part." This larger unity was an essential aim of the National Health Service. It might indeed have been achieved but for two serious flaws in the statute—the neglect of preventive medicine and the relative isolation of the general practitioner. The bias was all in favour of the hospitals. These defects in the Act are now being increasingly recognized, and to-day there is much greater opportunity for bringing the health services and the general practitioner more closely together. How can this be done? The Ministry of Health, in a memorandum[3] published more than thirty years ago, gave an admirable account of the duties of the medical officer of health:

"The chief function of the medical officer of health is to safeguard the health of the area for which he acts by such means as are at his disposal, and to advise his authority how knowledge of public health and preventive medicine can be made available and utilized for the benefit of the community. He should endeavour to acquire an accurate knowledge of the influences, social, environmental, and industrial, which may operate prejudicially to health in the area, and of the agencies, official or unofficial, whose help can be invoked in amelioration of such influences. While he has special duties for the prevention of infectious diseases, all morbid conditions contributing to a high sickness rate or mortality in the area from these or other causes should be studied with a view to their prevention or control. . . ."

Five years earlier the Dawson Report[4] had set out clearly the health functions of the general practitioner, and in 1930 the British Medical Association[5] gave detailed consideration to the part which the general practitioner should take in the health services. These views are now meeting with wide acceptance. The general practitioner, it is now agreed, is the right person to undertake all clinical services outside the hospital —that is, in the home, the factory, and the workshop. In this way alone can there be a real continuity of observation and medical care, which is his prime function. In an integrated service he should be in touch with consultant medical services through the hospitals and with the preventive health services through the medical officer of health and his staff. At the present time the majority of industries have only a skeleton medical service, and, except in the large, self-sufficient firms, the clinical work is likely to be increasingly done by general practitioners.

The medical officer of health, in addition to the broad functions stated in the Ministry of Health's memorandum of 1925, now has a better-defined duty to render services in support of clinical needs, such as nursing, home helps, special assistance to the aged and the chronic sick at home, and rehabilitation of the patient at home. He must also be an experienced epidemiologist, able to handle a threatening situation with common sense. Nowadays few people know the major epidemic diseases by sight, and even diphtheria is rare enough for specialist diagnosis. The medical officer of health should be trained in the recognition of the rarer infections and in the methods of protecting the community when they occur. So far as his administrative work is concerned, the M.O.H.'s essential function is to interpret medical and technical matters to the lay public. For this reason among others he must be in a position to inspect all places where people dwell and work and eat and play. Lastly, the medical officer of health educates the people in healthy living. In this, as in many of his other functions, he acts not as an individual but as leader of a team in which general practitioners, health visitors, sanitarians, and teachers all take their place.

The ability to see problems in their broad extent or to appreciate the need for a common purpose in such a development as a health service is not necessarily a common characteristic among professional and scientific men and women.

"It is an ironic fact that the very technical skills which are ostensibly employed to further the progress of men, by the intensity of their specialization create disunity rather than order and imperil the whole success of their common objective. Resources cannot be developed in unity until each technologist has learned to subordinate his expertness to the common purpose. . . ."[6]

The present generation of medical officers of health have seen many examples of disruptive tendencies—such as the transference of the care of deprived children to the Home Office and the exclusion of occupational health from the services administered by the Ministry of Health. It is hoped that the Society of Medical Officers of Health will enter its second hundred years with a firm resolve to promote integration, both within its own sphere of activity and in its broader relations with Medicine.

DIESEL OIL AND LUNG CANCER

Evidence that smoke-polluted air causes death from bronchitis and bronchopneumonia has again been confirmed this year.[1] That it causes death more insidiously is suggested also by comparing the lung-cancer mortality rate in cities with that in the country.[2] Proposals to increase or to change the character of the smoke poured into the atmosphere thus deserve to be met with anxious scrutiny, and the doubts of some medical men about the wisdom of increasing the number of diesel-fuelled motor vehicles on the road were expressed in a resolution passed by the Representative Body of the British Medical Association last year. This urged the Council of the B.M.A. "to draw the attention of the transport authorities to the possible dangers of fumes from diesel engines and to the remarkable coincidence between the increased use of diesel fuel for transport and the rise of mortality from lung cancer and other respiratory disease."

Some evidence that diesel fumes may be harmful is provided by H. L. Falk, P. Kotin, and their colleagues.[3-6] They have reported the presence of aromatic hydrocarbons, including 3:4-benzpyrene, in the atmosphere of Los Angeles and in the exhaust products from petrol and diesel engines. It is likely that most atmospheric aromatic hydrocarbons in that city arise from the use of oil products in one form or another, since virtually no coal is burnt there. In Britain, on the other hand, the air is polluted mainly by coal smoke, containing a similar range of hydrocarbons. Though smoke from this source is tending to decline, smoke from vehicles burning diesel fuel is increasing.

The exhaust gases from a diesel engine contain smoke, carbon dioxide, carbon monoxide, oxides of nitrogen and of sulphur, aldehydes, unburnt fuel, and traces of hydrogen, methane, acrolein, and other organic compounds. When properly maintained, and under normal-running conditions, the diesel engine is highly efficient, and little combustible matter is emitted. To help start it excess fuel may be injected, and unfortunately the driver sometimes does this while the vehicle is in motion; he thus gains some extra power at the expense of a greatly increased emission of carbon monoxide and smoke, with its associated hydrocarbons. Falk and his colleagues found that the diesel engine used in their experiments was capable of producing 1,700 γ of benzpyrene per minute. Benzpyrene is now widely regarded as the standard by which to measure atmospheric pollution by carcinogen, but there is no reason why other carcinogens may not also be implicated. In Falk's experiments the benzpyrene was found to be gradually destroyed by atmospheric oxidation in light, but not in darkness, and more effectively in the presence of ozone. When benzpyrene is adsorbed on soot particles it is to a certain extent protected from oxidative degeneration. These investigators have also suggested attaching a catalytic after-burner to the exhaust system of diesel engines to complete the oxidation after the exhaust gases have left the engine, and such after-burners are now being tried out.

But no statistical evidence of the kind that showed a connexion between lung cancer and smoking has yet shown any relation between that disease and exposure to diesel smoke. One reason for this might be that not enough people have yet been exposed for long enough, since until recently diesel oil has been a relatively small, though fast increasing, source of smoke, the greater part coming from solid fuels. The following Table gives figures for the consumption of diesel and other oils in the United Kingdom.[7] The column headed "Derv" refers to the fuel used in *d*iesel-*e*ngined *r*oad *v*ehicles, and the figures in the column "Gas, Diesel, and Fuel Oils" refer to the oil used for town-gas enrichment, stationary diesel engines, and fuel for furnaces and heating. The quantities shown are tons.

	Motor, Aviation, and Industrial Spirit	Kerosene (Burning Oil and Vaporizing Oil)	Derv	Gas, Diesel, and Fuel Oils	Lubricating Oils
1900	—	870,000	—	—	165,000
1910	190,000	615,000	—	356,000	239,000
1921	850,000	536,000	—	726,000	342,000
1925	1,765,000	683,000	—	956,000	504,000
1930	3,324,000	676,000	600	1,266,000	472,000
1931	3,466,000	707,000	3,000	1,335,000	453,000
1935	4,293,000	737,000	142,000	1,521,000	502,000
1940	3,786,178	874,332	429,175	1,730,000	511,389
1945	5,991,796	1,263,396	511,551	1,877,000	546,455
1950	5,557,829	1,539,024	1,034,103	5,337,791	748,796

Since diesel-engined road vehicles did not come into use in this country until 1930, the figures suggest that, if petroleum oils have played any part in causing the rise already recorded in the incidence of lung cancer, then the kinds of oil involved were motor, aviation, and industrial spirit, and kerosene, gas, diesel (stationary engines), fuel, and lubricating oils, but not "derv."

Whether the increased use of oils of different kinds is continuing to add to the carcinogenic potency of the atmosphere is in urgent need of investigation—for instance, by a geographic method of study on localities where little oil is used or where oil came into use lately. In less sophisticated communities the statistics are often in an elementary state; statistics from countries rich in oil-powered vehicles are more informative, but the conclusions are complicated by numerous additional factors, such as, for example, the contamination of the *milieu* by the rubber dust from motor tyres, which in manufacture are mixed with appreciable amounts of carbon black, containing benzpyrene.

Causal hypotheses connecting the introduction of a carcinogen into an environment and the development or increase of some resultant form of cancer run into difficulties because of uncertainties about the period of incubation. What knowledge we have of this latent period is all derived from industrial records or from experiments with carcinogens on animals. Even when the dose of carcinogen is controlled in animal experiments the induction period always covers a wide interval of time, owing to great

[1] Logan, W. P. D., *British Medical Journal*, 1956, **1**, 722.
[2] Stocks, P., and Campbell, J. M., ibid., 1955, **2**, 923.
[3] Falk, H. L., Markul, I., and Kotin, P., *A.M.A. Arch. industr. Hlth*, 1956, **13**, 13.
[4] Kotin, P., Falk, H. L., and Thomas, M., ibid., 1955, **11**, 113.
[5] —— —— Mader, P., and Thomas, M., *Arch. industr. Hyg.*, 1954, **9**, 153.
[6] —— —— and Thomas, M., ibid., 1954, **9**, 164.
[7] King, A. L., *J. roy. stat. Soc.*, 1952, **115** (A), 534.

variations in the susceptibility of the individual experimental animals. Up to the present no statistical evidence has been advanced which might show that road-transport drivers—the population most exposed to diesel exhaust fumes—are more liable to lung cancer than men in other occupations. Nevertheless, even if no evidence is available at the moment to incriminate the diesel engine as a contributory cause of lung cancer, there is no doubt that the exhaust gases from a continuously increasing number of diesel- and petrol-engined road vehicles pollute the atmosphere with a wide range of toxic substances discharged at ground level, and that the density of road traffic in this country is one of the highest, if not the highest, in the world.

NEUROMUSCULAR TRANSMISSION IN MYASTHENIA GRAVIS

Recent work by D. Grob, R. J. Johns, and A. McG. Harvey[1] at Johns Hopkins Hospital has thrown new light on the factors concerned in the abnormalities of neuromuscular transmission in myasthenia gravis. They studied the response of muscle to supramaximal stimulation of the ulnar nerve both in normal subjects and in patients with myasthenia, measuring the amplitude of the muscle action potential recorded from the skin over the abductor of the fifth finger, and determining the effect of intra-arterial injections of 1 to 5 mg. of acetylcholine upon the potentials. Acetylcholine depolarizes the motor endplate, and this depolarization was seen about 8 seconds after the injection as a fall in the amplitude of the potential from—for example, in one normal subject—11 to 2 millivolts. The amplitude quickly returned to its previous value, but underwent a second though smaller fall which began 1 to 3 minutes after the injection, was greatest in the period 5 to 10 minutes after injection, but did not finally disappear until 30 to 60 minutes had elapsed. This second fall in the amplitude was from 11 to 7.5 millivolts. If neostigmine was injected before the acetylcholine, both the early fall and the late fall were enhanced, which showed that the fall was in both cases due to depolarization. The question was, What caused the late fall? The authors supposed that it might be due to one of the products of hydrolysis of acetylcholine, and they found that the injection of 5 to 30 mg. of choline chloride produced an effect on the amplitude of the action potentials very similar to the late fall. They next made observations in the same way in myasthenic patients. In them the early fall was less and the late fall was greater than in normal subjects. The early fall was enhanced by neostigmine as in normal subjects, but the authors found to their surprise that the late fall was reversed by acetylcholine or by neostigmine. Choline chloride caused a fall in myasthenic patients like the late fall after the injection of acetylcholine, and the fall caused by choline chloride was also reversed by acetylcholine or neostigmine.

This investigation indicates that the choline formed by breakdown of acetylcholine plays a hitherto unsuspected part in muscle contraction. The effect of this choline, moreover, differs in the normal subject and in the myasthenic. Whereas in the normal subject it behaves similarly to acetylcholine itself, in the myasthenic patient the choline has a curare-like effect, establishing what is called a competitive block—that is, one which is caused to disappear by raising the concentration of acetylcholine. These results serve to explain the previous findings of H. C. Churchill-Davidson and A. T. Richardson[2] that in generalized myasthenia gravis decamethonium block (which in normal subjects is due to depolarization) is reversed by neostigmine. The results also support their view that the abnormality in myasthenia is an alteration in the response of the motor endplates, and not the presence of a curare-like substance in the circulation.

[1] Grob, D., Johns, R. J., and Harvey, A. McG., *Amer. J. Med.*, 1955, **19**, 684.
[2] Churchill-Davidson, H. C., and Richardson, A. T., ibid., 1955, **19**, 691.

DOCTORS AND CLERGY

About two years ago a Commission on Divine Healing, set up by the Archbishops of Canterbury and York, sought the aid of the B.M.A.[3] It wanted to know, broadly, whether evidence exists of improvement or cure as a consequence of spiritual ministrations, and what co-operation is possible and desirable between doctors and priests in helping the sick. The B.M.A. therefore set up a special committee to obtain evidence from the medical profession, and the report of its evidence to the Commission is published this week.[4] That man has spiritual needs, and that they are apt to be accentuated when he is seriously ill, may be accepted, and with this in mind the Representative Body agreed in 1947 that "most useful work may be done by close personal contact between doctor and clergyman, with an interchange of views and active co-operation where possible." The committee now endorses this conclusion, adding that "the best meetings between them are meetings of two, where the doctor and the clergyman discuss how they can best help the individual patient." Unfortunately, it appears that some clergymen still consider the principles of psychiatry and psychology conflict with Christian beliefs ; indeed, preachers who cast aspersions on psychology are said to be "by no means uncommon." The dangers of such an attitude to some patients are obvious, and no doubt the Archbishops' Commission will consider this part of the evidence with some care. But probably the main reason why collaboration between doctor and clergyman is still uncommon, at least over an individual case, is that it is "rarely considered . . . until the doctor and the parson are well launched on their careers." The case for its extension is clear, and both parties need reminding rather than convincing of it. The report therefore suggests that it should be made clear to students, so that co-operation "would be established later as a matter of course rather than as an exceptional measure."

[3] *British Medical Journal Suppl.*, June 5, 1954, p. 293.
[4] *Divine Healing and Co-operation Between Doctors and Clergy*, 1956, British Medical Association, London (2s.6d.). Summarized in *Supplement* at p. 269.
[5] *The Life, Letters and Labours of Francis Galton*, vol. 2, by K. Pearson, 1924, Cambridge.