS

All these aspects combine to increase the disparity of capitalist development between the United States and the rest of the world, and at the same time the dominating power of its ruling class. The enormous productivity of the U.S., however, fails under capitalist conditions to provide either stability or security. Quite the

¹ The older imperialist countries, particularly Britain and Holland, are busy picking up what is left.

contrary. It is the major cause of insecurity in the world today. The trend in American internal economy has been for the last ten years one of price increases which have, since the war, more than caught up with wage increases.

This is the classical character of a capitalist boom where sooner or later the purchasing power of the bulk of the population is unable to absorb the products of industry and the markets crash. Under present world conditions it is, however, possible to avert the slump for a while by exporting it. The accumulation of profits — in 1948 an all-time record of \$20,000 million — which cannot be shared with the American people, is being made the basis of an expansion of American investments, sales and influence of a pronounced and classical imperialist character. In the first place, capital is being exported at an unprecedented rate. In 1947, foreign investments amounted to \$744 million, mostly in direct investment by large corporations.¹ In 1948, the figure must have been much larger. The facilities for American investments, given their dominating economic position in the world, are unlimited. The heaviest investments are in Germany and Japan, but France, Italy and Spain are, though smaller, also open fields and the possibilities in Britain are not negligible. Indeed, this type of exploitation seems to be welcomed by Conservatives and Labour alike, as the

¹ See *New Statesman*, 23.10.48.

government's Four-Year Plan actually invites such investments as a way of removing the \$300 million deficit still anticipated for 1953.

“It is estimated that this can be covered by gold production and dollar earnings of the rest of the sterling area *together with the United States investment in the United Kingdom* and the rest of the sterling area.” (*European Cooperation*, HMSO, Cmd. 7572.)

It is also, however, necessary to absorb broad consumption as well as production goods: hence the pressure of the maintenance of American exports by the scarcely concealed dumping tactics of the Marshall Plan.¹ American monopolies are now almost openly out for economic world domination, seeking to force all other countries to take expensive American goods and supply America with cheap raw materials. It is a policy of exporting the slump, market restriction through high prices at home being balanced by expansion through dumping

¹ See J.J. Joseph, “European Recovery and United States Aid,” *Science and Society*, New York, Vol. XII, No. 3. “The policy of dumping under the ECA is apparent throughout. It is closely related to the U.S. intention to capture markets and to discriminate against possible competitors. Thus Great Britain is scheduled to receive \$50 million in sugar mainly from United States-owned companies in Cuba, though sugar could be obtained from the dominions. The ECA proposes to send almost as large a value of fish to the *island* of Britain.”

abroad.

The picture of the world in the American century, as it appears to those in control in the United States, is one of an economically prosperous United States secured by a belt of "poor white" Europe whose low-wage industries would form a valuable corrective to the wage claims of American workers. Both would depend increasingly on the products of the slave black empire taken over, though still managed for the time being by the older imperialisms of Europe. But the policy of capital export and dumping is not capable even of countering the dangers to capitalism from impending slump. The internal position of American capitalism is none too secure either economically or, as the recent election has shown, politically.

American imperialism, moreover, cannot hope to solve either its political or its economic difficulties by economic means alone. It is now no longer possible, as it was in the early days of the twentieth century, to carry out imperialist exploitation with little or no resistance from the victims. Whole areas of the world, such as Eastern Europe, are now closed to such exploitation and in further areas, such as China and Southeast Asia, there is a better organized and more successful resistance than has hitherto been known. Further, although there are no rival imperialist countries against which it is necessary to arm, American capitalists see their nemesis in the growth of a strong and

economically stable Soviet Union.

THE WORLD OF SOCIALISM

As the century advances, the focus of interest in human affairs is shifting from the last stages of decay of capitalism to the first stages of the growth of an alternative political and economic system. The Russian Revolution of 1917 was a portent. The Soviet Union of 1948 is a power which must be increasingly taken into account in every problem of contemporary economics and politics: and now the Soviet Union does not stand alone. Around it are grouped an increasing number of peoples which were formerly the outer, neglected and oppressed fringe of the capitalist world and who now have, largely as a result of the war, turned to the Soviet Union for inspiration in their own reconstruction and protection from the permanent danger of capitalist penetration and subjection. In the people's governments of Eastern Europe we have seen already in the three years since the end of the war an achievement of reconstruction unparalleled in the rest of the world,¹ but far more significant than any material achievement is the effective creation of new peoples, aiming by their own efforts at

¹ See series of articles on planned reconstruction in the new democracies in the *New Central European Observer* (35 Pont Street, London, S.W.1), commencing December 11, 1948.

reaching an ever-increasing standard of material well-being and social culture.

MOVEMENTS OF LIBERATION

There is all the difference in the world between these plans inspired and carried out by the people whom they benefit, and the paternalistic and hypocritical plans of the western powers for the improvements of backward peoples, whether these are directly under imperialist control, as in the colonies, or indirectly, as in the semi-colonial countries. In many areas of the world, notably China, Vietnam and Greece, the emerging national movements are engaged in a relentless and increasingly successful military struggle against the forces of local reaction which are amply and openly supported by imperialist governments. There is no country under capitalist control which is today without hope of liberation. The knowledge of this, and of the example of successfully liberated countries, is one of the major causes of the increasing reactionary tendency of the old and new imperialists. The basic impetus for liberation, however, is necessarily from within, arising from the intrinsic inability of imperialism to provide for the real needs and aspirations of the peoples of undeveloped countries. It marks an immediate reaction to the impact of a new wave of economic exploitation, aimed at extracting the largest amount of mineral and vegetable raw

materials from their territory for the benefit of the big monopoly interests to meet the insatiable demands of American economy and to provide the so-called strategic materials for war preparation.

The movement of liberation is not confined to the undeveloped or colonial countries. It is just as real in the imperialist countries themselves, though it takes different forms according to their economic structure and recent political history. In all the countries which were subjected to German occupation the *raison d'être* of the resistance movements did not disappear with the end of hostilities. Men and women did not risk torture and death in order to recreate a form of society which had betrayed them to the nazis and which was ruled, and is still ruled, by collaborationists. In France and Italy, although foreign threats and bribes have secured governments of reactionaries supported by subservient social democrats, popular resistance is still active and will prevent any reliable alignment of these countries with a military intervention against the Soviet Union. In the smaller countries of Europe it is more difficult to resist economic absorption by American capitalism, especially where, as in the case of Belgium and Holland, they are also imperialist countries whose hold on their colonial possessions is entirely dependent on American goodwill, but even here resistance exists and will grow as the crisis deepens.

The position of Britain, however, is altogether a special one. In the capitalist world Britain is, after the United States, far the most important industrial country and it carries with it both the experience and the prestige of her former position as a dominating imperialist country. Although as the result of war coupled with a disastrous economic policy that position has been lost and the country has become economically dependent on the United States, nevertheless, for reasons of interest as well as of sentiment, it pays the United States to conceal that dependence as much as possible and thus not to risk raising the great and effective opposition which the British people would undoubtedly exert once they realized where they were being driven.

II

THE DRIVE TO WAR

That direction is towards war, for the very size and extent of their interests is a source of danger to the capitalists. It becomes all the more necessary for them to protect their interests against the reactions of the exploited peoples of the world provoked by their own depredations. There was a time when this protection could be exercised by unacknowledged agents, of which the most conspicuous were the Italian fascists, German nazis and Japanese imperialists. These agents, it was hoped,

could be counted on to keep their own peoples in order and to contain and ultimately to destroy the one focus of resistance to capitalism in the Soviet Union. They did not turn out to be so reliable. In the first place, they found it more convenient to attack the weaker capitalist countries and then when they attacked the Soviet Union the peoples of the capitalist countries themselves forced their rulers, unwillingly and grudgingly, to assist the Soviet Union in the destruction of fascism.

THE UNITED STATES AS THE CENTRE OF REACTION

Now, with open fascism out of the way, the capitalism of the United States has to take on far more openly its role as a centre of military and political reaction in the world. It is a new responsibility. Hitherto the United States has been a relatively peaceful nation, but its rulers are driving it into a frantic militarism, one which can play on the capitalists' real fears of the growth of genuine socialism, and on the fears, cleverly stimulated in the rest of the population, of the horrors of modern war.

There are, of course, other and more positive reasons for the growth of militarism in the United States. The war brought into being an enormous new caste of military officers largely drawn from and closely linked with heavy industry. These have a vested interest in maintaining the country on a war footing. Even

more important are the economic rewards and justifications for large armaments. The American aircraft industry, for instance, would have been bankrupt many years ago if their lobbying had not been so successful in building up an enormous fighting force.¹ Again, however, even this degree of production wasted in war preparations will not in itself be sufficient to avert the crisis of overproduction. Only war itself can ensure sufficient outlets and adequate profits to keep the capitalist industrial machine working at full capacity.

(Note: This is only too apparent in the production chart. Figure 1.)

Hence the drive to war itself, a drive restrained for the time being by the only too well-founded doubts of the militarists themselves about the success of such a war and ultimately by the reactions of the peoples of the United States and its allies. As long, however, as the United States remains in the control of monopoly capitalist interests, in spite of gestures and apparent concessions that have been made from time to time to popular insurgence, the danger of economic collapse and war will always be present.

(Note: This can be seen from Table II showing the industrially employed population of different countries. It can be seen that

¹ One leading firm, Lockheed, reported in October 1948 that 95 per cent of its production was for military uses.

Britain, with some fifteen million industrially employed, stands midway between America with its thirty million and France with its five million industrial workers.)

Within three years of the end of the Second World War staff talks, alliances, rearmament and general preparations for a third world war are already being made, at a time when the capitalist countries are already either involved in or on the brink of a deep economic crisis. These immediate questions overshadow all others and are preventing any possibilities of long-term reconstruction. The most characteristic feature of the present situation is the drive to territorial and ideological splitting of the world, involving an increasing polarization of people driven to choose between capitalism and socialism, and the open admission of economic and political dependence of all capitalist countries on the United States.

TABLE II
EMPLOYMENT IN INDUSTRY—
MINES—CONSTRUCTION—
TRANSPORT

*(excluding commerce, finance, personal service
and agriculture)*

	000s
United States (1946)	20,763
Great Britain (1946)	10,184
France (1946)	4,075
Canada (1941)	1,574

Germany ¹ (1939)	16,289
Japan (1930)	7,057
USSR (1936) 22 million. Not exactly comparable with other figures.	
All wage and salary earners (1941)	31,600
Aim by 1950	33,500

The policy built up by the Allies during the war, and which took its final form at Potsdam has now been openly repudiated by its American and British signatories. That was a policy envisaging a common and cooperative move towards permanent peace reconstruction, particularly of the devastated countries of Europe and Asia, to be carried out through the assistance of the United Nations and directed in each country by governments representing all the popular elements that fought against Hitler and Mussolini. It then seemed that a beneficial evolution of the world at least for decades would be possible, with the different political and economic systems existing side by side. This has been, and still is, the aim of Soviet policy, but it has been increasingly repudiated in Britain and America as effectively by Mr. Bevin and Mr. Truman in action as it is by Mr. Churchill and General de Gaulle in words.

THE COLD WAR

¹ Excluding Saar and Austria.

Instead American-British policy has become one of pacts and unions of an increasingly military character, together with economic plans to secure their material basis and a general intensification of colonial exploitation. Most important and significant of all are the efforts now being made to reconstruct German and Japanese economy under the control of the most reactionary elements in these countries, recreating by doing so the very danger which the Second World War was fought to avert. Also in line with this policy is the support of reactionary regimes everywhere, a support expressed by armed interference in Greece and China, and by economic and political support of the fascist regimes of Spain, Portugal, South America and the Middle East.

This policy has now acquired a name of its own, that of the "Cold War" on the Soviet Union, and this war is being conducted more and more along the lines of the old Anti-Comintern Axis of the fascist powers. The application of the term "Cold War" is now being twisted into a description of a war the Soviet Union is alleged to be waging against its former allies. In fact, it arose largely as the result of British instigation, expressed in Churchill's Fulton speech in 1946, as a policy of "getting tough with the Russians" enheartened by the possession of the atom bomb.

The tendency that is now being clearly revealed is one of return, so far as that is possible, to the pre-war capitalist world picture.

Only the wilder imperialists, such as Mr. Churchill, would like to see the whole picture restored, including the reincorporation of India and Burma in the Empire, and the restoration of the countries of Eastern Europe to the incompetent and tyrannical governments to which they were entrusted by the victorious allies of the First World War. Nor is it possible to carry reaction through under the same cynical terms that were acceptable in the inter-war period. People have experienced enough to be aware of them. Instead hypocrisy is now the rule. The same things are now being attempted under new names, those of the Marshall Plan for economic recovery, Western Union and Atlantic pacts for the defence of democracy. The advantage of these presentations is to secure wholehearted support from a great majority of honest people for these schemes who believe that they are intended by their sponsors to achieve, and in fact would achieve, economic prosperity and peace. To their more well-placed backers, particularly in America, these pretences are usually apparent. They see well enough the real objectives of securing effective United States predominance in the world, containing the Soviet Union and ultimately restoring the "freedom" of capitalism in every part of the world.

THE MARSHALL PLAN

The Marshall Plan is ostensibly one for

securing the reconstruction of the economics of certain Western European countries to the state that within five years they should become “wholly independent of any further exceptional external aid” (Sir Stafford Cripps’s speech in the House of Commons, 1.11.48). Even if the European recovery program schemes were effective, and in view of recent experiences it would seem most surprising if they were, they would in fact leave Europe at the end of the time with an economy entirely dependent on that of the United States and with a political structure so organized as to ensure the predominance of reactionary capitalist elements. In the Labour Party pamphlet, *Feet on the Ground*, it is made clear that in every country receiving aid the right parties are in the majority¹ and the more Western Europe is united, particularly with the inclusion of a far-from-denazified Germany, the heavier will the predominance of reaction be. The result of these developments is that by restoring effective capitalist power throughout their area of operation, Europe is exposed once again to just those economic and political strains that brought them under fascism and the drive towards war.

The economic basis of the Marshall Plan is in itself extremely unsound. As was pointed

¹ They manage by using electoral figures to show that Labour is itself a minority in Britain and they use that to excuse their own subservience.

out in the 1948 report of the European Economic Commission,¹ the tendency since the war has been for Western European countries to increase their imports from the Western hemisphere and to decrease those from Eastern Europe, thus ensuring on account of lower productivity of Western Europe compared to the USA a condition of permanent trade unbalance. Increased trade with Eastern Europe, particularly during the reconstruction period, in the exchange of capital goods from the more industrialized Western countries with food and raw materials from the Eastern, would be of immense mutual benefit and is the only way in which a really stable and progressive European economy can be built up.

EUROPE AS AN AMERICAN COLONY

One of the criteria by which the real intentions of the promoters of the Marshall Plan can be judged is their attitude towards improvement of productivity in Europe. The plan aims at restricting industrialization in Eastern Europe as much as possible. It has, for instance, already prevented effective trade between Poland and France, and the French government is made to take expensive German coal, payable at a high price in dollars, in preference to

¹ *A Survey of the Economic Situation and Prospects of Europe*, UN Dept. of Economic Affairs, Geneva, 1948. See also J.J. Joseph, op. cit.

cheap Polish coal. Similar restrictions are placed on steel imports from Austria into Czechoslovakia. Further, the specific United States prohibition of types of goods likely to be of military value has been extended to cover so much machinery, particularly electrical machinery, that its intention is clearly as much economic as military.¹ The proposal of the

¹ "At this moment, Poland is being refused by the United States export licences for about seventy commodities representing her normal imports from the United States, the value of these commodities not exceeding \$10,000,000...

"You might perhaps ask whether the reasons on the part of the United States for refusing licences to Poland are of a military nature and if the American government does not consider them as susceptible to serve the Polish military effort. I shall let you judge for yourself: the commodities involved are cotton linters, synthetic resin, tubes for condensers, radio lamps, apparatus for measurement, gramophone discs for recording, needles for textile industry, ball bearings, etc. Can you believe that these commodities constitute war material, the export of which might endanger American interests?

"You are all familiar with the provisions of... the Economic Cooperation Act of 1948, which constitutes the basis of what in everyday language is called the Marshall Plan. This gives to the administrator of the Marshall Plan the right to prevent exports of all raw materials and semi-manufactured products to the destination of any of the countries participating in the Marshall Plan, if these commodities might serve to the production of finished products likely to be exported in turn by those countries

Soviet Union that the European Economic Commission should set up a committee to speed up the industrialization of war-devastated countries was defeated at the instance of the British and American governments. Further, serious industrialization in Western Europe except in the case of Germany is almost

to the destination of any European country not participating in the Marshall Plan... The United States government reserved its right to direct the overall export policy of these countries — obviously in order to be able to prevent exports to the destination of Eastern Europe...

“How can the statement of Mr. Hoffman, the Administrator of the Marshall Plan, on the necessity of economic reconstruction of war-damaged countries as well as on the necessity to strengthen the economic ties between Eastern and Western Europe be reconciled with his assurance that Western Europe should not make ‘war contraband’ to the destination of Eastern Europe? Does this mean that Mr. Hoffman intends to forbid the countries of Western Europe to export to Poland apparatus for measurement or spare parts for tractors, just as the United States government is doing now? But if this is the case, how does Mr. Hoffman intend to improve, by aid of Eastern European exports, the food supplies in Western Europe, if at the same time, he refuses to Eastern Europe agricultural implements that are indispensable for that region?” — (Extracts from speech by M.Z. Modzelewski, Polish Foreign Minister and Chairman of the Polish delegation, at the meeting of the Second Committee of the Third General Assembly of the United Nations, Paris, 2.11.48.)

as severely frowned upon. For instance, the revised plan for France envisages the production of much more food and much less steel. In general it would appear that the position of Europe under the plan would be one in which there would be no possibility of competition with major industries in the United States, but in which Europe could be permitted to produce food for itself and a certain amount of light industrial production and luxury goods made with cheap labour, thus exercising a valuable corrective on high wage rates in the United States.¹

It is often claimed that the restriction of Marshall Aid to Western Europe was imposed by the refusal of the Eastern states to come into the Marshall Plan. This refusal, however, was based on the very character of the plan itself, which is one of extending everywhere it operates the principles of normal capitalist exploitation under the guise of free economic intercourse. It was recognized even in the nineteenth century that free trade between a highly developed industrial nation and a poorly developed one simply meant subjection of the economy of the second to that of the first. That was why it was so popular in Victorian England, but also why it was resisted at that time in less developed countries by the creation of

¹ For a detailed analysis of the character of the Marshall Plan and its economic consequences see J.J. Joseph, *op. cit.*

tariffs. Under the Marshall Plan, far from protection of the weaker countries, it is they who have to promise to facilitate one-way free trade. Much play is made of the generosity of Marshall terms, with its free gifts and loans. That is an old story, too, but in those days it was the bankers in imperialist countries of Europe who used to give loans and assistance to Turkish pashas or Chinese mandarins and they were certainly not in business for their health. Western Europe is also beginning to experience the pleasures of being colonized; the troubles will not keep us waiting long. Those countries that have governments capable of defending them from such exploitation naturally could not accept the plan on these terms, but the reactionary or weak "socialist" governments of Western Europe preferred subjection to capitalist America to the sound economic development and independence of their own country.

The Marshall Plan has also the convenience that opposition to any of its features could be put down to Cominform influence and rapidly equated with treason. Thus it is possible to shoot down strikers and pass anti-labour laws in France and Italy while holding in check the natural sympathy of their fellow-workers in Britain and America. In those countries where things have not got so far it is in the name of the Marshall Plan that wages are frozen while prices rise and the traditional reactions of trade unionists are stifled by

threatening them with the foreign devil of communism.

Nevertheless, it is only with the fullest support of militant workers that any permanent increase in productivity can be achieved, and such support can never be given as long as a policy of cooperation with capitalists and repression of the working class is followed.

The operation of the Marshall Plan has in fact already had the effect of lessening the possibility of economic recovery of all the countries which it covers; particularly is this the case in Britain where the Cripps policy of "all for export" and of capital cuts has already lost precious time needed to achieve the productivity based on the application of science and technics. The success of this export policy itself is in doubt; the apparent improvement in the balance of payments is largely due to windfalls, including £100,000,000 for the sale of the Argentine railways. Production and export targets have both been scaled down and the future possibilities of attaining these targets are very doubtful in view of the hardening of the market position, and will be even more so when German and Japanese goods produced through the agency of the Marshall Plan and American investments begin to compete with those of Britain.

This is to ensure a market for the enormous surplus of American production on America's own terms; to compel the Marshallized countries to take such commodities as the

American capitalist monopolies please; to restrict the development of the key industries of steel, engineering and chemicals which could lead to the Marshallized countries being able to stand on their own, assert their independence and even compete with American production; and to maintain the Marshallized countries in a condition of permanent economic independence.

By this means American capitalists evidently hope to avert the onset of the inevitable slump, the danger of which is quite apparent to them. This slump is actually in process of being exported from America to the Marshallized countries — the crisis is to be driven out from the centre to the periphery. The economic provisions of the Marshall Plan, which lead to the restriction of the capital re-equipment of industries and to lowered standards of life, can only hasten the onset of capitalist economic crisis of the classical form in Britain, France and other Western European countries.

MILITARY ASPECTS OF THE MARSHALL PLAN

The Marshall Plan, it must be remembered, is only a second stage of American initiative which started with the so-called “Truman Doctrine,” a doctrine expressed as the willingness of the United States government to support with money and arms all governments willing to repress communism internally or to

carry out policies hostile to the Soviet Union. There was to be no nonsense about the “democratic” character of such governments or how far they contained collaborationist or fascist elements. What this meant was shown only too clearly by the first recipients of Truman Doctrine aid in Greece, Turkey, Persia and China. All the countries were valued not primarily for economic reasons but because they furnish useful bases for military attack on the Soviet Union. The Marshall Plan is an extension of this policy to Western Europe with an appropriate camouflage because these countries are not yet under such dictatorial regimes as those of the Middle or Far East.

This aspect of the Marshall Plan as a bulwark of capitalism (individualism, freedom, democracy, the American way of life, etc.) against communism is quite openly stressed in the United States. Indeed, it was a major factor in making it acceptable to Congress. President Truman, in his message to Congress, December 19, 1947, stated: “Our deepest concern with European recovery is that it is essential to the maintenance of the civilization in which the American way of life is rooted.” Mr. Hoffman, the ECA administrator, put it more bluntly: “Prosperity through ERP is a powerful antidote to communism.” (Senate Hearings, January 1948.)¹ Since then matters have moved much further.

¹ Cf. J.J. Joseph, *op. cit.*, p. 362.

Its application proceeds in two stages, first of political and then of strategic preparation for war. The political objective is one of securing that all of the countries concerned have governments easily amenable to American strategic policy; this involves as a first step the break-up of democratic coalitions which included communists. In France and Italy it is the unstable and reactionary governments installed by American pressure, and not communist parties, which are disrupting the economies of their countries. While the latter remained in the government they cooperated loyally and indeed took the lead in the recovery and industrial productivity of their countries. Their crime was to insist that this should not be done to the disadvantage of the working classes. Their expulsion has been a signal for an attack on the working classes' standard of life and for the emergence of a regime of corruption, black market and inflation.

The political objectives of the Marshall Plan — stable, amenable capitalist governments — have not been achieved, nor can they be. The contradictions of capitalism lie too deep. The only logical but still futile step is towards fascism. But the military stage cannot be delayed. The objectives are the provision of bases for United States bombers in Western Europe, and particularly in Britain; secondly, the rearming of Western European countries to provide ground troops to hold these bases until reinforcement can arrive from America;

and, thirdly, the development of such an industrial base in Germany as will provide equipment, labour force and ultimately fighting men for an assault on the Soviet Union.

Such plans have been openly discussed, not only in American journals, but in such responsible British periodicals as the *Observer*.¹ That

¹ "This means, in practice, three things. Russia will have to withdraw her armies to within her own frontiers. She will have to call off the universal campaign of political subversion and economic sabotage which is now waged by her fifth columns. And, most important of all, she will have to agree, like every other country, to the establishment of an all-embracing super-national Atomic Control Authority as the sole agency empowered to develop atomic energy, with all necessary inspection and sanction rights to enforce its monopoly.

"So far, Russia rejects every one of these necessary demands. While she continues to do so, the drift of the world is inevitably towards war, and no wishes, hopes and prayers can stop that drift. Every day that Russia adds to her conquests and pushes the unconquered part of Europe and Asia further towards the last ditch, every day that Russia proceeds with atomic research and development to add atomic bombs to her already huge military and political armoury, brings war relentlessly nearer. If peace is to be saved, Russian policy must be reversed.

"Can it be reversed without war? The only chance is to build up overwhelming strength to back up our just and moderate terms of peace. Faced with overwhelming, instantly available strength, Russia might accept our terms, give up her imperialist

they make military nonsense is not the point; the peoples of Western Europe are neither able nor willing to act as a cushion for atomic warfare between the USA and the Soviet Union, as one frank official military commentator in the United States proposed. Nor does the fact that the Americans consider most of Continental Europe "expendable" have any appeal to the local population. The war plans of Churchill from Fulton to Llandudno may be in fact as foolish as those that lured Hitler into the attack on the Soviet Union, but they are being proceeded with as energetically.

If it were not for military preparation already embarked upon by the countries of Western Europe, most of their economic difficulties would not have occurred. In particular Britain, without the armed forces of 800,000 and its expenditure, direct or indirect, of some £1,000 million per annum for military purposes would have been able to meet her external payments without exceptional help from the United States. Marshall Aid may in fact be regarded as a concealed subsidy to the states of Western Europe for military preparations

ambitions and be content to become a nation like any other, without going to war. Faced with hesitation, irresolution, disunity and moral or physical weakness, Russia is sure to go on pushing forward in all directions till a desperate death-struggle, with unconditional surrender of one side or the other as the only possible outcome, becomes unavoidable."

— Extract from *The Observer*, 21.11.48.

against the Soviet Union with the additional sting that here we are expected to refer to it as far-sighted generosity and idealistic contribution to world peace.

This apparently is not yet enough. Neither Western Europe nor Germany are arming soldiers at the rate to suit the American tempo of the "Cold War"; not only must military pacts of the Western Union be entered into, not only must joint chiefs of staff remain in existence, or be extended in function, but even further rearmament is required and an Atlantic Pact involving lend-lease arrangements and the provision of American arms is forecast in the near future. If this happens it will be difficult to maintain the pretence that Western Europe is anything but a collection of satellite buffer states whose populations exist to work and tight and die for their American benefactors.

THE ATOM BOMB

Behind all the war preparations now so busily going forward under the guise of the defence of Western civilization, its latest products — the atomic bomb, radioactive poisons and bacterial warfare — are busily being perfected and got ready for instant action. War, too, has become scientific and the governments of the United States and Britain are spending many times more on research to produce these horrors than they are willing to spend for the health and welfare of their

peoples.

Professor Blackett's timely book¹ shows us how much more the atom bomb means as a psychological and political weapon than as a military one. The other types of "scientific" warfare, striking as they do indiscriminately at the civilian populations which are much more difficult to protect than the military, only emphasize this point. Mass bombing of cities proved its futility as a means of winning the Second World War. Though it was extremely useful in exalting the importance of independent strategic air force and of the industries that exist only by virtue of their building warplanes.

The political value of the new terror weapons is, however, enormous. The news of the dropping of the atomic bomb produced, particularly among the American and to a certain extent among the British people, a great feeling of fear. The fear, which was natural enough, was exaggerated with the best intentions by naïve scientists who wished to scare the world into abandoning this weapon. It was in fact skilfully used to produce the opposite effect of justifying the most lavish expenditure of public money on the production of even more horrible weapons as the only means of defence through retaliation. There was also, particularly in America, a deep sense of guilt at the

¹ *The Military and Political Consequences of Atomic Energy*, by Prof. P.M.S. Blackett. (Turnstile Press, 1948.)

wanton and horrible killing of hundreds of thousands of civilians in the demonstration of a new weapon at the very end of a war that was already won. As people come to realize that in fact the atom bomb was dropped as the opening of a third world war against the Soviet Union and that the Japanese were only the unwitting victims — a thesis amply documented in Blackett's book — the feeling of guilt will increase, but so will the attempts to evade it by building up the bogey of Soviet power to such an extent that any means will seem justifiable to crush it.

The great military attractiveness of the atom bomb, sedulously propagated by the military clique in the United States and their backers, is that as long as the United States are the only power possessing it war might be fought with the casualties practically all on the other side. That hope, although it is somewhat discredited, is still the basis for the propaganda for preventive war — "Nothing stands between us today and complete subjugation to communist tyranny but the atom bomb in American possession," said Churchill in his notorious Llandudno speech. The veteran pacifist, Lord Russell, cannot wait for the attack but wants to drop the bomb at once. The essential and economic weakness of this popular view of atom-bomb warfare is that it does not in itself justify either expenditure of money or the draagooning of soldiers necessary to maintain capitalist production at boom levels and suppress

working-class opposition. Hence the increasing emphasis on the need for other arms — ships, guns, tanks — and mass armies.

The spectre of militarism that two wars were fought to exorcise is marching again and will march as long as the dominance of capitalism that cannot long exist without militarism is allowed to persist. Militarism has been traditionally associated with reaction in politics and culture. When generals begin to aspire to political prominence liberties soon disappear. It is not for nothing that the author of the Marshall Plan was a chief of staff or that the aspirant to the dictatorship of France is General de Gaulle. Military and economic reaction are natural allies.

THE WESTERN UNION

The militarism of this era, however, is not the multinational militarism, or even the imperialist militarism of the earlier decades of the century. It is effectively American imperialism and nothing else. The other armies will be no more independent than were those of Hungary or Romania under the nazis. They will be armed by America, trained along American lines, operated under the control of American commanding officers. Some face must be preserved by the appointment of Allied commanders such as General Montgomery and some pretence may be made that the Western Union, plus the colonial empire, could be a third force

of equal status to the United States of America and the Soviet Union.

“There is no doubt that if the countries of Western Europe could act together as one, their collective resources in population, industrial capacity and raw materials would give them power in the world equal to either Russia or America.” — (*Feet on the Ground*, p. 5.)

Actually the countries of the Western Union are being bound economically, politically and militarily to the United States and will be even more so by the end of the operation of the Marshall Plan than they were at the beginning. Only Britain and Germany are first-class industrial countries. The Marshall Plan, as it has already been pointed out, does not propose that Britain should develop its heavy industry to any extent,¹ and in so far as German industry is permitted or helped to do so it will be as a branch of American heavy industry. Without a heavy industrial base and without armament-producing industries for which the Western Union has neither the manpower nor the machinery, there can be no independent military action and the exploitation of the colonies, however hard pressed, is unlikely to do more

¹ Indeed, by restricting scrap imports and by scarcely disguised political pressure, one important branch of heavy industry — shipbuilding — has been cut down and others are threatened by capital cuts.

than provide Europe with food substitutes and the United States with strategic war materials.

In fact the Western Union is a negation of the national dependence of the historic countries of Europe, a negation which has been accepted by their governments as a lesser evil than accepting popular democracy under the leadership of the working classes. It is besides an unnecessary and futile gesture, militarily and economically. On paper it is true the grouping together of 260 million people gives the appearance of numerical strength. But the strength of an alliance or a union can never be greater than that of its component units and the countries of Europe under reactionary and corrupt governments by coming together are only multiplying their weakness and disagreements. Above all, they cannot carry with them the support of their peoples who, as events enlighten them as to the real objects of their governments, will move into ever more effective opposition.

BRITAIN UNDER MARSHALL AID

The internal effect of aligning Britain with the Marshall Plan and Western Union is to emphasize every negative and reactionary aspect of British politics. As Conservative speakers have not been slow to point out, the more Britain is leagued with states of Right and anti-communist governments the more difficult it will be to have any "socialist" government in

this country. Behind the façade of socialism the capitalist economy of Britain is being effectively retained, in spite of, or even by means, of nationalization, including an altogether insupportable burden of rent, interest and profit. The policy of holding up capital development means that industry cannot be equipped materially to achieve the high levels of productivity. These results drive towards harder work and longer hours, a process which is intended to be disguised by the use of psychological incentives. At the same time higher prices impose lower real wages and any effort to better them is put down to Cominform propaganda.¹

Under these crippling restrictions British economy has proved unable to recover from the effects of war and the loss of many of its imperial sources of income. Instead of attempting to change the whole basis of British productivity and use the magnificent equipment and manpower of Britain to reconstruct

¹ "To desire to keep down the rate of wages, with the view of favouring the exportation of merchandise, is to seek to render the citizens of a state miserable, in order that foreigners may purchase its productions at a cheaper rate; it is, at most, attempting to enrich a few merchants by impoverishing the body of the nation; it is taking the part of the stronger in that contest, already so unequal, between the man who can pay wages, and him who is under the necessity of receiving them." — Extract from *Political Economy* (Works of Benjamin Franklin, Boston, 1847), p. 437.

British economy, the Labour government has taken the disastrous course of dependence on American "aid" and in return has been obliged to act as the agent of American interests in attempting to rebuild capitalism in Europe, and particularly in Germany, and re-establish imperialist control throughout the world. Effectively the Labour government is making Britain safe for capitalism, or perhaps more accurately, safe for American capitalism.

The touchstone of British political and economic life is rapidly becoming how far it fits in the economic policy of the Marshall Plan or the militarization policy of the Western Union. To question the wisdom of either is rapidly being taken as a proof of disloyalty or even treason. The drive for rearmament affords further excuses for reaction. It has already led to the purge of those even suspected of opposing official policy and is spreading from the armaments ministries to the rest of the civil service and from them to public and private employment; it has now even reached the trade unions.

The drive to secure larger armed forces goes inevitably with propaganda against our former allies and this propaganda becomes more and more indistinguishable as time goes on from that of our common enemies, Mussolini and Hitler.¹

This means a closer and closer alliance

¹ See quotations, p. 90.

between the Labour Party and most reactionary elements in the country stretching to the fascists whose propaganda the Labour Home Secretary has taken such pains to protect. The ultimate aim is to promote an attitude of docility at home and aggressiveness abroad, as well as to make a new war possible even before the old has had time to be forgotten.

THE CONTRADICTIONS OF THE MARSHALL PLAN

It is most important to realize that the Marshall Plan is, like the capitalism that engendered it, torn with multiple contradictions. The "plans" of the various receiving countries are irreconcilable as each of them is attempting to cut down imports from each other at the same time as increasing exports to each other. A far more important contradiction is that the desires to combat communism and to ward off the American slump are fundamentally incompatible. The first implies the revival of an independent, competing, capitalist economy in Western Europe, and this is impossible to reconcile with immediate American economic interests. These contradictions will result in vacillations and compromises. It will probably be necessary, especially if the rearmament of Western Europe is to proceed fast enough, to allow for greater industrial development even in Britain than American industry would like.

The effect of this, however, will be offset

by heavy American investment and rapid recovery of German and Japanese industry, which, as it cannot all be turned to armaments at once, will increase the competitive difficulties of the other capitalist countries. In the last resort, however, it will be the dominant monopoly interests in America that will determine the character of Western European economy and politics: and whatever else it is, it will be reactionary and militaristic.

To sum up, the fruits of the Marshall Plan for European countries and for Britain in particular are: economic and political dependence on the USA; restriction of basic industries, capital cuts and disruption of post-war recovery; perpetuation of the capitalist system, under USA tutelage; the onset of a new capitalist economic crisis; military preparations for war against the Soviet Union.

This policy has not had the success in Britain or America, not to speak of France or Italy, that its sponsors had intended. The war-tired people show themselves allergic to recruiting drives or to extreme right politics. In the measure that political leaders began to advocate reaction more openly they are being repudiated by the electors. Truman's real policy has been one of industrial suppression at home and war preparation abroad, but he won his election on a "labour rights and peace" platform. The feeling of the people throughout the world, and not least in America and Britain, is dead against the policies which their governments and their economic and military bosses are

following. Before, however, that opposition can be effective in the face of a barrage of deceptive propaganda people have to learn to distinguish between the peaceful professions and the war-like actions of their rulers.

III

HOW SCIENCE IS AFFECTED

Both the present operation and the future prospects of science are absolutely dependent on the developments in the economic and political fields that have just been discussed. In general, and with a time lag that is shortening with the years, the direction and intensity of scientific work is determined by those of the economy and politics of the country. Any important change of direction in policy immediately changes the type of work done by scientists or engineers operating or controlling production; after a short delay it changes the direction of scientific development and research. On a long-term basis it affects the training of scientists of the future.

In the present situation three general trends are observable in the utilization of science in Britain; firstly, the trend towards predominant concentration on war research; secondly, the trend towards an emphasis on immediate export production and away from long-term development in industry; and lastly, the trend towards increasing colonial research.

In contrast, research for immediate human welfare, housing, health and home agriculture are growing so much more slowly that they are relatively taking a smaller and smaller place in the national research programs.

This picture, drawn for Britain, is repeated with characteristic variations in other capitalist countries. In many European countries, however, science is maintained on a much more meagre budget, so small in fact that in spite of the work of a few brilliant individuals its continuance is in danger. French expenditure on civil scientific research and development is only about £8 million per annum, of which £1 million is for fundamental research, and the poor salaries of scientists discourage entry into that profession. Only in relatively sheltered countries, such as Switzerland and Sweden, is science in a healthy state.

DOMINANCE OF UNITED STATES SCIENCE

Moreover the absolute predominance in wealth of American science is already having a very depressing effect on science in the whole area. There is a tendency, particularly for scientists of reputation and promise, to be drawn by the better salaries offered in America to such an extent that this, combined with political and economic disturbance in Europe, has led to an exodus of probably more than half of the most brilliant scientists of Europe.

It has been made clear in Britain, particularly by the Scientific Manpower Commission, that there is an existing shortage of scientists which is likely to become more acute unless the teaching of science is much extended. This has been brought home in a most striking way by the appeal for geologists from the United States for exploration in the British Empire, the supply of native geologists having been depressed for years by the poor prospects and employment that have previously been offered.

There is probably no field of human effort in which the dominance of the United States over the rest of the capitalist world is so clear as in science and this even more for applied and military science than for the older more fundamental sciences. It is interesting to note, for example, that in a recent survey it was found that more American than British scientific literature was read by British scientists.¹

SCIENCE IN THE SOVIET UNION AND THE NEW DEMOCRACIES

In contrast to these developments has been that of science in the Soviet Union and in the new democracies. In the former a consistent policy has been followed from 1917 onwards of developing science in relation to the economic and social needs of the people. In fact most of

¹ Report of Royal Society Information Conference, 1948.

the schemes of scientific development now adopted in the United States, Britain and France have been based on the Soviet experience, but they have lacked what the Soviet Union had — economic principles and a plan to which the scientific research could be positively linked. Naturally there is war research in the Soviet Union — enough to have provided the nazis with some very unpleasant surprises — but it does not infiltrate and dominate the research of civil science as it is doing in Britain and the United States. Even during the war, civil science, which practically came to a standstill in the other countries, flourished and expanded in the Soviet Union.

In the new democracies the initial task has been very much harder than in any Western country on account of the initial poor development of science in those countries because they were for years before the war subjected to German political and cultural domination and because during the war the nazis had a deliberate policy of massacring all intellectuals. Nevertheless they have been able in a little over three years by heroic efforts to develop an organization and practice of science related to the problems of reconstruction and to start the training of thousands of new scientists for the further raising of the economic and cultural levels of their peoples. Here as in the Soviet Union another great advantage has accrued, the ability to call on the whole of the people and not on an almost hereditary class of intelligentsia,

civil servants, professional men and teachers for the scientists of the future. Even in Britain and the United States, with their allegedly democratic traditions, this is by no means the case. It is estimated that only 20 per cent of those coming from working-class families in Britain, and an even smaller proportion in the United States, actually benefit from university education.

SCIENCE FOR WAR

The greatest and most dangerous distortion of science in Britain and the United States is that in the direction of preparation for war. This has three bad effects on science which reinforce each other. In the first place the objective of destruction is increasingly becoming an objective of blind slaughter without even military excuse. This is foreign to the whole tradition of science and inevitably demoralizes not only those engaged on war research but also the whole body of scientific workers who through coming to accept this as a matter of course tend to lose all sense of social responsibility and moral value in science. Further it gives apparent justification to the non-scientific public to associate science with war in its most horrible aspects. All this in turn lends additional support to the popular tendency of dislike for and suspicion of science and of scientists.

MILITARY SECRECY

In the second place, though purely military research has of its very nature to be carried out in secrecy, this secrecy is extremely difficult to limit. The result of the great use of science in the war has been the spread of the atmosphere of secrecy far beyond the field of military science. Indeed if the security officers had their way there would be practically nothing in science that could not be classified as secret either because it had already or might later have an application to some weapon or piece of equipment. As Sir Robert Watson Watt pointed out, the size of the earth is a secret because it is necessary for the proper aiming of long-range rockets; on the same grounds the position of the stars might become secret. In biology every aspect of physiology and medicine might be turned into account for new forms of chemical or bacteriological warfare. If things have not proceeded to this length, they have already proceeded far enough. Large areas of new sciences vaguely known to exist are being kept out of the common pool. At the same time the existence of secrecy and the fear of unwittingly revealing secrets destroys the free communication of scientists nationally and even more internationally, irrespective of whether their work is secret or not.

THE BURDEN OF MILITARY RESEARCH

Thirdly, the concentration on military science drains off men, and, even more, material support from these branches of science, both fundamental and applied which increase man's knowledge and control over his environment and would enable him to deal with the urgent and pressing needs of provision of food, increase of industrial productivity and the preservation of health. It is still not sufficiently realized to what extent in Britain, and even more in America, science — the sensitive growing point of civilization — is being twisted into the service of war. Of the wealth of the country and its manpower 10 per cent is being employed on war or war preparations. This is bad enough, but over 60 per cent of all expenditure on scientific research and development and some 80 per cent of all government research is being devoted to war research, mainly weapon development, while a force of 2,836 scientific workers, which represents some 64 per cent of those employed in government and some 20 per cent of all scientific workers in applied science, are being for that purpose kept away from constructive tasks.¹

It is officially argued that some of this, such as aerodynamic and turbine work, is also of civil use; but this is specious, since much civil research is also of use to the military, and in any case the airplane has been almost since

¹ See the *Scientific Worker*, August 1948, p. 20 (journal of the Association of Scientific Workers).

its invention far more of military than of civil use. It would be perfectly possible to turn this scientific manpower, equipment and experience to civil use. Detailed proposals for this purpose have already been put forward.¹ This would undoubtedly lead to great and immediate increase in the tempo of industrial research and shorten by years the achievement of effective economic independence of Britain.

SCIENTIFIC WEAPONS — ATOM BOMBS

The militarization of science is seen at its worst in the production of the new weapons of atomic and bacteriological warfare — those referred to so quaintly by General McNaughton as “quality” weapons.² It is here that the

¹ *Ibid.*, p. 22.

² General McNaughton, surveying the great progress made in the application of science and engineering to war, stated that they now had to contemplate the possibility of aircraft of supersonic speeds; guided missiles of great range; virulent bacteriological and chemical poisons; and, most important, atomic bombs of catastrophic power. Such forms of bombardment would be rapidly followed up by considerable forces, airborne or seaborne, capable of operating effectively in the face of widespread destruction and contamination. If they were ever attacked, it was on “quality” forces and “quality” weapons that they must rely. — *The Times*, 26.11.48.

scientists, particularly the scientists of America, are brought face to face with their political and social responsibilities. The fact that they were able to organize and, to a limited extent, instruct the public as to the nature of these weapons and their implications, shows at least that scientists are capable of acquiring both political responsibility and a certain measure of power. But it equally remains a fact that in the end the militarization of atom research¹ and the failure to reach international

¹ "Six months or so ago it would have been necessary to report that atomic development work was in a state of near stagnation.

"That was late last summer. And that was the bottom. At just about that time, the year-old Atomic Energy Commission began to get a grip on its huge job. Things began to improve. Today the situation is still spotty — good here, bad there — but everywhere it is visibly on the mend.

"The program that AEC is now beginning to push along is above all things an armament program.

"The publicity still goes to the civilian applications of atomic energy — actual or potential. But the fact is that around 80 per cent of AEC's money and effort is directly aimed at maintaining and increasing the production of bombs.

"This concentration on weaponeering inevitably has a retarding effect on civilian applications. The most immediate application — production and distribution of radioisotopes — doesn't compete seriously for material or engineering talent. That's why it has been able to forge ahead rapidly.

agreement on its control has completely stultified the work of the scientists and has revealed in them a lack of political understanding.

As Blackett points out in his book, the Lilienthal plan for international control of atomic energy was worked out with unconscious or deliberate disregard for political realities. The scientists responsible thought they had done a grand job and had laid the foundations of peace through the atomic development agency (ADA). They were surprised and pained that this was taken up by the politicians and so modified that it became the most powerful argument for preventing any international agreement on atomic energy. The provisions of the Baruch plan, which is essentially the same as that now accepted by the American controlled majority of the Atomic Energy Commission of the United Nations calls for inspection, the abolition of veto and does not propose to consider the destruction of bombs till every other condition has been fulfilled. To

“But application of the atom’s power to non-destructive uses does definitely compete for both material and talent. The result is that the work in this field has had to be laid out on a rather slow schedule that puts economically significant power utilization a generation away. In order to economize on engineering talent, particularly, the power work is largely being put into academic hands; AEC’s industrial contractors are being discouraged from putting too much effort into power.” — Extract from *Bulletin of the Atomic Scientists*, July 1948, p. 213.

accept it would mean admitting effective control by the United States government not only of atomic energy but of military offensive and defensive power throughout the world.¹ Naturally this is enthusiastically welcomed by those who wish the United States to have such power, including the man who gave it to them in the first place — Mr. Churchill — but many honest scientists fail to see that this means handing over the whole of the world to capitalism, an action which, not surprisingly, that part of the world which has had enough of capitalism will resist at all costs.

THE ILLUSION OF THE WORLD STATE

What had not been taken into account by the scientists is that the world is at present divided into two areas with economies based on entirely different principles, one planless and motivated by private profit, the other planned for the public benefit. Now while it is possible for both to exist side by side without war, it is not possible for either to submit to an overriding external authority. This is the reason why the solution advocated by such American scientists as Einstein and Urey, that of escape

¹ When it was pointed out, for instance, to Lewis Mumford, the American sociologist that the Baruch proposals would in fact mean that the United States with its permanent majority on the ADA would control the whole world politically and economically he answered: "Why not? It's democratic, isn't it?"

from the danger of atomic warfare by the setting up of a world state, is even less possible or desirable than the control schemes over which so much fruitless discussion has ranged during the past few years.¹

It is, of course, much pleasanter and easier to forget the existence of economic and political factors and make ideal plans for the reconstruction of the world on scientific lines. Thus, for instance, nearly all scientists recognize that the major problem facing the world today, as Sir John Boyd Orr has repeatedly pointed out, is the threat of the growing shortage of food, which may become catastrophic in a few years with the increase of population and the continuation of soil erosion. There have been calls to drop discussion of politics and to concentrate on the technical solution of this problem. Yet it remains obstinately a political one. The more conservative scientists see the danger as one of overpopulation and deprecate the introduction of health measures which would allow the population to grow. The more idealistic would like us to concentrate on plans for a world state which would organize rationally food production and population policy. The fact of the

¹ As one French scientist put it: "It is as if the American scientists, having found that a system of control which violated the second law of thermodynamics would not work, have looked instead for one of a world state which violates the first law of thermodynamics as well."

threat to the food situation in the world is a direct by-product of capitalist economy. It is the pursuit of profit that has stripped the forests from the hills, snatched crops from the plains until the very soil has blown away and herded the former inhabitants of colonial territory into bad land reserves where their animals are bound to eat away what vegetation there is. Rational exploitation of natural resources is in fact impossible under capitalism and will not take place until capitalism is destroyed. It is the same with most other beneficent schemes envisaged and planned without regard for the political and economic factors.

INDUSTRIAL RESEARCH

Industrial research in Britain, as in other capitalist countries, is mainly carried out by the great monopolies.¹ The government's contribution to industrial research, though rising, only represents some 15 per cent of the expenditure of private industrial firms. It is too early yet to see what the contribution of

¹ Of the £30 million estimated spent by private firms on research, £15 million is spent by five large firms, one in chemical and four in the airplane-automobile industries, each spending more than £1 million annually on research; and only £1³/₄ million by 346 smaller ones not spending more than £20,000 each on research — (*Statistical Survey on Scientific and Technical Research in British Industry*, by the FBI Industrial Research Secretariat, July 1947.)

nationalized industry to research will be. The major criticisms of industrial research in Britain today are that it is short-sighted, ill-balanced, chaotic and almost totally unplanned. The economic policy of the government, far from remedying this state of affairs, has on the whole intensified it. The pressure on immediate production for export has turned most research departments in industry on to short-term developments, "troubleshooting" or testing problems to the detriment of long-term research leading to new lines.

There has never been any rational balance in industrial research. Historic factors such as the growth of new industries based on science have led to the concentration of research into the electrical and chemical industries to the detriment of the others. In certain of the older industries, notably steel and cotton, some beginning in centralized research work has been made, but it is in just these industries that it is most difficult to get some of the research results applied. Working parties in the still older British industries such as those for wool, leather and pottery have reported on the need for coordinated research in these industries but little or no action has been taken as a result of it.

If it were really desired to get the best out of British industry the same effort would be made to concentrate scientific research and engineering development where they were most needed, taking into consideration the needs of

the future as well as those of the present, and this would imply a general extensive redeployment of scientific manpower.¹ The government has not chosen to do this, partly because of its general disinclination to interfere with private industry in any constructive way, but mainly because it would be quite impossible to redeploy a scientific force effectively except in relation to a general plan for industry. Such a plan does not exist, nor is there any intention of making one. So-called planning is simply a collection of targets drawn from sections of the industries themselves on what they can do on existing lines and immediate foreseeable developments. The characteristics of this kind of planning have been succinctly exposed in a letter by Academician Strumilin to the *Manchester Guardian* (10.11.48):

“...According to Mr. Morrison this new British method of planning, unlike the old Soviet method under which the state plan is a law, binding on the entire country, consists in the fact that the plans are based on the tendencies of development and drawn up as forecasts for the future. As for their implementation or non-implementation — that is left entirely to the discrimination of the owners of the enterprises concerned. In

¹ Some idea of how this could be done is to be found in the *Scientific Worker* of October 1947, p. 25; December 1947, pp. 6 & 28; April 1948, p. 5; June 1948, p. 26; August 1948, p. 17; October 1948, p. 11.

substance this method fully embodies the vaunted 'middle way' between planning in words and lack of planning in fact. In a class society, like the one existing in Britain, the state plan merely recommends, say, that for a certain time not only wages should be pegged, but also prices and profit rates. But there is no doubt that under the conditions existing in your country the employers will only carry out the first of these recommendations. The standard of living of the workers will drop, but the profit of the employers will keep on rising... It has long become an ABC of the science of planning that where the elemental tendencies of development of modern private capitalist economy are at work only one forecast can be 'planned' quite unmistakably — namely, that this economy is inevitably heading for its next crisis. Forecast plans are not really plans at all. Since they are not binding on anyone, they are doomed to failure from the outset... In a country in which compromise is the highest principle of statesmanship, where even the realization of socialism is not conceived without the active sympathy of the propertied class, and where the forces harnessed to the chariot of planning are pulling in different directions — in such a country the conditions for planning do not yet exist."

The most perfect example of this type of

planning is furnished by the prematurely published Memorandum on Economic Cooperation (op. cit.). Quite apart from the improbability of the assumption on which it rests (op. cit., p. 4), it represents merely a projection on to the future trends of production in Britain together with a reliance on an enormously extended exploitation of colonial and semi-colonial countries. In the general table (op. cit., p. 5), while the deficit on visible trade is presumed to be reduced, between 1947 and 1953, by \$1,112 million depending on an export increase of nearly \$3,000 million, the invisibles are expected to change by no less than \$1,827 million from a deficit of \$774 million to a surplus of \$1,053. This relatively enormous increase is largely dependent on an assumed output of over 100 million tons of oil products by 1953. Incidentally, this includes the products of the Royal Dutch Shell group which may explain our somewhat hesitating reaction to Dutch imperialist wars.

The actual investment in home capital development is far less than would be required for any thoroughgoing reconstruction of our basic industries on modern lines — \$600 million for coal, \$1,000 million for steel, \$800 million for chemicals over the four-year period. Indeed, Sir George Paish and others¹ have argued that the investment program scarcely

¹ See *Westminster Bank Review*, November 1948. S.P. Chambers, *Lloyds Bank Review*, January 1949.

covers the normal wear and tear of existing plant, estimated at \$4,000 million annually, and is certainly unable to cover the total loss of some \$40,000 million of capital incurred in the war.

Although in the Memorandum some lip service is paid to scientific research and development, it is clearly not relied on for any serious contribution and the indications are that what capital replacements are introduced will be effectively obsolete before they come into production.

INDUSTRIAL SECRECY

The present set-up, for it would be absurd to call it an organization, of industrial research in Britain is quite incompatible with any kind of planning. The use of research for profit leads to duplication and secrecy as bad in its effects as military secrecy and even more futile, for most of the supposed secrets are known to many rival firms. The rapid growth of industrial research means that more and more knowledge, some of it fundamental, nearly all capable of leading to fundamental discoveries, is being locked away from the free market of scientific ideas. Further, what information is allowed out is published in a scientific and technical press with so little attention as to order and presentation that it becomes almost as difficult to find out whether something has been published about a topic as to do research

on it directly. The necessary steps which would have to be taken before any planning of industrial research can be a reality are the pooling of technical knowledge and the setting up of an effective inter-industrial information service.

It would also be necessary if any rational scheme of utilization of science were decided on, to ensure that it was done in the interest of the nation and not that of private profit, for otherwise it would be very difficult to persuade scientific workers to put up with the risks and discomforts involved in shifting to other jobs.

THE URGENCY OF RESEARCH AND DEVELOPMENT

The failure to utilize research is bad enough at present but it is likely to be even more disastrous in the future. There is a considerable time lag even under the best conditions between scientific research and the development of working prototypes: there is a smaller lag between that development and full-scale operation. The industries of fifteen years hence depend on the fundamental work that is being done now: industry five years hence depends on the development that is going on now. Such major developments as the use of oxygen, continuous casting of steel and electronic instrumentation are likely to come along so slowly that they will be in full use in other countries such as the Soviet Union and the United States before they have passed the

development stage in this country.

This state of affairs is fully recognized by responsible persons in industry and the government, but they do not for the most part choose to accept its obvious implications or rather they take the obstacles to the carrying out and the applications of research as absolutely inherent factors in industry. Sir Henry Tizard in his address to the British Association stated:

“...my view is that it is not the general expansion of research in this country that is of first importance for the restoration of its industrial health, and certainly not the expansion of government research remote from the everyday problems of industry. What is of first importance is to apply what is already known.

“The fact is that all really new developments of industry are the product of the work of very few men. In general, knowledge in the physical sciences now accumulates at a rate much faster than it is, or possibly than it can be, applied in industry. There is a vast amount of knowledge waiting to be used. No new discovery, in any field, is likely to have so quick and beneficial an effect on British industry as the application of what is already known.”

Sir Henry probably intended these remarks to stir British industry into some degree of receptivity of the results of research, but they have effectively been taken as discouragement

to research itself.

The claim that further physical research is unnecessary and useless would not be true even if no development of new devices and processes were undertaken. Experience, particularly war experience, has shown that existing knowledge is not something that can be just taken out of a report and applied straight away. Its application will, of course, always be wanted under circumstances slightly or sometimes significantly different from those in which the knowledge was originally obtained. To make full use of old knowledge new research has to be carried out and this new research in itself can only be turned to full account by using it for further developments. Without physical research and development, industry will stagnate technically and in a short period, especially if run at the present rate, will actually retrogress.

SOCIAL RESEARCH AS A SUBSTITUTE

As long as the official view is that physical research is unlikely to produce results of immediate value to industry there is every likelihood of this happening. The further implication is that, in the place of research and development leading to improved industrial plant, the best use of science is in social and psychological research leading to propaganda to persuade workers to produce more goods from the old plan without, of course, affecting in any

way the wages or profits in industry. It is interesting to note that the social sciences, which have been for a long time the Cinderellas of science, come into prominence only when it is thought they can be of use to provide something for nothing for the employers.

Instead of trying to use knowledge to patch up and make tolerable old abuses, there is plenty to be done even in the short term to raise British industry to a level which will make the country self-subsistent. Existing industry is almost as wasteful of materials as it is of men, but its very inefficiency makes it all the more easy to secure startling advances with the minimum of effort. If research were directed towards tackling the problem of waste with due regard to the priorities, effective production could be increased by diminishing consumption of raw materials without any loss of useful function.

AGRICULTURAL AND MEDICAL RESEARCH

The position in agriculture and medical research only differs from that of industrial research in that the effort directed to them is on an even less adequate scale. The amounts spent on them, £2,446,840 and £1,173,000, represent only $2\frac{1}{2}$ and 1 per cent of the total research of the country and only $3\frac{1}{2}$ per cent and $1\frac{1}{2}$ per cent of that spent on military research. The neglect of agricultural and medical

research in Britain is not accidental; there is in fact no big money in either. Under capitalism, governments, Labour or otherwise, are unwilling to step in and waste the taxpayers' money on such a vague object as the public interest. In these fields also the mere chaos of organization and lack of planning is even more apparent than in industry. In agriculture the system of land tenure with its thousands of farmers with inadequate capital itself makes it impossible to ensure that research results are effectively applied and prevents any ordered generalized attack on the problem of finding which are the agricultural products that Britain should produce from her own land and which she should import. In medicine, although we have now administratively a National Health Service, there is as yet no real beginning of a direct health research program linked through properly equipped health centres with the lives of the people.

COLONIAL RESEARCH

It has been government policy since the war to try to make up for the deficiencies of the internal economy by tapping neglected sources in the colonies. This necessarily involves a fresh research effort and here there should be the greatest possibility, working in a relatively open field, for a combined attack on all problems — biological, agricultural, health, industrial and social. But this is made impossible

from the start by the character of the colonial policy aimed at the most rapid exploitation of the resources in which native populations benefit only in so far as it makes them efficient labourers for operating the schemes. The full development of backward territories is only possible if the people of the territories themselves become the main agents as well as the main beneficiaries of those schemes, as the example of Soviet Central Asia has shown.

THE FAILURE TO UTILIZE SCIENCE

Overall the picture is one of an inadequate scale of effort in research and development which is failing to achieve even its limited objectives owing to the distortion imposed on it by economic and political factors. In spite of the enormous experience that the war has brought, in spite of the considerable expenditure in scientific research that has occurred, the predominant feeling among scientific workers is still frustration mingled with a good deal more anxiety than they had before even in the difficult days before the war. Here is an enormous potential source for human well-being, which is being misused and which is suffering from misuse.

Many scientific workers projecting the lessons of the war into the tasks of peaceful reconstruction were able to see how science could be used. They were even able to plan in considerable detail the organization and

progress of this utilization. Most of them are now in a state of disillusionment or cynicism. There was nothing wrong with the plans; they made no unreasonable demands on money or manpower, but they could not be used; they were revolutionary, they were totalitarian, they were perhaps merely premature. In any case they were allowed to fade away. What we see now is that it is useless to consider the potentialities of science without taking economic and political factors into account, and that no goodwill or ability on the part of the scientific worker can be of any value unless as part of a larger planned effort completely divorced from monopoly capitalism, military preparations or colonial exploitation.

The fact that capitalism was never able to provide for the full utilization of science and in its present state of crisis and decay is using science more and more for destructive ends should not, for those who recognize it, lead to an apathetic acceptance of things as they are. Scientific workers have the responsibility to their tradition as well as to the people of considering and planning for the utilization of science, taking fully into account the unfavourable economic and political atmosphere of the time. All scientists should be made to see in detail, as well as in general, the inherent capacities of science and should continue to demand that these should be used. Unless this theme is well and convincingly stressed, we will always be open to the charge that in fact science has

very little of value to offer. This is the kind of lesson, for example, that is frequently drawn from Sir Henry Tizard's address quoted above. In fact the future prosperity and well-being, even the existence of a large proportion of the people of this country, depends on the rational development and utilization of science. This can only be done by a planned approach linking science with the long-term needs of the people and not with the short-term exigencies of capitalist crises and political deals with America or other Western States.

A healthy science requires to be linked through and through with popular and democratic forces at home and abroad. This means drawing the scientist of the future predominantly from working-class families as representing far the most numerous section of the population. It implies educating and training scientists not apart from the people but closely in touch with production and trade union activity. It implies an organization of science of a democratic character and the linking of scientific activity with general economic planning.

THE FREEDOM OF SCIENCE — IRRESPONSIBILITY AND REACTION

This positive attitude towards science is also an antidote to that which urges the withdrawal of scientific activity from social life altogether, the "contracting out" of society

which would turn science from a lively discipline closely connected with every other human activity into a peaceful contemplation of the harmonies and perhaps more of the disharmonies of the universe. The passive and idealist gospel of the advocates of the "freedom of science" is, however, only a cover for their real obscurantist and reactionary tendencies.¹ It is only too obvious that the leaders of the movement are more interested in blackening the Soviet Union and implicitly and explicitly urging war against it than in protecting science in their own country from effective interference by outside forces hostile to its spirit. They will protest vigorously only against any use of science for a beneficent purpose, claiming that science is the intrinsic pursuit of truth and must not be distorted to serve social ends but they never complain about the use of science in monopoly enterprises for private profit or its use in the service of the state for the perfecting of weapons of destruction, even though both of these also involves the imposition of secrecy which is the antithesis of the spirit of free enquiry. Nor are they really interested in the discovery of truth itself except as an exercise of personal virtuosity. This has been shown very recently in their public intervention to preserve the existing chaotic system of scientific literature, which not only wastes the time of scientists but effectively prevents them from finding

¹ See p. 110.

out what their colleagues are doing.

THE ATTITUDE OF THE SCIENTIFIC WORKER

The bulk of scientific workers, particularly of senior scientific workers, in this country do not go to the full lengths of the advocates of "freedom in science," but they are equally afraid of supporting any radical changes in scientific direction or scientific organization. The characteristic attitude of the scientific workers is attention to immediate business, an attitude which is very understandable on account of the almost intrinsic interest of almost any kind of scientific work, but which has, reinforced by the education of the scientist, left him outside his science rather more timid and conventional than any other kind of intellectual worker. There is a general willingness to accept frustration, to grumble but to rely on muddling through. In so far as he considers political questions, the scientific worker adheres to a vague patriotism which includes a general willingness to do whatever the government orders in the "national interest," but never to criticize or initiate action himself.

This attitude, however, is changing. The war itself, by bringing scientists away from their normal avocations, has created a much greater awareness of contemporary realities and the very growth of the Association of Scientific Workers from 5,000 to nearly 20,000

during the war shows the new interest of the scientists, particularly the junior scientists, in economic and political issues.

The problems of the post-war era are far more serious for scientific workers and they are also much more difficult to understand. With full employment and nominally good salaries, the scientific worker should be well off, but he actually suffers as acutely as the manual worker from the general rise in prices. The drive to immediate production for export turns him away from long-term development work and, though it keeps him busy, tends to sap his originality and imagination. Most of all, the lack of plan and directive makes it impossible for him to give of his best or even know what he would be best occupied in doing. The result is general frustration and a tendency to concentrate on the immediate job of getting a living. The Association of Scientific Workers will need to use all the energy and enthusiasm on which it can call to recreate an effective and universal sense of purpose among actual and potential members.

Scientific workers are necessarily concerned with day-to-day issues, but they are also, more perhaps than any other professional workers, concerned with the future. Other professions such as law, the Church or medicine are maintained on a highly traditional basis; the prospects for an individual, given reasonable assiduity, are predictable, but science of its very nature cannot become a traditional

profession. Either it grows and changes or it decays. The scientists have therefore a deep and personal interest in the future of science, though they may not always be very conscious of it. The outlook of the scientist is accordingly likely to be of a more long-term nature than that of the other workers and further he will be more able to appreciate the general considerations of the prospects of science in this country and less likely to be carried away with exclusive concern of the immediate exigencies.

The scientific worker can draw on his own experience to see that in fact science is not, and cannot be, fully used as long as the government continues in its present economic and political policy. He will be able to see that with the slowing down of capital development of this country and the increasing subservience to American business interests, the long-term future of science is becoming seriously compromised. He may therefore be more ready to see that his real interest as a scientist is closely linked up with the interests of the whole people and with the need to establish in this country as soon as possible a forward-looking economy which would ensure its effective national independence.

THE NEED FOR INTERNATIONAL COOPERATION IN SCIENCE

The scientific worker also differs from those in other professions because as a

scientist he must have an international outlook. No profession has as many links both in writing and in personal contact with co-professionals abroad and the tradition of internationalism in science is continually being reinforced by the day-to-day development of scientific experiment and theory. The scientific worker may depend for the whole success of his work on information which he cannot get himself and which he must draw from scientists in other countries. It is therefore all the more important that the links between scientists in different countries which were so seriously interfered with by the war should be restored.

But this is not a restoration of things as they were. Science in many parts of the world has rapidly changed during the war; in the United States, as already indicated, it has developed enormously, but at the same time it has come more and more under the domination of big business and the military. In occupied Western Europe on the whole and in Germany and Austria science has not been able to recover fully, not so much from war destruction as from the inaction of unstable, bankrupt or reactionary governments whose policies are fundamentally opposed to the utilization and consequently to the support of science. On the other hand there has been a great upsurge of science in the new democracies and the semi-colonial countries of India and China. The links between scientists in all these countries, though difficult, can be established and

widened.

None of this, however, touches the most important source of new scientific activity in the world, that of the scientist in the various republics of the Soviet Union. Here we know that great things are being done and we catch occasional and fragmentary accounts in publications of the nature of the work. But real and intimate contact cannot yet be achieved. It is important that we should realize that this is one of the penalties we have to pay for the reactionary policies of the British and American governments. The first gesture made by the Soviet Union at the Academy Celebrations in 1945 was marred by the prohibition by these governments of the attendance of some of their most distinguished scientists and the way in which Soviet science has been treated in the general and scientific press of the capitalist world has not helped to promote scientific intercourse. Yet on the occasions of visits and international conferences when British and Soviet scientists have met, the resulting contacts have been most cordial and fruitful.

The overriding reason for the lack of contact has been the major political and scientific issue of the atom bomb. As long as there is no agreement about the atom bomb, as long as the United States continues to stockpile atomic bombs which can only be intended for the destruction of the Soviet Union, so long will all science be wrapped in atom-bomb secrecy and all international scientific intercourse with the

Soviet Union burdened with suspicion.

Nevertheless in spite of this great exception the movement towards effective cooperation of scientists throughout the world is a live and growing one. On the academic side it has been expressing itself through the old and new international scientific unions. More significant, however, is the cooperation of scientists in the more objective tasks, the planning of science in relation to national reconstruction. More active scientists in all parts of the world have found a common basis in the integration of their work with that of planned national economies and, where such plans do not exist, with the building up of solid trade union scientific organizations. The new scientific workers in all parts of the world, particularly those in the new democracies or the colonial countries, start without the burden of the old traditions of science, tied as they were to ruling-class patronage. They are capable, and willing, to form trade unions and join with other working-class organizations.

THE WORLD FEDERATION OF SCIENTIFIC WORKERS — THE CHARTER

It is in this spirit that the World Federation of Scientific Workers has been formed, a body still very young but which has already had the most valuable effects in pooling experience both in the professional status of scientists and

in the organization and planning of science. The issue of the Charter for Scientific Workers is in itself an important stage in the formulation of the policies for science in each country and for its links through international science. The charter lays down the responsibilities, as well as the rights, of scientific workers.¹

¹ Among these responsibilities are included:

“1(2). *To the community:*

1(21). To study the implications of science, particularly in their own field, to current economic and social and political problems and to make efforts to ensure that this knowledge is widely understood and acted on.

1(3). *To the world:*

1(31). To maintain the international character of science.

1(32). To study the underlying causes of war.

1(33). To aid agencies seeking to prevent war and to build stable bases for peace.

1(34). To work against diversion of scientific effort to war preparation in particular to the use of science in providing methods of mass destruction.

1(35). To resist movements inspired by anti-scientific ideas such as irrationalism, mystical intuition, racial inequality and the glorification of force...

7. *Special Needs for Science in Undeveloped Countries.*

Science has been most unevenly developed,

IV

WHAT NEEDS TO BE DONE

The character of the activity of the scientific worker in the present situation is implicit in the analysis of that situation already given. As a scientist he is concerned in a particularly intimate way with the future economic and social development of his country and of the world. But although his interest is a special one the objects are common and thus the scientist cannot, or should not, act alone but together with other groups concerned with the different aspects of the whole situation. In the first place he has, together with other intellectual workers — artists, writers, etc. — the responsibility of preserving the culture of the world against the danger that at present threatens it.

THE FIGHT FOR PEACE

This was the theme of the recent Congress of Intellectuals at Wroclaw, attended, among other intellectuals, by many eminent

following closely the evolution of industrial communities and being relatively undeveloped in agricultural ones. We must work for the creation in all countries in as short a time as possible of an indigenous body of scientists working in conditions of political as well as economic liberty.”

scientists.¹ The scientist can, with other intellectuals, effectively combat both those who take a fatalistic attitude and think that war is inevitable, and those who more cynically and actively are working for immediate war. The part of the scientists in the struggle against war has now become of critical importance because of the close association of the atom bomb with world political developments, and because of the belief already described, that the possession of the atom bomb allows the American government to go to war with impunity, risking only the lives of its European satellites. It is the duty of scientists to demonstrate the falsity and danger of this view, following the lines admirably indicated in Blackett's book.

Scientific workers are linked through the character of their work with other intellectuals; they are also, through the results of their work, linked with productive workers and the population as a whole. Science is not so much a distinct industry as a common productive service in which scientific workers are effectively in detailed contact with every branch of industrial and agricultural enterprise. They must work by associating themselves closely with the day-to-day activities of other workers, both individually and organizationally through the trade unions, shop stewards' committees and joint production committees.

There should be no illusions as to any

¹ See *Modern Quarterly*, Winter 1948.

special prestige or importance of scientific and technical workers. Major industrial decisions can only be effective with the backing of the large manual unions and it is on the political wisdom of their members that the future of the country ultimately depends. Nevertheless the scientists have got an essential role, that of putting their knowledge and ability at the service of their fellow trade unionists and hence to the real welfare of the country. Both have a major interest in the long-term program of Britain's industry, towards the achievement of a fully independent status of the national economy; both have an interest in removing internal political checks that prevent any honest attempt to achieve such a status, and both have an interest in resisting the disastrous foreign policy of subservience to American capitalism and war preparation which is diverting the industrial potential of this country away from productive and constructive industry.

The scientific workers can help here because from the very nature of their work they are concerned with the future and therefore they are necessarily more sensitive to dangerous trends and more concerned with long-term solutions. It is only in the alliance with the whole working-class movement that the conditions essential for the flourishing of science in Great Britain can be achieved and the peace of the world secured.

DIFFICULTIES AND OPPOSITION

In this task we must face at the outset the fact that we have ahead of us a very hard struggle. The ideas here put forward are in direct opposition to those expounded in unnatural harmony by Labour Party and Conservative leaders, aided by the whole battery of modern propaganda methods. We are told that if we work hard enough and do not ask for more wages, with the kind and unselfish help of the American people through the Marshall Plan, we will be able to achieve economic independence by 1953, if we are successful in restraining meanwhile the insidious growth of communist totalitarianism which is threatening our liberty and waging a Cold War against us.¹

In this way the Labour Party apologists attempt to shift the blame for the economic crisis from its intrinsic origin in capitalism onto the shoulders of those who are trying to rescue the

¹ "We have all become only too familiar in these last few months with the expression 'the Cold War' and with the activities of the Soviet Union and its satellite states in promoting that more subtle form of attack upon the democracies, not only of Western Europe, but throughout the world. But the spear-head of that attack has been against Western Europe, because the Soviet Union hopes that, by creating a state of chronic economic weakness, they may be able to win domination by their fifth column agents, as they already have done in, for instance, Czechoslovakia." — (Extract from speech by Sir Stafford Cripps, Hansard, Monday, November 1, 1948, p. 525.)

peoples of Europe from it once and for all. On the basis of this analysis they are forcing the acceptance of an alliance between capitalism and organized labour which is working, as it is bound to work, entirely to the disadvantage of the latter. It cannot be denied that this line of propaganda has had a considerable measure of success. It is following the precepts of that great prince of propagandists, Adolf Hitler, with his two guiding rules: "The bigger the lie, the better," and "Never tell people anything they do not already believe." Appeals to patriotism blend beautifully with the ideal of the national unity and can easily be pressed to the point of making all criticism of government policy equivalent to treason. Our allies, who lost twenty million of their people in our common defence, can be turned in three short years into the "wicked oligarchy of Moscow... the fourteen men in the Kremlin who rule over 300 million human beings with an arbitrary authority never possessed by any Tsar since Ivan the Terrible" (Churchill, Llandudno, October 9, 1948).

It is not even necessary to be original. Everything that was said about communism by the Axis leaders in the days of the anti-Comintern pact only needs to be translated to be enunciated by a minister or trade union leader. "The greatest and truest democrats the world knows today are in Germany and Italy. This community of ideas in Germany and Italy is found at present in the fight against Bolshevism, the

most modern form of darkest Byzantine terrorism, the exploitation of the credulity of the lower classes, and in the fight against the government of hunger, blood and slavery.” (From a speech by Mussolini quoted in the *Manchester Guardian*, 29.9.37.) “We shall not accept the communist doctrine. That doctrine springs in the East. Oriental in its main conception, it does not belong to the main stream of democratic thought... The communists... have a vested interest in chaos.” (From a broadcast by C.R. Attlee, quoted in *The Times*, 28.6.48.) The further advantage that the propaganda enjoys is that all it demands from the people of the country are implicit obedience, hard work, austerity and no dangerous thoughts. It consequently plays at the same time on the best and worst qualities of the British people.

THE EXPOSURE OF REACTION

This propaganda can only be met by argument and demonstration based on actual everyday experience and leading towards a better understanding of the underlying realities of capitalism. It is a fact that already the Labour Party has abandoned the essential features of socialism; it is a fact that it is allied to the worst reactionaries at home and abroad, and that it prefers to associate with them rather than with socialist workers of Russia, Eastern Europe and the Far East. Nevertheless we must recognize that this alliance with reaction and

surrender to reactionary ideas has occurred step by step in an imperceptible way and that many of its leaders and the great majority of the followers of these policies have deceived themselves, or been deceived, into accepting a doctrine of the lesser evil, comforting themselves by such phrases as the "defence of freedom and true democracy." Unconscious hypocrisy is the strong defence of social democracy; it is so much nicer to think that Marshall Aid is a noble and useful gesture from the American people to assist the economic well-being of less fortunate countries of Western Europe and even of the whole world if the wicked communists would only let them. Indeed, this is probably the belief of the vast majority of the American people themselves: but although the American people pay they do not control the allocation of payments, and all the reactionaries in the world, from the hangmen of Greece and Spain to the head-hunters of Malaya, have reason to thank their blindness as to the real interests they are serving.

We know that the people of the world, even of the capitalist countries themselves, do not want war, as witness the recent elections in the United States. To continue such reactionary policies and to drive them to the point of war requires that the people should be kept in effective ignorance of the nature of the action carried out in their name. It is our duty to dispel that ignorance, to make people face the facts of the international situation, and those

facts will include not only the revelation of the dangers to which present policies are leading, but, even more important, the knowledge that it is in the power of the people to alter those policies and to build in peace the stable foundation for a better way of life. There is no need for war in the near future. It is perfectly possible, as many years of experience have already shown, to maintain harmonious and mutually beneficial relations between countries with capitalist and socialist economies as long as the people in the capitalist countries can restrain the financial and military groups from precipitating war in the service of their narrow interests. How far this can be done while preserving the capitalist control of economics and politics is another question. The essential thing is to apply in the developing situation the test as to whether this or the other system can foster human welfare. If in the end it should prove that capitalism and peace are incompatible, capitalism is not essential to human survival and peace has become so.

THE BATTLE OF IDEAS IN SCIENCE

Maurice Cornforth

The entire present position of science in the capitalist world is determined by the circumstances of the general crisis of capitalism, of the rise of American imperialism, of the Marshall Plan and its operation, of the developing economic crisis, of the preparation of a third world war. This has been demonstrated in the preceding analysis by Professor Bernal. It is impossible usefully to discuss science policy without taking these factors into account, and without facing the economic and political issues which scientists have to tackle if future scientific progress is to be achieved.

But the effect of the conditions of contemporary capitalist society upon the development of science is to be found not only in the frustration of scientific effort which results from such factors as the cuts in capital expenditure, the threat to the living conditions of scientists and the diversion of scientific work into war channels. This effect is felt in the very content of science itself, in the character of current scientific theories and direction of research. It is to this aspect of contemporary science that I now want to direct attention.

I

THE IDEOLOGICAL CAMPAIGN OF REACTION

“Nature” of August 21, 1948 contains a leading article reviewing the work of the American Rockefeller Foundation in organizing what we may well call ideological aid from the USA to other countries. The Foundation’s appropriations in 1947 amounted to \$23,413,615, of which 61 per cent were for work in other countries. Special attention is being devoted to Western Germany. The University of Chicago, for instance, is receiving a grant to set up an “American Faculty” in the University of Frankfurt. Columbia University has a grant for training German personnel for the German radio. Another big grant goes to the Germanistic Society of America for supplying “scholarly periodicals” to Germany.

Nature records that of all the dollars going for the propagation of American culture abroad, by far the greater part is going for what they call “social science” and “the humanities,” which will receive more than twice as much as the natural sciences. This is because physics, chemistry and engineering are said to “contribute little” towards “the winning of wisdom.” If this age — the American age, one presumes — is to “achieve greatness,” so *Nature* informs its readers, “it will not be through

physical triumphs” but through “new spiritual and moral values which lead men forward.”

It is hoped, says *Nature*, to establish between America and the countries “within the Marshall Plan” a “community of ideas and ideals.” Besides dried eggs and squadrons of super-fortresses, America is also letting us have “spiritual and moral values,” This is because “while in the present situation an element of physical force is essential... that alone will be of no avail unless we meet the challenge on an intellectual and ethical plane.”

What is this “challenge” which the givers of dollar aid are concerned to meet? It is the whole movement of the people for independence, democracy, peace and socialism. It is this which they are setting out to destroy by a combination of physical force and “ideas and ideals.”

I quote this report of the Rockefeller Foundation because it is just one example of the huge ideological campaign which is now being waged, in which all the forces available to world reaction are being mobilized, and with which even such an institution as the Rockefeller Foundation is by no means unconnected. This campaign is being waged through the press, the radio, the cinema, and there are being mobilized for it philosophers, theologians, literary critics and scientists.

What are the objectives behind all the balldash about “social science” and “moral values”?

Behind it is the concern to find new markets and spheres of investment for America's huge output and accumulated profits. From this follows the objectives: to make the people accept American imperialist domination; to make them accept the Western military bloc and the militarization of West Germany and Japan; to make them accept the fascist regimes in Greece and Spain; to make them accept military expenditure, colonial wars, and lowered standards of life; to make them hate and mistrust the new democracies and the Soviet Union, and be prepared to go to war.

These objectives require an enormous ideological deception of the people. The people must be made to accept all kinds of falsehoods and the overthrow of all rational human values, and to mistrust truth and reason. That is the basis of the "community of ideas and ideals" they want to establish in the Marshallized countries. The centre of world reaction is in the USA, where native talents have been reinforced by philosophers, theologians, "social scientists," and others, recruited from all parts of the world. One example is the University of Chicago, where the logical positivists, Carnap and others, rub shoulders with the native Deweyites. All the obscurantist ideology of Europe over the past fifty years has been imported into the USA, and is being worked up by the cosmopolitan ideologists of reaction gathered there. While Hollywood is a central agency for pouring out films glorifying sadism, violence

and lust, philosophers are busily engaged in the production of more subtle ideological poisons. From the Catholic philosophers to the logical empiricists, they are engaged in disseminating a variety of debased philosophies, which for all their differences one from another may be recognized as converging on certain fundamental points. They form a single ideological front of reaction, united in:

(1) A common hostility to scientific materialism.

(2) A denial of the scope and power of human knowledge, affirming the limitations of science, the impotence of reason, the impossibility of a rational comprehension of objective reality, the illusoriness of social progress.

(3) A common propaganda of obscurantism, preaching the relativity of truth, the mysteriousness and incomprehensibility of the universe.

But not only philosophers and theologians are being mobilized in the service of reaction. They are seeking to mobilize the scientists too. For imperialism needs the service of its scientists. It needs in particular to make full use of its scientists in its war plans against the USSR.

For this reason there is taking place a colossal distortion of science in the service of the American war machine. They seek, moreover, the service of science specialists for putting over reactionary ideas and adding to them the authority of science. They want their scientists to accept an imperialist ideology, to accept the

distortion of science in the service of imperialism, and to be ready tools of imperialism.

When we speak of the battle of ideas in science we mean the fight against all this. We mean the fight in the name of science and reason against scepticism, obscurantism and irrationalism in all their forms. We mean the fight against the distortion and prostitution of science in the service of imperialism, for a truly progressive science which serves the people.

Marxism is the theoretical weapon in this fight, whose use it is of the highest importance to master.

II

SCIENCE UNDER DECAYING CAPITALISM

There is needed in the first place a clear conception of the position of science under decaying capitalism.

Scientists are apt to think that science occupies some special privileged position among ideologies, somehow apart and aloof from the class struggle. It may be that the state, for instance, is not above classes, and is organized to serve the interests of a class, but surely science as an institution is above classes. There may be a bourgeois press, but surely not a bourgeois science.

There are many who strongly object to

what they take to be an attempted importation by Marxists into science of materialist philosophical ideas and of a socialist political tone which they consider quite alien to the true scientific spirit. Science, they insist, is philosophically, ethically and politically neutral.

But any such illusion of the Olympian remoteness of science is something which has to be eliminated if the efforts of imperialism to utilize science for its war aims are to be defeated and if science is to fight on the side of the people. For, in fact, science is always governed by philosophical presuppositions, and the course of development of science is never independent of social and political factors. That scientists are often not conscious of their own underlying philosophical assumptions, or of the social and political factors which affect the whole character and direction of scientific work, does not invalidate this truth. On the contrary, such factors are the more potent if scientists are unaware of them and so let them operate without restraint.

In this connection may be noted the constant stress being laid in the Soviet Union at the present time on the differentiation of the socialist development of science in the USSR and the decay of bourgeois science in the capitalist world.

At the conference of the USSR Academy of Sciences in August 1948, the President of the USSR Academy, S.I. Vavilov, said:

“Our science, the science of the socialist country marching towards communism, is separated from bourgeois science by an abyss. Our science has quite a different ideology, quite a different task — the task of servicing the people in every way, attending to the people’s requirements.” (See *Soviet Monitor*, No. 9874.)

In the same strain *Pravda* wrote:

“There is no country in the capitalist world where science is linked with the people. Bourgeois science, which serves the interests of the capitalist bourgeoisie, is alien to the people. The bourgeois states leave science in the power of capitalist monopolies and condemn scientists to sell themselves to the exploiters...” (Editorial on Soviet Science, see *Soviet Monitor*, No. 9872.)

In a statement replying to the American Professor Muller in December 1948, the USSR Academy of Sciences declared:

“We Soviet scientists are convinced that there is, and can be, no science in the world divorced from politics. This is proved by the whole of historical experience. The root of the matter is with which policy science is connected and whose interests it serves — the interests of the people or the interests of the exploiters.

“Soviet science serves the interests of the common people and it takes pride in its

connection with the policy of the Soviet Union which has no other aims but to improve the welfare of the working people, to consolidate peace and ensure the flourishing of democracy...

“Soviet scientists sincerely sympathize with those foreign scientists who honestly and sincerely strive to serve the interests of peace, progress and democracy. But it should not be overlooked that in the capitalist countries the bourgeoisie subjects scientific investigation to its own interests, aimed at profits, oppression of the working people and suppression of democracy. At present it is common knowledge that science in the United States is being militarized and subjugated to the prying, aggressive plans of American imperialism.”

Modern science was the creation of the bourgeoisie. All the past achievements of science bear the hallmark of bourgeois ideology. This was brilliantly demonstrated, for example, in Hessen's famous analysis of “the social and economic roots of Newton's *Principia*” (*Science at the Cross Roads*, Kniga, 1931), and can be brought out in countless other instances.

To say this is not to belittle the gigantic achievements of bourgeois science, which are the foundation for science of the future. But in the stage of imperialism, which is capitalism in decay, all the negative, limiting features of

bourgeois science become accentuated. Science becomes more and more distorted and frustrated by its subjection to the power and interest of the capitalist monopolies.

In modern capitalism, with its great development of technique, there has taken place a vast extension of scientific work, which is based on large institutes utilizing elaborate and expensive apparatus and requires the planned cooperation of large numbers of scientific workers. Thus science ceases to be the concern of a few sages and becomes a great and important social institution.

At the same time, there is an inherent anarchy in the capitalist system. Capitalism is incapable of planned social production. Far from planning the utilization of resources and the development of science for the benefit of society, it subjects them to the dictate of capitalist monopolies, in their scramble for profits and drive to war. And this in turn leads to the disorganization of science and to waste and frustration of scientific work. Capitalism continually disorganizes its own scientific base.

LEADING CHARACTERISTICS OF BOURGEOIS SCIENCE

What are some of the principal results of the subjection of science to the interests of monopoly capital?

(1) There results an accentuation of the unevenness and lack of balance in the

development of the sciences, which has always been characteristic of bourgeois science — some branches of science developing in a one-sided way while others lag behind. There is a disproportionate emphasis on chemistry and engineering. Again, there is disproportionate development of the physical in comparison with the biological sciences, where quite fundamental problems are still neglected.

For example, the whole important field of plant physiology remains relatively undeveloped. This is, to put it crudely, because there is no money in it. The state of agriculture under capitalism is such that the conditions are not created for fundamental researches in this field. In this connection it is worth noting that it is precisely in the Soviet Union, the land of socialist collective farming, that new vistas of research in plant physiology are opening up in the work, still in its initial stages, of the new Michurin school of biology, headed by Lysenko. It is interesting to note, too, that while some fields of science are neglected because there is no money in them, others suffer because there is too much. Thus geochemistry is hampered, for instance, because the very powerful oil interests impose conditions of secrecy on such researches.

Science is called upon to answer just those particular problems in which the capitalist monopolies are interested, which is by no means the same as answering the problems which are bound up with the further development of

science and with the interests of the people. This warps the whole development of science and upsets what S.I. Vavilov called the "internal logic" of science. S.I. Vavilov wrote in this connection:

"Science, which arises out of the requirements of practice, and which justifies its existence by submitting findings which can be applied in practice, has at the same time its own logic of development. Sometimes scores of years may pass before a proper estimate can be made of a given scientific theory and before its practical applications are realized. Maxwell's theory of electromagnetic waves was formulated in the sixties of last century, but radio did not come into existence until the end of the century. The idea of the atomic nucleus was advanced by Newton. Atomic fission was discovered by Bequerel fifty years ago, but it is only today that we have come to realize the full significance of atomic energy. This explains why our plan (the plan of the USSR Academy of Sciences) is determined by the requirements of the theoretical advance of science as well as by the problems presented to us by the Soviet state. The Academy's work is not divorced from practice and has its roots in practice; but it aspires to results far beyond present-day practice." (See *Soviet News*, No. 1542.)

Such a balanced, long-term theoretical

development of science is, however, frustrated by the demands of the capitalist monopolies.

(2) There results a frustration of fundamental research in fields that are important for the all-round development of science and for the ends of general human welfare, and a diversion of research into less useful fields or into directions that are harmful and anti-social. Emphasis is placed on this or that particular research desired by the monopolies or for war preparations.

One outstanding example is the kind of problems biologists are put on to in connection with preparations for bacteriological warfare. More generally, this same tendency is exemplified in the constant trend to separate theoretical from practical and experimental workers. We find the same thing expressed in the most open way by Sir Henry Tizard, in his 1948 presidential address to the British Association, as well as in the report of the Advisory Council on Scientific Policy. Sir Henry Tizard puts forward the view, in essence a defeatist view, that we have still to learn how to apply properly techniques and discoveries already available, and he puts the emphasis on learning how to do this before launching out on fresh researches and discoveries.

(3) In the social sciences and psychology there results a picture of theoretical chaos and confusion. These sciences are prevented from undertaking genuine scientific examination, criticism and development of their material.

Instead of elucidating the real laws of motion of society, social science is called upon to justify the ways of American imperialism. Psychology is diverted from its task of solving the problem of the nature and causation of psychological processes into such problems as grading people for capitalist industry or for the army, or working out ways and means of improving "morale" in capitalist industries.

Thus, while genuine scientific development in these fields is held back, an enormous volume of pseudo-scientific literature is produced, plus an accumulation of facts and statistical data, the scientific interpretation of which is lacking. And at the same time a growing army of social scientists and psychologists is got together and set to work, especially in the USA, applying these sciences in the attempt, in the interests of the capitalist class, to solve social problems produced by the workings of the capitalist system.

(4) There results a narrow specialization of scientists — development of people who are supposed to be experts in some narrow field but whose outlook is completely unscientific outside that field, whatever it may be inside that field.

This feature is directly connected with the fact that the majority of scientists are still drawn from a narrow social stratum, from the so-called educated classes. As a result, many still carry with them all the prejudices and illusions of their class. And such class prejudices

are substituted for scientific ideas. The very fact that such men may be extremely able in the particular branch of science in which they specialize breeds the illusion, in their own minds and in the minds of others, that their outlook as a whole is scientific — that their general views about the world and about society and social problems, in reality class prejudices unconsciously assumed, represent the mature judgment of men of science.

With this goes the use of the so-called specialist or expert to put across reactionary propaganda — for instance, expert geneticists are put up to slander the Soviet Union; expert psychologists are put up to explain that, for social psychology, fascism and communism are the same thing, and that anyone who wants to change the existing capitalist order of society suffers from “maladjustment.” Another example is that of the expert physicist, Schroedinger, who, as a result of a study of the inter-relationship of quantum theory and genetics, informs the world that “the personal individual self is equal to the ubiquitous, all-comprehending, eternal self.” (E. Schroedinger, *What is Life?*) The scientific specialist has in some cases become nowadays a most important servant of reaction, because whatever obscurantist twaddle he puts across, no one who is not an expert is supposed to be able to contradict him.

(5) There results the failure to relate the results of one science with those of another, and

in consequence the frustration of the building of a unified scientific picture of the world which could serve as a weapon in the struggle for enlightenment and progress. In consequence there occurs the propagation in the name of science of all kinds of idealistic and obscurantist worldviews, and of mysticism and scepticism.

(6) There results the use of science against the people, and not to serve the interests of the people — in other words, the use of science for the ends of more efficient capitalist exploitation and war.

(7) There results the domination of scientific theory by idealist, metaphysical conceptions. To this aspect of bourgeois science I shall return later.

These, then, are some of the leading characteristics of bourgeois science. Bourgeois science is science distorted and frustrated by the conditions and demands of capitalist society. Socialist science is science which has won free of those conditions, which is therefore on the road to developing all that is greatest and most progressive in the traditions of science, which is on the road to the free development of all the great potentialities of science in the unlimited conquest of knowledge and placing that knowledge at the service of the people.

In the face of such facts about the character of scientific development and of scientific work and its application under decaying capitalism, it is impossible to make out that science

stands somehow above the struggle — that science, for example, is the same in the capitalist countries and in the Soviet Union — just “science” in both cases. On the contrary, there is taking place a cleavage of fundamental tendencies, and bourgeois science is today faced with rising socialist science. That which is old and dying is faced with that which is new and growing in the field of science.

“PURE SCIENCE”, “FREEDOM OF SCIENCE”

There has been considerable discussion of late about the concept of “pure science.” This is usually thought of as meaning the ideal of a science which pursues truth “for its own sake,” independent of practice and social application.

Such a concept of “pure science,” of the search for knowledge for the sake of knowledge alone, had at one time its progressive aspect. It had the aspect of a protest against the commercial exploitation of science. It was the rallying cry of men of science who wanted to pursue their work independent of demands for immediate cash returns. Today, however, it is more and more becoming a slogan of reaction, directed against the demand for the planning of science in the interests of the people.

One very influential version of the concept of “pure science” is now the idea of a science which develops independent of the class

struggle. There is no such ideal, impartial science. The only science that actually exists consists of the sum total of actual scientific activities and accumulation of past results and ideas; and in the capitalist countries this science, the sum of scientific work and scientific theory in each country, is profoundly modified by its social origin and by its social functions in capitalist society.

In this connection it is worthwhile noting the activities of those who have lately set themselves up as the champions of "freedom of science." These people want to preserve all the existing disorganization and lack of balance in scientific work in the name of "freedom of science." What do they mean by "freedom of science"? Apparently they mean the existing chaos in the publication of scientific papers, the lack of planning and coordination of fundamental research, the failure to mobilize scientific effort to serve the welfare of the people. Making out that they are championing "freedom of science," i.e., the purity, independence and self-determination of science, its freedom from extraneous influences, they are in reality defending and seeking to perpetuate precisely the thralldom of science to monopoly capitalism. While any suggestion of the organization and planning of scientific work for progressive social ends outrages them, they raise no protest at the direction of scientific work into war research, or against the secrecy that surrounds atomic research — and not only atomic

research. They raise no protest at the subjection of science to the dictate of private monopolies or its state regimentation for reactionary ends.

SOCIALIST SCIENCE

There is need to fight precisely against this subjection of science, against all these bourgeois trends in science which fetter scientific development. We want to set science free of the dictate of monopoly capitalism, to work for a science which serves the people and which serves the fight for peace and socialism.

This new science is already being born in the Soviet Union and will appear, too, in the new democracies. Stalin (in his speech to the electors of Moscow in February 1946) called upon Soviet scientists to undertake the task of "not only overtaking but outstripping in the nearest future the achievements of science outside our country."

It is of the highest importance to recognize the new and progressive character of socialist science, of science in the Soviet Union, where for the first time in history science is set free of the shackles imposed by its service to an exploiting class and is embarking upon a free development in the service of the people. It is true that this socialist science is new on the job. But nothing could be more out of place than a patronizing or condescending attitude to Soviet science on the part of scientists of the

West, failing to understand that here is the beginning of a great future development and that tremendous advances are already being made in the USSR in all fields of scientific work — that the overtaking and outstripping of which Stalin spoke is already becoming a reality.

As for those scientists who are throwing in their lot with the present anti-Soviet campaign, when they talk about the inefficiency and retrograde character of Soviet science they are, after all, only repeating what we seem to have heard in the past about the Soviet Army. They may yet live to be rudely disabused of their ideas.

What, then, are the main characteristics of advanced progressive socialist science, as compared with science in the bourgeois world? Briefly they are:

(1) The placing of science wholly and unreservedly in the service of the people's interests.

(2) The progressive realization, in the planning of scientific work as a whole and in the integration of fundamental theory, of the unity of science, under the guidance of the dialectical materialist world conception.

III

IDEALIST DISTORTIONS OF THEORY IN BOURGEOIS SCIENCE

In characterizing bourgeois science it is necessary to stress the way science is dominated by idealist metaphysical conceptions in fundamental theory. It becomes of the highest importance to undertake the theoretical criticism of such conceptions. Scientists are often well aware of the absurd idealist misinterpretations of scientific results which are produced by philosophers and theologians, and which are produced by some scientists, like Eddington, when they undertake to write books of popular science or to philosophize about science. What they are not so well aware of is the presence of idealist distortions at the heart of their own scientific theories.

What is meant, in this connection, by “idealism”?

In a well-known characterization of philosophical idealism, Engels wrote that: “Those who asserted the primacy of spirit to nature, and, therefore, in the last instance, assumed world creation is some form or other, comprised the camp of idealism. The others, who regarded nature as primary, belong to the various schools of materialism.” (*Feuerbach*, p. 31.)

In its more obvious forms, idealism maintains that the material world is the creation of spirit, e.g., that God created the world to realize his preconceived purpose. Idealism likewise takes the form of various views concerning the “immanent” purpose in the world; or, again, concerning the existence of a “spiritual

realm" side by side with, or above, the material world. Some modern idealists go so far as to maintain that only thoughts, ideas and sensations are real and that the material world is an illusion. Such is the view, for example, of those physicists who say that physics is concerned solely with "experiential data" and knows nothing of "matter" existing independently of anyone's experience.

More generally, it can be said that fundamental to the idealist way of thinking — whatever particular form the idealist approach may take — is the feature that ideas, abstract conceptions, are not regarded as reflections of material reality, but, on the contrary, as existing somehow in their own right. Whereas Marx wrote that ideas are "nothing else than the material world reflected by the human mind and translated into forms of thought" (*Capital*, Preface to Second Edition), for idealism ideas have somehow an independent status of their own. Thus for idealism the nature of a thing follows from the abstract idea of it, and not vice versa.

From this it follows that one of the manifestations of idealist thinking is *metaphysics*, i.e., to take for granted some rigid scheme of abstract ideas, which is declared to express the very nature of things, and to insist that the real world must necessarily correspond to that scheme.

IDEALISM IN COSMOLOGY AND

PHYSICS

The character of the fundamental ideas of the sciences merits close critical scrutiny. Science, as a growing body of knowledge, does not rest merely on observing phenomena, but science is a social operation; science rests on an activity of changing the world, it rests on techniques and experiments, it is an operation on the universe. But the results of this operation are interpreted in terms of ideas, and these ideas are drawn from past activities, they reflect and are determined by the whole social heritage of the past. Hence there always tends to occur a lag in the ideas of science, which do not keep pace with the advancing front of scientific work — a gap between scientific theory and advanced scientific practice.

In present-day science this manifests itself in the presence and persistence of idealist and metaphysical ideas in the sciences, drawn from the old decaying social order. Such ideas do not meet the requirements of contemporary scientific theory and practice which seeks to overcome the bounds of bourgeois science, and become not only a hindrance to the development of science, but actually antipathetic to that development.

Such idealist distortions of theory can be found in contemporary physics.

In cosmology, for example, we may characterize in this way the theories of the finite universe and of creation, which have become

widespread in connection with certain developments of the general theory of relativity, of the expanding universe and of Milne's generalized theory of kinematic relativity. The essential idealism of these theories is shown by the way they limit the physical world, which thus assumes a mysterious aspect and seems to demand something else, outside the physical world, beyond the scope of scientific knowledge.

Characterizing these cosmological theories, A.A. Zhdanov said in a speech concerning the history of philosophy (Conference of Soviet Philosophical Workers convened in June 1947 by the Central Committee of the Communist Party of the Soviet Union):

“Contemporary bourgeois science supplies clericalism, supplies fideism, with new arguments which must be mercilessly exposed... Many followers of Einstein, in their failure to understand the dialectical process of knowledge, the relationship of absolute and relative truth, transpose the results of the study of the laws of motion of the finite, limited sphere of the universe to the whole infinite universe, and arrive at the idea of the finite nature of the world, its limitedness in time and space. The astronomer, Milne, has even calculated that the world was created two billion years ago. It would probably be correct to apply to these English scientists the words of their great

countryman, the philosopher Bacon, about those who turn the impotence of their science into a libel against nature.”

Zhdanov continued:

“In like measure, the Kantian subterfuges of latter-day bourgeois atomic physicists lead them to deductions about the ‘free will’ of the electron and to attempts to represent matter as only some combination of waves...”

In the discoveries of modern physics, science is approaching new and more profound and truthful conceptions of the fundamental processes of nature. In opposition to the old Laplacian determinism, new ways of describing physical states and processes and of formulating basic physical laws are being worked out. But this gets represented in current quantum theory as if there were an absolute indeterminism in nature, as if the basic processes of nature were governed entirely by chance and physical laws were merely the results of the combination of an enormous number of absolutely random happenings. Together with the so-called disappearance of matter there is also taught the disappearance of causality.

Here again we may say that “the failure to understand the dialectical process of knowledge, the relationship of absolute and relative truth” has led to an idealist “libel against nature.” Because in the present stage

of physical knowledge physical processes, viewed in certain relationships, have a spontaneous and undetermined character, it is concluded that such a character is absolute, an ultimate character of physical reality. Because in certain relationships physical processes are best described in terms of chance and probability, it is concluded that these are ultimate physical concepts. The provisional results of the given stage of physical knowledge are, by a process of extrapolation, transformed into a theory of the ultimate nature of physical reality, and into a theory which sets definite bounds to the scope of physical knowledge. Absolute limits are set up to possible knowledge of fundamental physical processes.

THE LYSENKO CONTROVERSY

The sharpest struggle of all between new progressive trends in science and bourgeois idealist distortions of science centres at present in the controversy in biology raised by the work of the Michurin school in the Soviet Union, headed by T.D. Lysenko.

Lysenko has directed his attack against theories current in genetics, associated particularly with the names of Mendel, Weismann and Morgan, which postulate the absolute distinction of the germ plasm and the soma. Soviet science characterizes this as a metaphysical theory, which, postulating the existence of a "separate hereditary substance,"

independent of the rest of the organism, goes beyond anything justified by any evidence. Such a conception fails to relate heritable variations to changes in the conditions of life of organisms. Soviet science, on the other hand, regards "the organism and the conditions required for its life" as "an inseparable unity" (Lysenko: *Soviet Biology*, p. 25), and studies the possibilities of bringing about controlled changes in the nature of organisms by such methods as inducing heritable variation by controlled changes in the organism's environment or by physiological treatment such as graft hybridization in the case of plants.

The endorsement of Lysenko's views by the conference of Soviet biologists, held in August 1948, has occasioned much comment in this country, where a number of "experts" and "specialists," without even waiting to read the summaries of the Soviet discussion, have hastened to explain to the general public that Soviet science has taken the wrong turning. Writing in *Picture Post*, for instance (September 25, 1948), Dr. C.D. Darlington flatly stated that, for science, "differences are inborn and unalterable. Some wheats were unalterably better than others." He characterized as unscientific, therefore, Lysenko's view that "heredity can be changed by changed conditions."

Yet the view that "differences are inborn and unalterable" is itself nothing but an *a priori* deduction from the dogmatic and metaphysical theory that the hereditary substance is

unaffected by the conditions of life of the organism — that, in T.H. Morgan's words, "the germ cells" are "in origin independent of the rest of the body and have never been a constituent part of it." (*Encyclopaedia Americana*; quoted by Lysenko, *Soviet Biology*, p. 14.) It is in opposition to this metaphysical theory that Lysenko maintains "the absolutely true and generally known proposition that the reproductive cells, or the germs, of new organisms are produced by the organism, by its body, and not by the very same reproductive cell from which the given, already mature, organism arose." (*Soviet Biology*, p. 15.) This being so, it would be expected that "heredity can be changed by changed conditions."

According to the metaphysical theories current in genetics, changes in the hereditary substance happen in a chance and uncontrollable way, though such changes may be induced by means of X-rays or by the use of such substances as colchicine. There is no direct way of controlling and foreseeing the kind of changes to be brought about in the heredity of organisms. The best that can be done is to select and breed from those mutants which happen to have changed in some desired direction. Soviet theory and practice, on the other hand, has concentrated on overcoming the limitations laid down by the tenets of current bourgeois theory and finding techniques for influencing organisms to change in a desired direction — to control, direct and foresee such changes.

Where genetics had declared that there was no way, Soviet biology had set itself the task of finding the way. The aim of Soviet biology, dictated by the requirements of socialist agriculture, has been precisely to find out how the heredity of organisms can be influenced and controlled most effectively and surely.

It is no accident that this development in biology took place precisely in the USSR. As Dr. C.H. Waddington points out, referring to the capitalist world: "In the particular economic situation in which man has found himself during the last few decades, production, even with little help from science, has been so far ahead of consumption that the application of genetics to this field (the improvement of agricultural crops and stock) has, in most countries, not been investigated wholeheartedly and on a large scale." (C.H. Waddington, *Introduction to Modern Genetics*, p. 309.) This application is intensively investigated, however, in the USSR, where this "peculiar economic situation" does not prevail. Here practice bases itself on Ivan Michurin's conclusion that "it is possible, with man's intervention, to *force* any form of animal or plant to *change more quickly and in a direction desirable to man*. There opens before man a broad field of activity most useful for him." (*Soviet Biology*, p. 25.)

It should be stressed, because of the libels that are current — and some writers do not stop short at the most unscrupulous misrepresentation, including the statement that

Lysenko is ignorant of all the work of experimental genetics over the past thirty years — that the new trend of biology in the Soviet Union in no respect throws overboard the experimental results of Mendelian workers or denies any well-attested facts. Thus Lysenko states: “Naturally, what has been said does not imply that we deny the biological role and significance of chromosomes in the development of the cells and of the organism. But it is not at all the role which the Morganists attribute to the chromosomes... Does this detract from the role of the chromosomes? Not in the least. Is heredity transmitted through the chromosomes in the sexual process? Of course it is. We recognize the chromosomes. We do not deny their presence. But we do not recognize the chromosome *theory* of heredity.” (*Soviet Biology*, pp. 15 and 43.)

In opposition to “the chromosome theory of heredity,” to “Mendelism-Morganism,” Lysenko maintains that: “The extent of hereditary transmission of alterations depends on the extent to which the substances of the altered section of the body join in the process which leads to the formation of reproductive sexual or vegetative cells. Once we know how the heredity of an organism is built up, we can change it in a definite direction by creating definite conditions at a definite moment in the development of the organism... Heredity is the effect of the concentration of the action of external conditions assimilated by the organism in a

series of preceding generations... Heredity is determined by the specific type of metabolism. You need but change the type of metabolism in a living body to bring about a change in heredity." (*Soviet Biology*, pp. 28, 31, and 40.)

Lysenko defines heredity as "the property of a living body to require definite conditions for its life and development and to respond in a definite way to various conditions." It is in this precise sense of heredity that he speaks of changing the heredity of organisms. And in this connection, too, an examination of the contentions of Soviet Michurin biology shows that the new point of view is by no means a re-statement of Lamarckism, although uninformed critics have made this assertion.

As a matter of fact, weaknesses and inconsistencies in "orthodox" genetical theory, and discrepancies with fact, are well known to all geneticists. Few of Lysenko's opponents are really prepared to defend all the dogmas of the Weismann-Morgan system. Yet some still seem to prefer to go on working with a theory which is known to be inadequate, and to cling on to and salvage at all costs as much of the relics of this theory as they can, rather than make a serious examination of a new, Socialist trend in biology which attacks the roots of the idealism and metaphysics in "orthodox" genetics.

While it is clear that some "orthodox" biologists are quite prepared to deduce what can and cannot happen in the life of organisms

from the dogmatic theoretical principles of Mendelism-Morganism, at the same time they charge Soviet biology with making an *a priori* deduction of biological facts from dogmatic principles of dialectical materialism. This is one part of the attack on Soviet biology contained, for example, in Hudson and Richens' *The New Genetics in the Soviet Union*. Here there is a considerable misunderstanding, to say the least. That Soviet biology is guided by dialectical materialism is quite true. But what does this mean? Lysenko himself has clearly explained it:

“A knowledge of *causal* connections is essential for the practical work of regulating the development of cultivated plants and animals. For biological science to be in a position to render the collective and state farms ever more assistance in obtaining higher crop yields, higher yields of milk, etc., it must comprehend the complex biological inter-relations, the laws of the life and development of plants and animals. A scientific handling of practical problems is the surest way to a deep knowledge of the laws of development of living nature... But when living nature is studied in isolation from practical activity, the scientific principle of the study of biological connections is lost... (*Soviet Biology*, p. 36.)

“*Science is the enemy of chance*,” Lysenko states. “That is why Michurin, who

was a transformer of nature, put forward the slogan: 'We must not wait for favours from nature, our task is to wrest them from her...' The strength of the Michurin teaching lies in its close association with the collective and state farms, in the fact that it elucidates profoundly theoretical problems by solving important practical problems of socialist agriculture." (*Soviet Biology*, pp. 48-49.)

Such are the leading principles of biology as it is being developed in the USSR. Many now see in this an interference of politics in science. Indeed, a past president of the Royal Society, Sir Henry Dale, has demonstratively resigned from the USSR Academy of Sciences in protest. Such an action agrees so well with the present politics of the anti-Soviet camp that it is difficult to see in it nothing but a protest against political interference with science. Such an action rather demonstrates that, whatever may be the connection of science and politics in the USSR Academy of Sciences, they are becoming very closely connected in the case of some members of the Royal Society.

The fact that after years of discussion and controversy among Soviet biologists a biological conference has declared itself in favour of the new trend, that this trend has been endorsed by the Soviet government and by the Central Committee of the Communist Party of the Soviet Union, and that the USSR Academy

of Sciences has taken practical decisions towards the organization of future work along these new lines, is interpreted as the subjection of science to politics. Actually it is nothing else than the progressive development of science in the service of socialist construction, of the ends of man's dominion over nature. This development has demanded a break with limited metaphysical conceptions in science, which were nothing but a hangover from the past.

It is said that this is, however, a vulgarization of biology for the benefit of the ignorant masses — of the Soviet collective farmers. What could be more inappropriate than such patronizing references by bourgeois specialists to the Soviet collective farmers? For the collective farmers are not ignorant peasants but the builders of the world's most advanced agriculture. It is said they were dissatisfied with "orthodox" biological theory because it did not promise quick enough or big enough practical results for them. That is true. But it is a condemnation of "orthodox" biology, not of socialist science. In Stalin's words, referring to those science specialists who complained that socialist construction was trying to force the pace and to transcend the limits imposed by previously accepted theories:

"They say that the data of science, the data contained in technical handbooks and instructions, contradict the demands for new and higher technical standards. But

what kind of science are they talking about? The data of science have always been tested by practice, by experience. Science which has severed contact with practice, with experience — what sort of science is that? If science were the thing it is represented to be by certain of our conservative comrades, it would have perished for humanity long ago. Science is called science just because it does not recognize fetishes, just because it does not fear to raise its hand against the obsolete and antiquated, and because it lends an attentive ear to the voice of experience, of practice.” (J.V. Stalin, *Speech at First All-Union Conference of Stakhanovites*, November 1935.)

Before leaving this topic of the biological controversy in the Soviet Union, a few remarks may be made about some of the wider issues which it raises. For this controversy in biology is a part of a wider process.

At the present time in the socialist Soviet Union there is taking place a process of the very radical examination and criticism of ideas and tendencies throughout the entire cultural field. Thus in philosophy, literature and the arts — music, painting, architecture — sharp criticism is being directed against ideas and methods which reflect the influence and outlook of the old bourgeois society. A conscious effort is being made to create new socialist culture — a culture which assimilates all that is

best of the achievements of the past, but which corresponds to the requirements of the new socialist society, breaks with the degenerate features of the culture (if it can any longer be called culture) of decaying capitalism and carries human achievement forward to a new stage.

It is the same process that is taking place in the sciences. The ideas and methods of the sciences are being subjected to the same constructive socialist criticism. And just as this criticism rejects the decadent trends of formalism in the arts, just as it exposes the reactionary anti-social character of both the selection of themes and the method of treatment of them in bourgeois literature and art, so it rejects as inherently false and anti-scientific the metaphysical idealist types of theories which have come to penetrate science in the capitalist world. It calls for a re-examination of scientific theory, for ridding science of all that is negative and false in the heritage of capitalism and carrying science forward to fresh achievements in the service of the common people and of the building of socialism.

This process of criticism is bitterly and violently resented by many people in this country.

Loudly protesting against the socialist criticism of the state of the sciences, some of the critics of this criticism are now talking about Galileo and the inquisition. The comparison implied with the Soviet Union is in any case

absurd and slanderous, since the “inquisition” which those who are being criticized are facing is the critical examination of their theories and methods by fellow scientists — something without which scientific progress is impossible. But the comparison is even more inappropriate when it is remembered that what Galileo did was boldly to open up new paths in science, in opposition to the accepted theories of his times, and this is exactly what those who are now accused of being “inquisitors” are doing. They are attacking the old ideas and striking out on new, untrodden paths.

By all means let these new ideas, too, be subjected to close and strict examination. But this is scarcely what those who are now shouting about Galileo are doing. They are not, in fact, on the side of Galileo at all, but on the side of the inquisition. They are insisting on the correctness of the old accepted ideas, on the iniquity of a radical criticism of those ideas — demanding that the critics of those accepted ideas be outlawed and made to recant, and hurling at them all manner of abuse and denunciation.

SCIENCE AND CLASS STRUGGLE

What is the significance of the idealist mysticism and metaphysics which is introduced into the fundamental ideas of physics and biology, and which is to be found, indeed, throughout the whole field of science — to a very

marked degree, for example, in psychology, physiology and neurology? In all these sciences there are to be found idealist trends in theory, under which must be included the influence of mechanist conceptions, since mechanism in contemporary science and philosophy is simply one of the forms of idealist metaphysics. All this is nothing but the ideological reflection in science of the present position of capitalist society, of decaying capitalism — just as the scientific ideas of Newton, for example, reflected the earlier and progressive stages of capitalist development.

Science, which is based on a technique of experimentation, discovers and reveals the laws of motion of objective reality — but it interprets its discoveries from the standpoint of a class, since it is impossible for science, which is a social product, to exist independently of classes in a class society. Science reflects objective reality through the medium of conceptions which themselves reflect the standpoint of a social class. Bourgeois science inevitably distorts scientific truth and smuggles idealist conceptions into science in the interests of the bourgeoisie. It is incapable of carrying its own greatest achievements to fruition. This is left to the science which bases itself upon the struggle of the working class, the struggle for socialism. For the working class, whose historical mission is to build socialism and end exploitation, is not interested in ideological distortions or deceptions but in knowing things as they are —

in the widest development and extension, therefore, of scientific knowledge.

The essence of the contemporary idealism in science is to be found above all in the conception of the existence of absolute barriers to further knowledge and to practical control over nature.

Conceptions of the existence of such absolute barriers, of the de-limitation of the possible and of the scope of human knowledge and practice — conceptions of a type which might be called “impossibilist” — have been common throughout the whole recent history of bourgeois science. Thus Malthus, for example, invented a theory of population to prove that it was impossible to abolish poverty and want. Again, bourgeois economics invented the “law of diminishing returns” to prove that it was impossible to develop agricultural production beyond a certain point. Of the same type in another sphere was Kelvin’s deduction of the “heat death” of the universe. The recent theories, already mentioned, of the finite universe and of the creation of the universe are of the same type. Recent conceptions in the sphere of quantum theory likewise set out to impose limits to knowledge. And such limiting ideas are now becoming widespread throughout all the sciences, physical, biological and social, in the form of conceptions of chance or fortuity as an ultimate and irreducible characteristic of reality, of the unpredictability of events, and therefore of the mysterious and unaccountable

character of the fundamental processes of nature.

Such conceptions are incompatible with the further flowering of science and its application to the ends of human progress. Man's knowledge and power must always be limited — but progress demands overcoming the limitations of the past, whereas to represent them as absolute means stagnation and death.

The presence of such limiting conceptions in bourgeois science means only that capitalism is incapable of sustaining and continuing the scientific development it began. And what they reflect is the disintegration and decay of capitalist society and its culture. Capitalism faces a general crisis from which it can find no means of escape. It has no future, nothing whatever to offer to the progress of mankind. It is precisely this position of contemporary capitalism which now finds its reflection in the negative, limiting conceptions of contemporary idealism.

We must draw the conclusion from all this that the class struggle is waged in science, too. The so-called impartiality of science is a complete illusion. The struggle for the advancement of science, for scientific truth, is a partisan struggle — a struggle of the scientific partisans of the working class and of socialism against idealist influences, born of capitalist society, which hamper and distort science, and against the whole distortion and frustration of science in the interests of monopoly

capitalism.

This struggle on the front of scientific theory is profoundly practical, profoundly political at the present time. Monopoly capitalism wants to use science for its own ends, including the preparation of war against the Soviet Union, and it strives to bind scientists to serve those ends. Scientists have to face the question: What are you working for, imperialism or the socialist future of mankind? The ideological struggle in science is inseparably connected with the struggle to win scientists for the cause of peace and socialism.

HISTORY OF SCIENCE

In this connection a word should be said concerning the study of the history of science. Work on the history of science — to combat bourgeois falsifications of the history of science and establish a truly scientific history of science — is enormously important in the advancement of the sciences.

Much has been done to establish the intimate connection of science with technology. But a history of science which demonstrates the technological basis of scientific advance is not yet a Marxist materialist history of science. What has to be done is to demonstrate the class content of scientific theories. History is the history of class struggles, and this is what is reflected in the history of science.

The history of science is the history of the

advancement of man's knowledge of surrounding nature and of human society, and therefore of man's dominion over nature. This advancement is by no means a smooth evolution, a succession of discoveries and technical achievements each of which enlarged our power and knowledge and modified preceding scientific views, but exemplifies throughout its course the struggle for materialist scientific views against dead and limiting idealist conceptions. The scientific history of science must demonstrate, not only the achievements of bourgeois science, but likewise the shortcomings of bourgeois science, and its degeneration and decay, together with the struggle, which is the central issue today, for progressive socialist science which serves the people.

IV

DIALECTICAL MATERIALISM AS A GUIDE IN SCIENTIFIC WORK

Dialectical materialism, which is the theoretical weapon of the working-class struggle for socialism, is the indispensable guide in scientific work.

To appreciate the bearing of dialectical materialist philosophy on the sciences and its connection with the sciences, it is necessary, in the first place, to clear away certain misconceptions.

Dialectical materialism is not a dogma. It is not a fully finished rounded-off philosophical "system" of the old kind. Dialectical materialism marked the end of the traditional philosophical systems and the emergence of a new kind of philosophy. As A.A. Zhdanov has said: "The discovery of Marx and Engels represents the end of the old philosophy, i.e. the end of that philosophy which claimed to give a universal explanation of the world." (Speech on *The History of Philosophy*.) With reference to this old philosophy Zhdanov said:

"The creators of the philosophical systems of the past, who laid claim to the knowledge of absolute truth in the ultimate sense, were unable to further the development of the natural sciences, since aspiring to stand above science, they swaddled them with their schemes, imposing on living human understanding conclusions dictated, not by real life, but by the requirements of their philosophic system."

This remains true of the idealist philosophies of today, including the so-called scientific positivist or logical empiricist philosophy, which, while disclaiming any philosophical "system," still seeks to force science into the straitjacket of a philosophical scheme, to dictate to science what the form of its hypotheses must be and to lay down bounds and limits for scientific knowledge.

To apply dialectical materialism in science,

then, does not mean that we attempt to deduce what must be the case from the principles of dialectics; it does not mean that dialectical materialism prescribes to the sciences what their results ought to be. That is not how the principles of dialectical materialism are used. For as Engels insisted: "There can be no question of building the laws of dialectics into nature, but of discovering them in it and evolving them from it... Nature is the test of dialectics." (*Anti-Dühring*, pp. 17 and 29.)

Nor can the principles of dialectics, which express the most general laws of motion of nature and of human society and human thought, ever achieve a final, complete formulation, but their content is enriched and developed with every new advance of science, every new advance of experimental technique, and of social experience.

But when Engels says that we discover the laws of dialectics in nature, this appears sometimes to be taken to mean that the laws of dialectics simply register, so to speak, the results of science. According to this idea, dialectical materialism is a broad philosophical generalization based on science — but the only connection between science and dialectical materialism which is recognized is that the principles of dialectics are *exemplified* in the results of science.

Such a conception would mean that the actual practice of science was unaffected by the conceptions of dialectical materialism. It

would mean that while dialectical materialist philosophy needs constantly to turn to science, science does not need to turn to dialectical materialist philosophy. But, on the contrary, the conceptions of materialist dialectics, which are a profound generalization of the results of the most progressive science, serve as a guide for the further advance of science and as a theoretical weapon in the fight for scientific progress and against idealist distortions in the sciences. A generalization which could only be exemplified but not applied, which summed up discoveries to date but did not help to make new discoveries, would be of very little use.

Dialectics, moreover, is not, in a narrow sense, simply a generalization of the results of science, but it is a generalization of the entire experience of the struggle for social progress. This experience includes within itself the development of the sciences, but not only the development of the sciences.

Another aspect of the same misconception — the misconception, namely, that dialectics simply registers the results of science — is the idea that dialectics is the same as scientific method, and that therefore all scientists are, as it were, natural dialecticians. To say this is to overlook the fact that dialectics refutes the limited and rigid ideas of “scientific method” which are taught by bourgeois specialists and expresses new and advanced ideas of scientific method.

In this connection Engels wrote:

“Natural science has now advanced so far that it can no longer escape the dialectical synthesis. But it will make this process easier for itself if it does not lose sight of the fact that the results in which its experiences are summarized are concepts; but that the art of working with concepts is not inborn and also is not given with ordinary everyday consciousness, but requires real thought, and that this thought similarly has a long empirical history, not more and not less than empirical natural science. Only by learning to assimilate the results of the development of philosophy during the past two and a half thousand years will it be able to rid itself on the one hand of any isolated natural philosophy standing apart from it, outside it and above it, and on the other hand also of its own limited method of thought...” (*Anti-Dühring*, p. 19.)

What dialectical materialism means in relation to scientific work was summed up by Zhdanov when he said:

“It is an instrument of scientific investigation, a method, penetrating all the natural and social sciences, enriching itself with their attainments in the course of their development.” (*On the History of Philosophy*.)

A SCIENTIFIC METHODOLOGY

Dialectical materialism, which generalizes the experiences of the working-class struggle and the progressive achievements of science, is an instrument and guide of scientific advance inasmuch as it contains a profoundly materialistic theory of knowledge and a conception of the basic laws of change and development absolutely incompatible with all idealist mystification.

The dialectical materialist theory of knowledge regards knowledge as a developing social process. At every stage our knowledge is limited, provisional, relative to the existing means of knowing. But the bounds of knowledge are constantly expanding: provisional, relative knowledge expands in the direction of absolute knowledge. There is no absolute boundary or limit to knowledge, no unknowable things-in-themselves, nothing which cannot in principle be known and explained. Knowledge is knowledge of the real material world, the discovery of the interconnections and laws of motion of real material processes, including therein the development of human society and the material basis of human consciousness and its laws of development.

The dialectical materialist conception of the world has at its foundation, as Engels has put it:

“The great basic thought that the world is not to be comprehended as a complex of ready-made *things*, but as a complex of

processes, in which the things apparently stable no less than their mind-images in our heads, the concepts, go through an uninterrupted change of coming into being and passing away, in which, in spite of all seeming accidents and all temporary retrogression, a progressive development asserts itself in the end.” (*Feuerbach*, p. 54.)

In this progressive development quantitative changes become transformed, with relative suddenness, into qualitative changes — the emergence of new qualities, of new kinds of things, of new levels of organization of matter. Such new qualities have their own laws of development which are not simply reducible to terms of what went before, to terms of lower levels. At the same time the new is fully explicable from what produced it, from the accumulation of quantitative changes which became transformed at a certain point into a change of quality.

Dialectical materialism sees change and development as issuing, not simply from the action of external forces — which is the concept of mechanism — but from the internal contradictions inherent in all natural processes, on the basis of which there takes place a conflict or struggle of opposing tendencies which “constitutes the internal content of the process of development.” (Stalin, *Dialectical and Historical Materialism*.) Thus in his *Philosophical Notebooks* Lenin wrote: “In its proper

meaning, dialectics is the study of the contradiction *within the very essence of things.*”

The dialectical materialist conception of process — of the universality of change, of the interconnection of all phenomena, of the law of the transformation of quantitative into qualitative change, of the existence of contradiction within the very essence of things — may be formulated as a very general philosophical description of the real world. Most important is it to understand that this general philosophical conception, unlike the “systems of philosophy” of the past, constitutes a powerful methodology, applicable in the scientific explanation of events and in the struggle scientifically to understand and control them. Thus simply to say that quantitative changes become transformed into qualitative changes, or that all processes contain internal contradictions, in itself explains nothing. But it shows what to look for in seeking an explanation, in seeking for the means of understanding, foreseeing and controlling events. It constitutes a scientific methodology — already hidden in the successful work of the sciences in the past, but now consciously and openly formulated and generalized.

So understood, dialectical materialism is a weapon for the unification of science and its further development in the service of humanity. And it is a weapon of sharp criticism against all forms of idealism in the sciences, including the metaphysical conceptions of

mechanism. To apply dialectical materialism in scientific work is at one and the same time to engage in the sharpest polemical struggle against idealist distortions in science and against the distortion and misuse of science in the interests of the capitalist monopolies and their war preparations, and to develop the ideas and methods of progressive science that serves the people.

SCIENCE AS A WEAPON OF POPULAR ENLIGHTENMENT

In so far as it remains distorted by the conditions and demands of capitalist society, science is powerless, and has proved itself powerless, to fight against the anti-scientific, obscurantist conceptions which are continuously being churned out by philosophers, theologians, politicians and journalists to deceive the people. On the contrary, bourgeois science itself feeds the ideological campaign of reaction. But the application of dialectical materialism in the sciences means that, in advancing science and overcoming the limitations of bourgeois science, progressive scientists are able fully to play their part in exposing and annihilating the false ideas put about by the ideologists of imperialism. Here there is involved a fight at all levels — against the subtle and elaborate doctrines of professional philosophers and theologians, as well as against the crudities which are put out in the popular press and over the radio.

At the same time, progressive scientists have the job of carrying science to the people — of making and taking every opportunity in lectures, articles and books, of propagating a genuine popular science.

The task of popularizing science is not simply to supply to people easily digested summaries of results in particular fields of science and interesting information about all manner of particular subjects — as is done extremely well, for example, in some of the articles in the *Penguin Science News*. To do that well is useful, but what is wanted is something much more. We want to be able to present science to the people in such a way that it teaches and propagates a scientific materialist outlook; in a way that arms the people against superstitions and obscurantist propaganda; in a way that presents scientific results, not as so many interesting discoveries of exceptionally clever and well-trained specialists, but as a source of enlightenment and a weapon of progress; in a way that always shows how the people can use science, which ties science up with the problems of our time as they affect ordinary men and women; in a way that builds up a unified scientific materialist world conception, that contributes to the building of a genuine scientific popular culture.

Such genuine popular science can only be achieved by scientists who have broken with the reactionary trends of bourgeois science.

SCIENCE IN THE STRUGGLE FOR PEACE AND SOCIALISM

I have tried to show that underlying the scientific controversies of our time, the disputes between different conceptions in the sciences and between different views of the functions and organization of science, is a conflict of different world outlooks — on the one hand that which corresponds to the existing conditions of capitalist society, on the other hand that which corresponds to the tasks of building a new, socialist society. The scientific and philosophical disputes reflect the basic social controversies of our time.

Many people who agree that there does exist a fundamental conflict of outlook would nevertheless not agree with the above description of it. Rather do they take their stand on the conception of the so-called Western tradition of free scientific research, and maintain that this is being upheld against socialist critics who seek to destroy this tradition. By an extraordinary process of muddled thinking this Western tradition is sometimes identified with the “Christian tradition.” And some even go so far as to declare that the “Christian tradition” has always fostered free scientific research — quite oblivious, for example, of the true history of Galileo and of the fact that scientists have had frequently to struggle against the opposition of the Christian churches.

But what is the truth about this Western

tradition? That a great tradition of scientific development has been built up in Western Europe is a fact. But how is this tradition now to be carried forward? Is it being carried forward under the auspices of the great American trusts who manufacture atomic bombs, of the U.S. Army and State Department, of the Federation of British Industries? Or is it not rather to be carried forward in the struggle against capitalist misuse of science and for the opening up of new paths of science in the service of the common people? The appeal to a Western tradition tells against those who are making this appeal.

Today the very future of science, and the carrying forward of the best traditions of science, is indissolubly linked with the anti-imperialist struggle, with the fight for peace. Scientists, whom the advocates of a new war would like to use as pawns in their criminal schemes, can play a major part in the struggle to prevent war. Reaction wants to keep scientists locked up in their particular researches, to keep them separate from the working-class movement and from the people, and to prevent the spread of new and progressive ideas in the sciences. Instead, let them have merciless exposure of their war preparations and of the prostitution of science to serve the ends of imperialism. Those scientists who cherish their belief in science and its mission of enlightenment, and who know that the development and application of science can transform human life for the better, must form a united front against the

reactionary misuse of science and against reactionary ideas in the sciences, and for the advancement of science in the service of the people and of the conquest of nature by man.

The future of science is as a weapon of enlightenment and emancipation, an instrument for the organization of human freedom, of man's dominion over nature, of the bright future of socialism.



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