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A CHALLENGE TO CIVILIZATION

By Dr. NIELS BOHR

COPENHAGEN

THE advance of physical science which has made it possible to release vast amounts of energy through atomic disintegration has initiated a veritable revolution of human resources, presenting civilization with a most serious challenge. Man's increasing mastery of the forces of nature, which has provided ever richer possibilities for the growth of culture, may indeed threaten to upset the balance vital for the thriving of organized communities, unless human society can adjust itself to the exigencies of the situation. The great technical developments of the last century already deeply affected the social structure of every country but, evidently, we have now reached a stage which calls for a new approach to the whole problem of international relationship.

The formidable means of destruction which have come within reach of man will obviously constitute a mortal menace to civilization unless, in due time, universal agreement can be obtained about appropriate measures to prevent any unwarranted use of the new energy sources. An agreement to this purpose will surely demand the abolition of barriers hitherto considered necessary to protect national interests but now standing in the way of common safety against unprecedented dangers. In fact, only international control of every undertaking which might constitute a danger to world security will in future permit any nation to strive for prosperity and cultural development without constant fear of disaster.

Whatever renunciations as regards customary prerogatives such regulation will involve, it should be clear to all that, in contrast to other issues where

history and traditions may have fostered divergent viewpoints, we are here dealing with a matter of the deepest interest to all nations. Moreover, the free and open access to information about all scientific and technical progress, which will be a basic condition for the efficiency of the control, will in itself go far towards promoting mutual knowledge and understanding of the cultural aspects of life in the various countries, without which respect and good-will between nations can hardly endure.

In all the circumstances it would appear that the possibility of producing devastating weapons, against which no defence may be feasible, should be regarded not merely as a new danger added to a perilous world, but rather as a forceful reminder of how closely the fate of all mankind is coupled together. Indeed, the crisis with which civilization is at present confronted should afford a unique opportunity to remove obstacles to peaceful collaboration between nations and to create such mutual confidence as will enable them jointly to benefit from the great promises, as regards human welfare, held out by the progress of science.

The attainment of this goal, which places upon our generation the gravest responsibility towards posterity, will of course depend on the attitude of all people. Valuable services, however, may be rendered by scientists all over the world in bringing about a genuine appreciation of what is at stake and in pointing out how the great development of our resources may contribute to progress for humanity. In a matter of such universal scope, help may also be found in the intimate connections between scientists, created by international cooperation which proved so fertile just in a domain of research that was to have such overwhelming consequences.

For meeting the challenge to civilization in the proper spirit it should be a most fortunate omen that we have to do with implications of pure scientific studies pursued with no other aim than to widen the borders of our knowledge and to deepen our understanding of that nature of which we ourselves are a part. Let us hope that science which, through the ages, has stood as a symbol of the progress to be obtained by common human striving, by its latest emphasis on the necessity of concord, may contribute decisively to a harmonious relationship between all nations.

THE ROLE OF BACTERIA IN THE FORMATION AND TRANSFORMATION OF PETROLEUM HYDROCARBONS[1,2]

By Dr. CLAUDE E. ZOBELL

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PETROLEUM is a complex mixture of gaseous, liquid and solid hydrocarbons. Besides the uncounted hundreds of hydrocarbons composing petroleum, there are numerous compounds of hydrogen and carbon which contain oxygen, nitrogen, phosphorus or sulfur. Petroleums from different oil fields differ widely in chemical composition and in physical properties. Some crude oils such as those from the Bradford, Pennsylvania, sands, for example, are clear amber-colored, free-flowing fluids, while others, exemplified by La Brea, California, crudes, are coal black, viscous tars. The density of petroleums ranges from a specific gravity of 0.65 (certain crudes from the Baku field in Russia) to somewhat more than 1.00 for oil from Athabaska (Alberta, Canada) tar sands. The range in the chemical composition of petroleums is as follows:

Carbon	82.2 to 87.1 per cent.
Hydrogen	11.7 to 14.7 " "
Sulfur	0.1 to 5.5 " "
Nitrogen	0.1 to 1.5 " "
Oxygen	0.1 to 4.5 " "
Minerals	0.1 to 1.2 " "

The hydrocarbons in various petroleums may consist predominantly of either (1) aliphatic compounds of the paraffin series, (2) aromatic compounds of the benzene series or (3) naphthenic compounds of the polymethylene or cyclo-paraffin series. Likewise, found in various crude oils are small quantities of fatty acids, phenols, naphthenic acids, resinous compounds, asphaltenes, mercaptans, thiophenes, sulfones, sulfoxides, sulfonic acids, organic sulfides, pyridines, quinolenes and other compounds. So complex are petroleums and so labile are some of their constituents that no crude oil has ever been completely analyzed.

In view of the ever-increasing importance of petroleum and its myriads of products to our mechanized and martialized civilization, it seems anomalous that our knowledge of what petroleum is and how it is formed is still so woefully wanting. Petroleum geologists have been so successful in finding subterranean

[1] Annual William Conger Morgan Memorial Lecture delivered before Alpha Kappa Chapter of Phi Lambda Upsilon and the department of chemistry, University of California at Los Angeles, April 25, 1945.

[2] Contribution from the Scripps Institution of Oceanography, New Series No. 265. These investigations were supported in part by a grant from the American Petroleum Institute, Research Project 43A.