

rants, pending the long lead time required to develop, tool up, and produce new engine types to replace existing vehicle power plants. What these new engines will eventually be, is difficult to ascertain. Turbine and stratified-charge engines are in the testing stage; development of radically new engines, such as those incorporating fuel cells, is also under way.

#### Atmospheric Chemistry and Physics

There is a need to adapt existing methods and instrumentation to the quantification of chemical pollutants in the atmosphere, both gaseous and particulate, and to develop more specific and more sensitive techniques. This need becomes greater as efforts are directed to specific effects of interest in the establishment of air quality criteria. During the past eight years or so, analytical methods, in particular those developed for industrial hygiene purposes, have been applied to air pollution problems, and fortunately these have proved adequate for many situations.

Previously we indicated that one phase of air pollution medical research—that dealing with laboratory animal studies—is going through a transition from studies of clinical effects utilizing exposures to single pollutants at high concentrations to those using multicomponents at concentrations more consonant with polluted atmospheres, so that threshold functional changes that may be precursors of chronic disease may be uncovered. These studies establish the need for the development of methods for the separation and quantitation of the host of chemical air pollutants that may be of health significance in relation to chronic diseases, such as cancer and cardiorespiratory ailments.

Efforts over the past ten years or so on a worldwide basis have stressed a group of hydrocarbon compounds com-

monly known as polynuclear aromatics or polycyclic hydrocarbons. Among these, benzo(a)pyrene is the best known because of the established relationship of this compound to production of skin tumors in animal experimentation. It is disconcerting to note, however, that known polycyclic hydrocarbons obtained from the organic fraction of air particulate constitute only about 1 to 2 per cent of the total organic particulate in air. The status of other organic materials of significance in cancer research, including cocarcinogens and anticarcinogens, is largely unexplored in the chemistry of community atmospheres. Information on the role of organic compounds containing oxygen, nitrogen, and other minor constituents is virtually nonexistent.

Recently national attention has been focused on the use of agricultural chemicals, particularly pesticides. The importance of these compounds, in relation to body insult through the respiratory route, is an air pollution responsibility which must be coordinated with the work of others in this field. Pesticide exposure by any route may well produce effects in individuals which are enhanced by exposure to other air pollutants. In other words, pesticide exposures may produce impaired individuals more susceptible as a result to community air pollution.

Another area of need concerns the low-molecular-weight organics. These exist in the atmosphere principally as vapors in contrast to the high boiling-point compounds previously discussed, which for the most part are adsorbed on atmospheric particulate. These low-molecular-weight reactive hydrocarbons were mentioned previously in connection with vehicle emissions, but it is obvious that vehicles are not the only source of organic vapors to the atmosphere.

Still another chemistry area that merits increased effort is the development of more specific and more sensi-