

The task of summing up the contributions of thirteen speakers and twenty-four participants in the discussion was allotted to Sir Henry Tizard, but he wisely preferred to round off the conference by stressing only a few salient points. If the supply of scientists and technologists who will remain as such is doubled, it will probably be adequate; but a very much greater increase is required in the number of scientifically educated people for industry, and indeed all walks of life. Specialization has no evils for the able man, and the university and advanced college are appropriate places for this specialization. Not so for the remainder, and greater care must be taken to secure a wider education for them. Everyone agrees that the British educational system is not meeting modern needs, but there has been substantial progress in the schools, colleges and universities. In his day at Westminster School, Sir Henry said that only one other boy was studying science; now the yearly increase is 10 per cent and the science sixth will soon equal the rest. Technical education is progressing rapidly in quality and quantity, and should be given far more money for its needs. A comparative survey of the systems of all the western European countries

is urgently needed. Though universities are complaining, Sir Henry said that he knew of no other European government which makes a recurrent grant equal to £31 million per annum to universities. How do those universities manage? And what light would such a survey throw on British university organization? Far more trust is needed between the universities and the schools in Britain, and one of the younger universities should take the initiative in making closer direct examination and nomination arrangements with selected schools. A pilot experiment, conducted some years ago at the Imperial College of Science and Technology, London, had improved relationships and the number of first-class people coming forward.

Well organized as the conference was, it had too crowded an agenda, with an almost breathless succession of speakers and participants. An opportunity was lost in not spreading the same programme over two days, with far more ample opportunity for discussion, and particularly for members to question the authors more closely upon many aspects of their valuable report.

P. F. R. VENABLES

CAPITAL FOR SCIENTIFIC DEVELOPMENT

THE conference on "Capital for Scientific Development" at the Royal Society of Arts on June 27 was the earlier of two conferences arising out of the inquiry conducted by the Science and Industry Committee of the Royal Society of Arts, the British Association and the Nuffield Foundation into the possibility of speeding up the application to industry of the results of scientific research. The other conference, on the supply of scientists and technologists for industry, is surveyed in the preceding article. In opening the conference the President of the Board of Trade, Sir David Eccles, suggested that the weakness of British industry lies in failure to pay enough attention to the cost of applying new processes and machines, and that the value of Profs. Carter and Williams's book lies in stimulating thought about industry and technical change, and in challenging generalizations too broad to be true. Sir David agreed that company taxation might be less of a deterrent than some people think, but said that it mattered what they thought and that the answer depends on whether, assuming any rate of taxation, the public sector would leave the private sector enough savings.

The subject was dealt with in two sessions devoted respectively to large and small firms, but the discussion was preceded by a short account of the survey by Prof. C. F. Carter, who summarized its findings on this point. At the time of the survey many firms were certainly not held back by lack of finance, although they might be described as stagnant pools. Others, including some highly progressive from a technical point of view, had their development limited by the difficulty of retaining enough money in a period of high taxation, or by their inability or unwillingness to raise money from outside. Prof. Carter suggested that the problem, in its broadest terms, was whether the supply of savings was as high as it could reasonably be made, and whether our financial machinery was such that these savings were available to the investment borrowers with the

best claim. These questions raised very wide issues, some of which, including the place of the National Research Development Corporation in the financial support of key developments, Prof. Carter indicated.

The discussion on the position of the large firm was opened by Lord Dudley Gordon, who thought that new capital was normally required to develop the results of research in an existing department, and he found it hard to accept the suggestion in the report that a board of directors might refrain from increasing a dividend so that it may have funds to erect a new factory. Lord Dudley observed that surpluses shown are not usually available as cash, and new development resulting from research has to be paid for in cash. Large sums have also to be found for maintenance and repairs and to comply with the provisions of such measures as the Clean Air Act, and nearly every major project involves raising additional capital in some form, rather than cash from internal resources.

Sir Nutcombe Hume, who opened the discussion on the smaller firm, said that the conclusions drawn by Profs. Carter and Williams on capital for development accorded with those reached by the Charterhouse group of companies, of which Sir Nutcombe Hume is chairman, as a result of their experience in this field. Sir Nutcombe thought there were all too many men in responsible managerial positions, especially in the smaller companies, who did not know the extent of the facilities available and their uses. An essential ingredient of good management was the realization that, at least in matters of finance, a company must choose some reputable finance house and trust it to do what is best for the company. He also pointed out that the minimum size for a company to prove attractive to the Stock Exchange and investors seeking a free market in the securities they hold had been growing for many years, and he did not think that the report distinguished strongly enough between capital in the

form of borrowed money and that in the form of share capital. It was thoroughly bad that the incidence of profits tax should favour borrowing money and put such a heavy burden on ordinary share dividends, but he agreed with the authors of the report that too much time and energy were occupied by the problem of death duties.

Apart from this, few of the issues specifically indicated by Prof. Carter were mentioned by the other speakers, though Prof. Carter did not suggest that they would necessarily be discussed. Some of these points may be mentioned in conclusion to indicate that something more was done at the conference than to ventilate a pressing problem of modern industrial development and to seek possible solutions. There is the question whether there is a right balance between compulsory and voluntary saving; is it good or bad for technical progress that so much capital invest-

ment should be financed from ploughed-back profits; are the inducements and privileges given to private savers sufficient, or could a useful increase in private saving be obtained by further inducement? Again, are selective means of encouraging specially productive industries needed and can we make better use of men with ideas but no great ability in finance or sales? What is the place of general measures such as the investment allowance and do frequent changes diminish their efficacy? Is there any better way of controlling fund-raising from the markets than the present Capital Issues Committee, or would it be better for technical progress if capital were rationed by prices? Is there any better way of ensuring finance for small companies which unite technical progressiveness with business competence, and can anything be done to allay the fears of small firms which inhibit them in seeking outside finance?

SMOKING AND LUNG CANCER

REPORT OF THE TOBACCO MANUFACTURERS' STANDING COMMITTEE

THE tobacco manufacturers of Great Britain, disturbed by the reports that the evidence for a close relation between smoking and lung cancer was piling up, gave in 1954 a fund of £250,000 to the Medical Research Council for furthering research on the subject. Not satisfied with the results of their philanthropy, the manufacturers are now about to set up a new fund for research to the tune of £1 million. Their Standing Committee consists of technical representation from the different companies, and a scientific consultants panel of two eminent scientists, namely, a chemical technologist and a statistician-geneticist.

The report issued by the Standing Committee (6-10 Bruton Street, London, W.1), dated June 17, 1957, shows undisguised attempts to belittle the findings of those investigators who have shown a correlation between smoking and lung cancer. For example, it points out that one's daily intake of benzpyrene in the air in a West Country town is equivalent to the benzpyrene content of the smoke from forty cigarettes and the daily intake in London to the benzpyrene from one hundred cigarettes. These statements could imply that the best-known carcinogen (benzpyrene) present in cigarette smoke can be ignored as a factor in the lung cancer-smoking relation, since the air already contains more benzpyrene than the amount to which the great majority of smokers are exposed. Unfortunately for this idea, the lung cancer rate has been rising rapidly in many places all over the world and including towns in Norway, Iceland and Denmark, where the air is far less smoky than in English towns and where, as a consequence, the benzpyrene content of the air is a small fraction of the English figures. Moreover, women have a much lower lung cancer rate than men, although they breathe the same air.

Nevertheless, the laboratory work of the Committee is largely concerned with the measurement and the formation of benzpyrene in cigarette smoke. The report records that the arsenic content of

cigarettes is declining due to alterations in the pest-control technique on the tobacco crop. However, the implication that arsenic in the smoke could be the responsible carcinogen is undermined by the available lung cancer figures for Turkey, where the disease is about as common as in other European countries, but where the tobacco contains scarcely any detectable arsenic.

Although the report begins by rejecting the lung cancer-cigarette relation, its laboratory work energetically pursues the theme that cigarette smoke contains carcinogens such as benzpyrene, arsenic, dibenzanthracene, or some as yet unknown carcinogen lurking among the other constituents of cigarette smoke, which are identifiable or have still to be defined.

The report brings its heavy guns to bear on the statistical aspect of the problem. It emphasizes that a contingent statistical relation does not guarantee causation. Let us take an example of what could be called contingent. Seaside-sunburn in London school children, before the motor-car, was always preceded by a railway journey. The railway journey is contingent to the sunburn but is not the cause of the sunburn. To take a strictly practical point of view, the seaside-sunburn could have been avoided by shutting down the railways, and in the same way lung cancer could be largely avoided by closing the cigarette factories, quite independently of whether lung cancer and smoking have a causal or a contingent relationship.

The report refers to the 'genetic factor', that is, a hypothetical factor present in part of the population which determines not only susceptibility to lung-cancer but also a disposition to seek tobacco. Then why did not this genetic trait show itself before the lung cancer epidemic got under way, at about 1910-20?

A further theme pursued in the report is the alleged imperfect randomness of the patients who were the subjects of the Doll-Hill investigation. Surely, non-randomness is what is required: to