they had conceived. When, to-day, we compare land transport at home and abroad, we must admit that we have not applied either the technology or the money necessary to keep up with the general advance.

Although very recent years have seen some awakening of Britain to its transport needs, a few facts and figures may be mentioned to underline the need for still greater boldness in plans and expenditure.

The projected expenditure of £60 million on new roads and major improvements is no more than the 1939 rate, allowing for the fall in the value of money, though the number of vehicles has grown from 3 to more than 7 million, and is increasing at 8 per cent a year. While attention is now being paid to motorways, by the end of 1959 only 64 miles will be in use, whereas between 1830 and 1850 new railway routes were being built in Britain at an average rate of 320 miles a year. Urban road development lags even more. We have no established centre for training high-grade traffic engineers, although the savings to be gained from traffic engineering are immense. An increase of only 5 m.p.h. in average speeds—at present 20 m.p.h. in urban districts and 32 m.p.h. in rural—would give an economic saving of at least £180 million a year, and much more as traffic grows.

The railways, too, suffer greatly from past neglect of capital expenditure and technical recruitment. During 1900–55 true capital outlays were very small, and as late as 1956 only 0·23 per cent of the employees of the British Transport Commission were qualified scientists or engineers. In comparison, in the National Coal Board the proportion was 0·7 per cent, in the Central Electricity Authority 2·9 per cent, and in the Atomic Energy Authority 10·9 per cent. The British Transport Commission is making valiant efforts to retrieve the position, and the results are likely to be striking. Nevertheless, even bolder thinking is desirable, particularly in regard to size of wagons and turn-round (wagons now average only 10 miles/day). It must be stressed that in this the users have major responsibilities as well as corresponding opportunities of gain.

In transport abroad, and in our newer and progressive industries, scientific engineers play a much larger part than in the road and rail transport organizations of Britain ; we need to train more and use them more widely. We must remedy the defects in the transport system of Britain, particularly on the roads, by far greater capital expenditure and by a bolder approach to the technical and organizational problems involved.

ARTIFICIAL ORGANS : BIOLOGICAL APPLICATIONS

WE are reminded by Prof. A. Hemingway, in his presidential address to Section *I* (Physiology and Biochemistry), how much the study of isolated organs and tissues maintained under conditions ensuring survival has yielded to the physiologist. These tissues are immersed in, or superfused (a new technique), or perfused with blood, serum or solutions which may be regarded as 'artificial bloods'. A solution in which the ionic concentrations of sodium, potassium and calcium were adjusted to maintain conduction and contraction in cardiac muscle was first introduced by Ringer ; but since his day many modifications have been made, including the addition of metabolites such as pyruvate and glutamate. To make a blood substitute for clinical use as an 'expander' after hæmorrhage or in post-operative hypotensive states, dextrans of appropriate molecular size have been prepared and added to these solutions to make them osmotically equivalent to plasma. But, so far, it has not been possible, except by employing suspended red blood corpuscles, to make these solutions adequate carriers of respiratory gases.

The introduction of antibiotics and ample supplies of anticoagulants have encouraged and established the use of perfusion and similar techniques for clinical purposes. The 'artificial kidney', which has proved successful in the management of certain types of kidney disorder, is a development of Abell's (1922) vividiffusion apparatus. The principle is that an artery is cannulated and the blood, rendered incoagulable, is passed through a 20–30 m. length of 'Cellophane' tubing which is formed into a spiral and rotated in a bath of modified Ringer's solution. According to differences in concentration across the membrane, substances will be interchanged between the blood and the surrounding fluid. By this means, substances which have accumulated because of renal dysfunction can be removed from the blood ; the rate and the extent of the exchanges can be controlled by regulating the composition of the surrounding bath. Ensuing chemical changes in the blood must be followed. Treatment by the 'artificial kidney' is indicated when the pathological changes in the kidney are reversible and the patient's kidneys are likely to resume their functions.

In the field of cardiac surgery more extensive and complicated operations have been made feasible during the past decade by the development of the 'extracorporeal circulation'. This is a method, based on techniques well established in physiological laboratories, by which the systemic circulation of the body can be maintained by a mechanical pump and a blood oxygenator for a period during which the heart and the lungs of the patient can be by-passed. The heart and its neighbouring vessels can then be opened and congenital abnormalities or valvular lesions repaired or modified. There are many problems in the design of pumps and oxygenators which, while giving, respectively, adequate flow of blood and sufficient exchange of respiratory gases, will not injure the blood. Striking clinical progress has already been made and it seems likely that the improvements in the technique of perfusion will be applied to further studies of organ function and control and, probably, of survival *in vitro*.

PERCEPTION, ATTENTION AND CONSCIOUSNESS

IN her presidential address to Section *J* (Psychology), Prof. Magdalen D. Vernon points out that we can never be aware at any one moment of the whole of our surroundings. The degree to which we are aware of them varies greatly, from a precise perception of a narrow central field of view upon which attention is focused, to a vague awareness of all other parts. We can vary the amount of attention and the accuracy of perception from moment to moment, and direct it to different parts of our surroundings ; but the area of the field, and the number of events or objects in it, of which we can be aware at any one moment are limited. Focal awareness of one part of the field may preclude the perception of surrounding parts. It appears to be possible, however, to perceive