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Science and Antiscience

We have yet to achieve a unifying view on which to base a conception of the nature of man.

Walter Russell Brain

I very much appreciate the privilege of addressing you and of attending this meeting as the representative of the Council of the British Association for the Advancement of Science. A few months ago, as president of that Association, I delivered an address on "Science and Behaviour." That is a large subject, and I did not attempt to do more than deal with it in outline. I realized that I left many important questions unanswered, and some, indeed, unasked. This, together with some reactions to my address in the English press and elsewhere, made me welcome this opportunity of carrying some of my ideas further.

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In my presidential address I drew attention to our collective failure to foresee the consequences of much recent and current scientific work, and I stressed the need for more education in science. Tonight, however, I am concerned with more subtle, and therefore less obvious, obstacles to the acceptance of scientific ideas, for I want to inquire into the nature of current prejudices against science and scientists. By prejudices I mean emotional attitudes more positive and active than mere ignorance, even though, as I hope to show, some of them are the outcome of ignorance. No doubt these prejudices vary in force from one country to another, and in individual countries from one stratum of society to another. They need to be taken seriously, because scientists constitute a minority of all populations, and in democratic societies the practical uses of their achievements depend to a considerable extent upon their acceptance by the majority. And in that majority there are intelligent people whose education has given them little or no knowledge of science. Some of these are suspicious of a culture which they do not understand. Since these intelligent people are often also influential, they tend to propagate their suspicions among those who listen to what they say. My object in this address is, first, to try to remove some at least of the unreasonable suspicions which the nonscientists may harbor about science, and to make scientists themselves aware of them.

But it would be a mistake to suppose that all the hostility to science is due to either ignorance or prejudice. Science seems to many to present a complex challenge to other ways of thought, which, though not perhaps actually older, were well established for centuries before science grew out of its infancy. Part of this challenge, however, comes, not from science itself, but from philosophical ideas which science is thought to support; but part of it is more fundamental because it is the challenge of new facts about man and the world, which science is revealing, and of novel situations which call for decisions about action.

Misunderstanding about Scientists

Let me begin by dealing with the misunderstandings about the nature of science itself. What is science? The first definition given by Webster's *Dictionary* is "knowledge." I suggest that those who ask anxious questions about the influence of science, or the supposed conflict between science and some established system of belief, should try the effect of replacing the word *science* by the word *knowledge*. Knowledge surely can conflict only with ignorance.

Science, of course, is knowledge obtained in a particular way—by the use of scientific methods. But because the term is used collectively for all knowledge of this kind, there is a tendency to project the general concept of science on to a collective group of scientists who are supposed to be responsible, in some way not always understood or defined by the nonscientist, for various of our current problems.

This is a complex misapprehension. In the first place scientists often have no more in common with each other than that they are all seeking knowledge by means of scientific methods. Professor A uses these methods to investigate the light from receding nebulae, while Professor B is interested in the physiological clock which regulates the habits of shore-inhabiting crustaceans in relation to the tides. Dr. C is investigating the atomic nucleus and antimatter, and so on through to Professor Z, who is studying the virus-carrying capacity of mosquitoes in a tropical forest. These scientists have probably never met one another. They may differ in age, sex, race, language, religion, and their general mode of life, and none of them may be interested in what the others are doing. As for the remote effects of their scientific activities, what Professor A does may be of importance for our ideas about the origin of the universe, while Professor B's work may have some implications for the storage of information in the brain, and possibly for our understanding of the relationship between the brain and the mind. Dr. C deals with a subject which has already had profound importance in relation to the development of nuclear energy and today is likely to interest the philosophers of physics who are concerned with the ultimate nature of matter and the relationship between the observer and what he observes. And Professor Z's investigation of viruses concerns a scientific topic of great importance for our understanding of cell behavior, information at the molecular level, the nature of the gene, and the cancer cell. The immediate social effects of his work may well be the elimination of a particular group of diseases in tropical areas, and a resulting increase in the local population, which is already too great for its food supplies. Unless they are rather exceptional men in their particular field of work, none of these scientists may be much interested in its more remote implications. At any rate, they can all be first-class scientists without such an interest.

I chose these examples at random, but I could well have chosen any other of the varieties of scientific work being practiced by the hundreds of thousands of scientists in the world. Scientists, of course, meet one another to exchange ideas, to promote their own particular branch of science, or science in general, or because they are aware of its social implications. Nevertheless, such collective activities, important though they may be in themselves, play a small part in their lives. Scientists, though they must always be aware of the work of their fellows in their own fields, are essentially individualists; and the body of knowledge to which they are contributing is an impersonal one. Apart from contributing to it, they have no collective consciousness, interest, or aim.

The next misconception with which I want to deal is the idea that scientists are responsible for the applications of science. This is true only in the sense that without science there would be no scientific technology. But, as I have just pointed out, many scientists, perhaps most, are not concerned with the applications of their work. The question of scientific responsibility was raised in its most urgent form by the development of nuclear weapons. Here surely we must distinguish between science and technology. Whether the scientific knowledge which made possible the release of atomic energy should be applied to the production of nuclear weapons is a difficult ethical question, but it is a different question from that of whether scientific knowledge is good or bad in itself. All scientists appear to take for granted that it *is* good in itself, whatever may be the case with the uses to which it is put. To argue otherwise would be in any case a waste of time, since the impulse to know is evidently an inherent part of human nature. I pointed out earlier that man does not sufficiently foresee the consequences of scientific discoveries. It follows that he certainly has not the capacity to decide that some particular line of scientific research ought to be abandoned because of its supposed evil consequences for mankind.

This brings me to the point that the idea of the scientist which we have been discussing is clearly an abstraction. The scientist is a member of society, and it is society which educates him, pays him for his work, and neglects to foresee its consequences. And society is responsible for what it does or fails to do with the scientist's discoveries, though he has a special responsibility as a member of society, as we shall see.

Nuclear weapons present a problem of urgency and immediacy, but there are other problems of applied science almost equally urgent and important. I spoke to the British Association about the world population crisis. This of course has come about as a result of the pursuit by scientists of immediate ends which seemed obviously good in themselves—for what could seem more clearly desirable than the abolition of malaria or smallpox? Neither of these scourges is by any means abolished yet, but the incidence of malaria in many countries has been greatly reduced by public health measures utilizing the recently introduced insecticides, and the incidence of smallpox, of course, by vaccination. But the scientists who invented the insecticides and the antimalarial drugs, and the devoted field workers who distribute them in and around villages in malarious regions, do not think about the effects of their actions on population growth in relation to food supplies. They cannot be blamed for this, for it was not their job to do so, and if they had thought about it there was little they could have done.

I have just mentioned insecticides in connection with the war on malaria, but their use in agriculture has also had unforeseen results in their deleterious effect upon wild life. On the other hand, agriculturalists, in particular those concerned with food supplies in developing countries, say that, by increasing crops, insecticides are saving many human lives. We do not

know at present whether the consumption of minute amounts of these substances in our food has any long-term ill effects upon human beings. Moreover, we must also remember that substances introduced by scientists, who are accustomed to accurate measurements, have to be used and distributed by workers most of whom have no knowledge of science, and who may not adequately appreciate the importance of accuracy in calculating the amounts of these powerful substances to be used. This illustrates the fact that a scientific culture demands some scientific virtues in a large part of the population.

There are those who try to minimize the population crisis. It may well be true that, with a better organization of its resources, the world could support a much larger population than it does now. But the organization is not at present there, and even assuming the utmost cooperation among all the countries concerned, it must take a considerable time to set up. Such an organization, moreover, could operate only through individual countries, in many of which progress is hampered by reluctance to abandon ancient traditions, lack of education, and inadequate means of communication. Whatever may be the theoretical possibilities, a large part of the world's population is now undernourished, and population growth seems at present likely to outstrip the growth of food supplies.

Looked at from the evolutionary standpoint, man has achieved his present dominant position because his intelligence has been of survival value to him. This may no longer be the case. As a recent writer in the *New Scientist* put it (*1*), ". . . it is essential to remember what we mean by evolution. There is a strong danger of thinking of it as a process which runs on a predetermined course like a clockwork motor with its spring unwinding (or, since the complexity is increasing, a better analogy would be a motor that wound its spring *up*). According to this attitude, once life has begun it automatically ends up producing intelligent beings, or something more 'advanced'. It is a completely fallacious view of evolution and the antithesis of what Darwin meant and common sense dictates. Evolution is primarily a fortuitous process based on the random mutations that occur in genetic material and the effects of environmental selection upon these mutations. What one ends up with at any given stage is the life-form best adapted to the prevailing conditions, whether its attributes include memory and associated intelligence or not. It is arguable, for example, that with man's invention of the H-bomb and his growing influence over his own environment, intelligence has become a factor threatening, rather than enhancing, his chances of survival."

To look at the matter in a different way, survival of the individual depends upon the development of a nervous system in which differentiation (that is, specialization of function) is balanced by integration (that is, the control of partial activities by the organism as a whole). The evolution of the human race is now threatened by a failure of integration. That integration is a social function, necessary both within individual national societies and, in the interests of our common humanity, between those societies. Our present crises have been partly produced by the activities of scientists. Scientists therefore must seize every opportunity to bring home to those who make the practical decisions about social organization the urgency of the problems with which they are faced and their true nature; and they can themselves contribute to their solution.

Sir Howard Florey said in his presidential address to the Royal Society this year (*2*): "Ought we as a society to be considering how science and scientists can contribute to the great problem of bringing the human population into satisfactory, even if dynamic, equilibrium with its surroundings? Or should we wait for these matters to be tackled by people who may have little connection with us? I have no doubt myself that we should try to lead scientific advances by positive action." But positive action does not mean dictation. I say this because of a strange idea which sometimes finds expression—that scientists seek to control human beings, and regulate their behavior in pursuit of some supposed aims of their own, in the same spirit in which they may organize the lives of, and perform experiments upon, animals in the laboratory. An example of this occurred in a comment on my own presidential address to the British Association. Pleading for more foresight in respect of the population problem, I said that animal breeders looked further ahead, and showed more concern for the future of the race with which they dealt, than the average human being does. This provoked a comment in an English newspaper about the chilling attitude of scientists who wish to breed human beings like animals. Similar criticism is familiar to those geneticists who think that a knowledge of genetics may be of some value for improving the human race. The truth is, as I have already suggested, that scientists, far from wanting to impose their ideas upon other people, are often too little interested in the social implications of their work, and in any case too much occupied with it to have time for political activities. On the other hand, as the recent history of Germany has shown, politicians may, if they get the power, try to impose their own pseudoscientific ideas upon the people they rule.

A variant of this fear, which perhaps needs rather more serious consideration, is that the computer may put some unforeseen powers of controlling mankind into the hands of the scientists. In their more fantastic forms these ideas verge upon science fiction, and contemplate machines which, it is supposed, will ultimately develop a life of their own and control the men who constructed them. More seriously it may be argued that computers, together with modern means of communication linked to knowledge of the psychology of persuasion, may be used to create a tyranny more complete and unbreakable than any which has dominated human beings in the past.

As I said earlier, science is knowledge. All computers can do is to provide knowledge, in the form of information, more rapidly, and over a wider range of data, than has ever been possible before. This knowledge can be used to influence man's minds on a scale and with an effectiveness that are unprecedented. But though computers are a product of science, such uses are not scientific but social. It is not scientists who are likely to want to control human beings in this way, though they may be faced with the ethical decision of whether and how far they should lend their aid to politicians who may. We must be alert to these dangers, and remember that if the price of liberty is eternal vigilance, vigilance without knowledge is blindfold.

Let me now sum up what I have said so far. I have suggested that some popular misconceptions about science

and the aims of scientists spring from ignorance, and I believe it is important that scientists should be aware of them, and that it should be part of the task of the public relations of science to try to disabuse the minds of nonscientists of these ideas.

I went on to say that, far from its being true that scientists were endeavoring to impose their ideas upon society as a whole, there is a great danger that society, including the scientists themselves, may not sufficiently foresee the technological and social consequences of much scientific work. This idea is today possibly in danger of becoming so much a platitude that people will accept its truth and do nothing further about it. What should be done is a difficult problem, and a good deal of the responsibility for finding an answer to it must, I would suggest, rest with the scientists, since they alone know what is happening in science. But it must often be extremely hard, and sometimes impossible, to foresee far ahead the social and technological consequences of particular scientific discoveries. Nevertheless, I believe we have to try to do it. If scientists are to be enabled to attempt it, society as a whole must recognize the need and provide the facilities; and may we not hope that the social scientists, in particular, will in this matter provide a bridge between society as a whole and scientists working in other fields? Even now such machinery for extrapolation in the field of the population crisis exists in a relatively embryonic form in the activities of some agencies of the United Nations Organization; this is a promising beginning, but these activities need to be developed with a much more wholehearted cooperation of all countries and a much greater readiness to look at all aspects of the problem if they are to be really successful.

Both the world population crisis and the dangers of nuclear warfare can be regarded, as in the passage I quoted, as challenging the evolutionary value of human intelligence. Is man too intelligent, or perhaps not intelligent enough? The world population crisis, as I suggested, may illustrate a lack of social integration of the intelligence of individuals. When we turn to consider international tensions, however, it may be said that individual societies are fully aware of their dangers, but that the tensions are the emotional reactions to a state of affairs which is the product of highly complex social, political, and historical causes. Many people would agree that there is a lack of integration between the individual national units which compose the world society; but what, it may be asked, can human intelligence be expected to do about that, more than it is doing? Has science any contribution to make to the solution of this problem? Any such claim must, I am sure, be extremely modest, for the social and psychological sciences are much younger than physics and physiology. Nevertheless, science can do two things which, though modest, may be important. It can challenge the emotional reactions, which political leaders take for granted, by saying that these, too, are the appropriate subjects of scientific study and may therefore be capable of modification. Secondly, as science is international, it can bring together scientists of many nations who are prepared to try not to take for granted the emotional attitudes of their own societies, but to look beyond them in search of the common interests of all nations. And perhaps the two approaches have something in common. International cooperation, or even competition, in coping with the population crisis might be a constructive antidote to international tension leading to competitive armaments.

Can Science Explain Man?

Now I turn to my second theme, the impact of science on man's ideas about himself. Can science explain man?

During the last quarter of a century we have learned a great deal about the part played by the brain in the life of the mind. Much of this knowledge has been gained from observations made on animals, and there are very great differences between the highest nonhuman animals and man. But these differences are related to the functions of those parts of the brain which have developed much further in human beings than in animals. Basically, those parts which are concerned with the emotional reactions and instinctive drives are similar in animals and man. As well as studying the results of experiments on animals, we can investigate in man how disease of the brain, and drugs, affect the mental life. From all these observations we have come to recognize that emotional reactions have their neurological basis in certain parts of the brain, and that other areas are particularly concerned with memory, others again with speech, and so on. We know too that the complex activities of the nervous system are influenced profoundly by biochemical factors, among others the secretions of the endocrine glands carried to the brain by the blood. There are still, however, many details of which we are ignorant. We do not know in detail how nerve cells behave when we think, nor how memories are stored and made available again. Nevertheless, the progress made so far suggests that these are not inherently insoluble problems, even though we do not yet possess the detailed knowledge to solve them.

All this leads to the conclusion that it is likely that we shall find some activity of the brain correlated with every recognizable activity of the mind, and therefore that ultimately we shall possess explanations of those mental activities in physicochemical terms.

For perhaps half a century now we have been offered explanations of mental activity at a different level, as it were—namely, psychological interpretations. Psychology is now a vast and varied field of knowledge. In his laboratory the psychologist studies many aspects of normal mental activities such as perception, learning, memory, and language. In the hospital he applies these methods to the investigation of the effects of brain disease on these functions, and in the school he tests intelligence and specific capacities. He studies animal behavior, too, in intact animals and animals with experimental brain damage. Then there is analytical psychology, which includes not only psychoanalysis but other schools of psychological thought which claim to provide explanations of human behavior in terms of mental factors, some of which are held to be unconscious.

While analytical psychology developed as a method of medical treatment (that is, it was concerned with people who went to a doctor because they had symptoms which troubled them), it soon became clear that unconscious mental processes play an important part in the lives of normal people too. Parallel with the development of analytical psychology, anthropology and social psychology have been demonstrating the profound influence of social forces of various kinds upon our mental attitudes and beliefs.

All these trends of thought in their different ways have tended to change man's ideas about himself. If his thoughts and feelings are the products of a nervous system behaving in accordance with physical laws, what becomes of the freedom of the will, or indeed, of the dignity of the personality? If man is influenced by factors of which he is unconscious, how can he be regarded as a rational being? If he is largely molded from infancy by his social environment, what remains of his individuality? Moreover, the concept of personality has been undermined in a more subtle way by the fact that all these modes of thought seem to be concerned less with the individual man than with the psychological features or nervous structures which he has in common either with everyone else or with particular groups of people who share his characteristics.

Such ideas tend to lead to what I may describe as a reductionist view of human nature. Man is regarded as reducible in physical terms to the activity of nerve cells, and in psychological terms to conflicting mental elements.

Public Descriptions and Private Experiences

Such views as these seem to me to involve several misapprehensions. Although they are apt to be regarded as scientific, they are not scientific but philosophical. To investigate what activity of the neurons in the brain is involved in thought, speech, memory, or feeling is a scientific activity, but, as science, it does not logically involve any particular view of the nature of the mind, or of the relationship between mind and brain. Sherrington, one of the greatest neurophysiologists, was himself a dualist, who did not identify the mind and the brain; Jung, for all his lifetime of contributions to analytical psychology, did not believe that the psyche could be finally reduced to the interaction of the psychological components revealed by analysis.

But even though it is a misunderstanding to believe that such views have a scientific basis, they dwell on the borderland between science and philosophy, and since scientists have frequently donned the gown of the philosopher (sometimes without acknowledging it) to discuss them, and since they are for various reasons of great importance today, I shall venture to say a little about them.

I shall begin by questioning the idea that current physical concepts of causation, which are valid at the molecular level, necessarily completely explain the interrelated activities of the millions of nerve cells which must be involved in all our higher mental activities. There are already hints that this may not be so. I have myself recently pointed out that the time of physical events in the nervous system is not identical with the time of conscious experience (*3*). What the psychologists call the specious present, or the mental present, must itself have some duration in time. And I quoted from some recent work in phonetics which showed that "in the mental present there is not only overlapping, but mutual modification of the representations of events, which in physical time are successive." Thus the naive physical determinism, which appealed particularly to some 19th-century writers, may not be applicable to present-day interpretation of the brain-mind relationship. Then one may question whether there is not a logical fallacy in the idea that the mind is capable of explaining itself in terms of its own ideas. Indeed, the brain is not describable as a machine, MacKay has recently argued (*3*), for no machine could embody within itself a complete description of itself. That, he maintains, is logically self-contradictory, and he adds that Gödel's theorem can be regarded as a formal demonstration of this proposition as a special case.

Aldous Huxley in *Literature and Science*, a book written just before he died (*5*), drew a distinction which has important implications for our present purposes. "All our experiences," he wrote, "are strictly private; but some experiences are less private than others. They are less private in the sense that, under similar conditions, most normal people will have similar experiences and, having had them, can be relied upon to interpret the spoken or written reports of such experiences in much the same way. . . . Science may be defined as a device for investigating, ordering and communicating the more public of human experiences. Less systematically, literature also deals with such public experiences. Its main concern, however, is with man's more private experiences, and with the interactions between the private worlds of sentient, self-conscious individuals and the public universes of 'objective reality', logic, social conventions and the accumulated information currently available."

It follows that when a scientist describes what is happening in the brain of a human being he is describing some part of that individual's private world, but he can do so only in public terms. Indeed, if one person's nerve impulses did not behave like another's there could be no scientific description of them at all. But the gulf between these private and public descriptions is so great that the scientist cannot correlate the nervous impulses with thoughts, feelings, or memories unless the subject of his investigation gives access to his private world by saying what his experiences are. Science in its descriptions of man must inevitably concentrate on the generic at the expense of the individual, but it is our private individual experiences which are the essence of our lives. To quote Aldous Huxley again, "the world with which literature deals is the world into which human beings are born and live and finally die; the world in which they love and hate; in which they experience triumph and humiliation, hope and despair; the world of sufferings and enjoyments, of madness and commonsense, of silliness, cunning and wisdom; the world of social pressures and individual impulses, of reason against passion, of instincts and conventions, of shared language and unshareable feeling and sensation; of innate differences and the rules, the roles, the solemn or absurd rituals imposed by the prevailing culture. . . . As a private individual, the scientist inhabits the many-faceted world in which the rest of the human race does its living and dying. But as a professional chemist, say, a professional physicist or physiologist, he is the inhabitant of a radically different universe—not the universe of given appearances but the world of inferred fine structures, not the experienced world of unique events and diverse qualities, but the world of quantified regularities. Knowledge is power, and, by a seeming paradox, it is through their knowledge of what happens in this unexperienced world of abstrac-

tions and inferences that scientists and technologists have acquired their enormous and growing power to control, direct and modify the world of manifold appearances in which human beings are privileged and condemned to live."

In all the talk and disputation about the two cultures the important thing, it seems to me, is not whether there are two or more cultures, or whether those who are said to belong to one understand the other. The important thing is that there is not *one* culture in the world today, in the sense in which Hellenism, for example, was the dominating and unifying culture in the Mediterranean for centuries. The reason why we have to speak of two or more cultures is that we have not yet achieved a similar unifying world view which can integrate the public knowledge of science with the private experiences of persons, and on which we can base a comprehensive conception of the nature of man.

I suggest that one of the essential ingredients of such a view should be the primacy of the private, personal, subjective, individual experience over any public account which science can give. This means that persons are to be regarded as values in themselves, and not as reducible to either physicochemical systems or bundles of psychological trends or impulses. The social and political implications of this are important. One of them is that science, though an end in itself to the scientist, is only a means to an end where other people are concerned, that end being the possibility of their greater fulfilment as persons.

But this does not mean that the explanations which neurophysiology and psychology give of human behavior are not important. Here we meet again the old philosophical conundrum about the relationship between the parts and the whole. A knowledge of the parts is none the less valuable because there is a sense in which the whole is more than the sum of its parts; and yet a knowledge of the whole alone may leave us without the power to influence it which we possess if we know how it is made up of its parts, and how they work. Though *body* and *mind* are convenient, indeed essential, terms, they are abstractions, and all abstractions leave something out. Each partially describes a person. But what we think about the nature of persons and their status in the universe is not a question for science, though it must take account of any facts which science can provide about either. Ultimately, it must depend upon our personal view of the nature of things.

Values

Since this concerns values, let me end with some reflections on the relations between science and values. It is yet another illustration of our failure to attain to a unified world view that many, perhaps most, people find it difficult to reconcile two views about the nature and origin of human values. Bronowski, in a recent book called *Science and Human Values*, says (*6*): "There have always been two ways of looking for truth. One is to find concepts which are beyond challenge, because they are held by faith or by authority or the conviction that they are self-evident. This is the mystic submission to truth which the East has chosen, and which dominated the axiomatic thought of the scholars of the Middle Ages. So St. Thomas Aquinas holds that faith is a higher guide to truth than knowledge is: the master of medieval science puts science firmly into second place. But long before Aquinas wrote, Peter Abelard had already challenged the whole notion that there are concepts which can only be felt by faith or authority. All truth, even the highest, is accessible to test, said Abelard: 'By doubting we are led to enquire, and by enquiry we perceive the truth.' . . . The habit of testing and correcting the concept by its consequences in experience has been the spring within the movement of our civilisation ever since."

Science, then, has a morality of its own, the foundation of which is respect for truth, and which, therefore, is bound to come into conflict with all attempts to curb freedom of thought and speech by any form of authoritarianism. Moreover, scientific thought and its devotion to truth are themselves a product of the evolutionary process, and must therefore have proved themselves, hitherto at any rate, to have survival value.

But the idea that all ethical considerations can be derived from the evolutionary process has not gone unchallenged. If, it is said, survival is what counts in evolution, on what grounds is man to be preferred to the tiger, the tapeworm or the tetanus bacillus, all of which have up to now survived? (It may be noted that man alone of these organisms asks this question.) But just as mind cannot explain itself except by taking some mental activity for granted, so we cannot explain values without assuming some value, if only the value of truth. In the course, and as the result, of the evolutionary process man has developed systems of values. In the individual these, as we now know, are the products of numerous and complex factors, including his family life, social circumstances, cultural traditions, education, and many others. Since man is a social animal his values arise in society and interpenetrate his social and personal relationships. Some maintain that the nature of life is such as to produce ever-increasing complexity in the individual and society, and with it a progressive enrichment of the individual consciousness. The test of our values, they claim, is whether they promote, or conflict with, those tendencies, which are held to be of the essence of life itself. General ethical principles are to be laid down on this basis, but individual actions must often be empirical, and ethical views may well change in the light of changing knowledge, and as fresh problems have to be faced.

Others, whose values and ethics are derived from other sources, may differ from these views. But we cannot indefinitely disregard what science teaches us about human nature, and if we believe the universe to be rational, it would seem unreasonable to treat ethics as beyond the criticism of reason. On the other hand, I suspect that at the foundation of an evolutionary theory of values there lies an act of faith, which cannot altogether be justified by reason.

But ought we to—can we—leave the matter there? Man seems to have a strong disposition to fit his beliefs into some unified system, so already we find the systematizers at work. And this is not merely a matter of abstract thought, for what we believe about the nature of man is likely to influence the way in which we behave toward him.

Aldous Huxley, whose words I quoted earlier, defined science as "a device for investigating, ordering and

communicating the more public of human experiences," while the main concern of literature, he said, "is with man's more private experiences" and with the interactions between these private worlds and the public universes of "objective reality." Have we here a basis of distinction between the "two cultures"? But, as Huxley points out, both science and literature describe man, and the same man, and his identical activities. How, if at all, are these descriptions to be reconciled? How are we to harmonize "our private and unshareable experiences with the scientific hypotheses in terms in which they are explained"? I said earlier that science concentrates on the generic at the expense of the individual. Let me in conclusion carry this idea a little further. Science is not primarily concerned with the uniqueness of events but with what they have in common with other events, so that it can explain their uniqueness in terms of general principles. Literature, art, and history, on the other hand, are chiefly concerned with unique human experiences and events, and even though they use public terms in their attempts to communicate those experiences, or general principles to try to explain them, there is always a unique element in their subject matter which is irreducible and inescapable. It is when science studies man himself that the tension between these two modes of understanding becomes acute.

Perhaps we cannot at present escape from the polarity between the public scientific description and the private world. Perhaps, indeed, at our present stage of knowledge the tension between them is itself a condition of development; as William Blake said, "without contraries is no progression"—an intuitive anticipation of Darwin. But if we *are* to progress toward a unified culture it must be through a mutual understanding, to which scientists have much to contribute.

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NEWS AND COMMENT

Crisis at Berkeley: (I) The Civil War

Berkeley. For nearly 7 months the University of California has been enmeshed in a crisis that may ultimately be recorded as one of the crucial episodes in the development of American higher education. The situation at Berkeley is so complex—and so much of it is unresolved—that any account of it at this point in history is unavoidably going to be incomplete. For the 3-week visitor there is the special problem that there is no such creature as an unbiased observer at Berkeley, unless it is Ludwig, the large black dog who habitually sits in the fountain opposite Sproul Hall. Few people remain sufficiently detached to comment with objectivity on the events around them; already there are "schools" and "counter-schools" and so many papers, articles, studies, and interpretations of the Berkeley events that it would not be surprising to see an interdisciplinary course on the uprising added to the University curriculum. But the situation is worth looking at despite the obstacles because the events at Berkeley are certain to have great significance, not only for the University of California but for the future of higher education throughout the United States.

At this stage, the problems appear to fall into two main categories. Internally, Berkeley seems adrift and disoriented. The events of the fall were an upheaval perhaps unmatched on any major American campus in the 20th century, and they left their marks on the people as well as on the institution. Faculty, administration, and students were all called upon to play unaccustomed roles. But while traditional relationships within the university community have been overturned, formulas for a new distribution of power and responsibility have not yet been found. The result is an instability continually edging over into chaos.

Exacerbating the internal crisis is what appears to be a rising tension between the campus community and the citizens of California, who pay many of its bills. The antagonism centers chiefly on the students, but drifts over into suspicion of the faculty and administration as well. Since the demonstrations against the House Un-American Activities Committee in 1960, Berkeley students have become increasingly political. In the past few years they have been involved in civil rights campaigns not only in Mississippi and Alabama but against the allegedly discriminatory policies of some of the University's neighbors—businesses in the Oakland–San Francisco area. Whether adult Californians approve of their objectives is an open question: the defeat of the fair-housing proposition on California's ballot last fall would suggest that perhaps they don't. But there is no doubt that many are affronted by the students' tactics, ingenious variations on the theme of civil disobedience, running from the now-standard sit-ins to "shop-ins" (at local groceries), "sleep-ins" (at a San Francisco hotel) and "lie-ins" (in an automobile showroom.) When civil disobedience was applied against the university itself during the disorders last fall, the latent public impulse to retaliation seems to have blossomed. And in March, when a handful of students became involved in an obscenity controversy which featured signs, speeches, and literary readings containing the world's most famous four-letter word, all restraints were ended. Public pressure and criticism became so intense, the internal situation so turbulent, that President Clark Kerr and Acting Chancellor Martin Meyerson (former