ence and new truth. Science is not based on authority. It owes its acceptance and its universality to an appeal to intelligible, communicable evidence that any interested man can evaluate.

No Dogma in Science

There is no place for dogma in science. The scientist is free to ask any question, to doubt any assertion, to seek for any evidence, to correct any error. Where science has been used in the past to erect a new dogmatism, that dogmatism has found itself incompatible with the progress of science; and in the end, the dogma has yielded, or science and freedom have perished together.

Our own political life is predicated on openness. We do not believe any group of men adequate enough or wise enough to operate without scrutiny or without criticism. We know that the only way to avoid error is to detect it, that the only way to detect it is to be free to enquire. We know that the wages of secrecy are corruption. We know that in secrecy error, undetected, will flourish and subvert.

Let me be clear. Science is not skepticism. It is not the practice of science to look for things to doubt. It was not by a deliberate attempt of skepticism that physicists were led to doubt the absolute nature of simultaneity, or to recognize that the ideas of strict causality embodied in classical physics could not be applied in the domain of atomic phenomena. There is probably no group of men who take more for granted in their daily work than the scientists. Common sense, and all that flows from it, are their principal basis for what they do in the laboratory and for what they make of it on paper. But for scientists it is not only honorable to doubt, it is mandatory to do that when there appears to be evidence in support of the doubt. In place of authority in science, we have and we need to have only the consensus of informed opinion, only the guide of example. No scientist needs to order his colleagues to use a new technique of experiment or to enter a new field of discovery. If he has done this, it will be an invitation to his fellows to follow.

These then are some of the attitudes of mind, these are some of the disciplines of spirit which grow naturally in the scientist's world. They have grown there in part as a result of a humane and liberal tradition in political life, and in part as a cause of that. The open mind, the reliance on example and persuasion, rather than on authority, these are the heritage of the centuries in which science has altered the face of the earth. Science can help in diverse ways in preserving and extending this heritage. Its very universality speaks across frontiers to make truth manifest in lands otherwise darkened; its material applications create the preconditions in leisure, in education, in means of communication—for the converse of men with each other. Science provides the material and the intellectual basis for a world in which example and understanding can help all men to improve their lot and fulfill their hopes. Today we need to remember that our country, founded on these practices, and grown strong by their exercise, owes its strength to them. In this time of crisis, we need to cherish that strength.

A World of Confidence

And this brings me to my second wish for you. I wish you not only the joy of great discovery; I wish for you a world of confidence in man and man's humanity, a world of confidence in reason, so that as you work you may be inspired by the hope that what you find will make men freer and better—in which, working as specialists in what may be recondite parts of the intellectual life of the time, you are nevertheless contributing in a direct and basic way to the welfare of mankind.

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MINING

Liquid Fuels Produced at Costs Near Petroleum

➤ LIQUID fuels from oil shale and coal can now be produced at costs competitive with petroleum products, the Secretary of the Interior revealed in his annual report to Congress.

Refined products could now be obtained from oil shale at an actual cost averaging 7.3 cents a gallon, and from coal at 10.8 cents a gallon. If produced by a private company, these fuels could have a wholesale price of nine and 14.5 cents a gallon respectively with a sufficient profit margin.

Further reduction in costs is certain as our knowledge is extended, the Secretary said. With emphasis now centered on operation rather than design and construction of laboratories and demonstration plants, the synthetic fuels program has entered its most valuable period and is making rapid strides.

The capital investment now required for a plant producing 10,000 barrels a day of crude shale oil, or 8,840 barrels a day of refined products, is about $41,381,000. This would cover mining, retorting and refining. Diesel oil and fuel for jet planes would be the primary products. Motor gasoline could be produced readily by modification of the refining process.

The estimated capital investment for a modernized coal-hydrogenation plant of 30,000 barrels a day capacity is $246,800,000. High-octane gasoline would be the principal product. Byproducts would include liquified petroleum gases and phenols, for which there is a growing demand.

Operation of a limited number of coal-hydrogenation plants to produce chemicals as a major part of the products may be very attractive, the report states. In addition to phenols, coal-hydrogenation plants can produce important quantities of benzene, toluene, naphthalene and tar bases.

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● RADIO

Saturday, March 25, 3:15 p.m., EST

"Adventures in Science" with Watson Davis, director of Science Service over Columbia Broadcasting System.

Dr. John D. Mizelle, Department of Zoology, University of Notre Dame; Dr. Fernandus Payne, Professor of Zoology at Indiana; Dr. Lawrence Baldinger, Dean of College of Science, University of Notre Dame; and Dr. Ralph W. Lefler, Department of Physics, Purdue, will discuss "How Nature Helps Mankind."