disinfectant for wool has been investigated, but owing to the cost of concentrating the dilute solutions obtained, success appears improbable. The production of carbon tetrachloride on a large scale, the corrosion of metals, accumulators, and containers for liquid oxygen, have been studied experimentally, but work generally has been impeded by the lack of adequate laboratory accommodation. More rapid progress can now be anticipated in view of the completion of the new chemical laboratory at Teddington, where special attention will be given to the study of chemical reactions under high pressures. The Engineering Co-ordinating Board has dealt with researches recommended by the Aeronautical Research Committee, such as light alloys, fatigue of materials, elasticity of steel strip, strength and properties of materials at high temperatures, prevention of rust, and tests for motor tyres. Among the researches undertaken in physics are: the silencing of aeroplanes, a high-power source of sound, acoustical properties of building materials, elasticity of aircraft materials, yellow glass for railway and aircraft lights, standardisation methods for the specification of colour, and the general nature of phosphorescence.

The gross expenditure on the various programmes of research was 303,070*l.*, of which 50,471*l.* was incurred for fuel research, 22,927*l.* for engineering, 17,571*l.* for food investigation, 14,529*l.* for chemistry, 13,948*l.* for radio, 11,940*l.* for building research, and 140,138*l.* for research and standardisation at the National Physical Laboratory. In all, 173,455*l.* was expended on the N.P.L., but nearly one-half of this sum was recovered in fees for tests and special investigations made for outside bodies.

The number of research associations in being during 1924–25 was twenty-five, of which twenty-one were in active operation. The Glass Research Association and the British Portland Cement Research Association have been liquidated, and the future of the Scottish Shale Oil Research Association appears doubtful. Research on glass will for the present be continued at the N.P.L., by the British Scientific Instruments Research Association, and in the Department of Glass Technology of the University of Sheffield. It is anticipated that a research association for food manufacturers will be launched shortly. Several associations appear to be in financial low water, and have needed the assistance of increased or extended grants; on the other hand, no payment was made to the British Iron Manufacturers' Association (which is temporarily suspended), or to the newly formed British Colliery Owners' Research Association.

The total disbursement on grants was 100,118*l.*, and the unexpended balance of the Million Fund was 518,200*l.* Average grants made to some of these associations during their existence—ranging from two to seven years—have been as follows: glass, 11,720*l.*; electrical and allied industries, 9552*l.*; cotton industry, 9819*l.*; scientific instruments, 9212*l.*; linen industry, 7510*l.*; portland cement, 4418*l.*; Scottish shale oil, 1500*l.*; rubber and tyre manufacturers, 5061*l.*; non-ferrous metals, 4070*l.*; boot, shoe, and allied trades, 797*l.* The total expenditure on the 258 grants made to individual research workers and students in training was 35,000*l.*; and the cost of administration at headquarters was 35,920*l.*, or about 6·5 per cent. of the total expenditure of the Department (539,199*l.*).

Obituary.

PROF. J. N. LANGLEY, F.R.S.

"YOU will always find it easy to generalise so long as you are content not to inquire too closely into detail." In these words, or words rather like them, Langley once expressed something which was very near to being the pivot of his intellectual outlook. The occasion was somewhere about the summer of 1900, when he was working at the properties of adrenalin, and discussing whether it could or could not be regarded as a general stimulant of the nerve-endings of the sympathetic system.

He came into the old physiological library at Cambridge, Foster's old room, from his operating room next door, to snatch a couple of rolls and a glass of milk. These formed the standard laboratory lunch of those days, and Langley would fall to talking about his work. Having finished his lunch he would return and perhaps operate until four or five in the afternoon, having started at about half-past ten. When he was conducting a research he would work in this way at high pressure for days on end, carrying through a long and exacting experiment each day, his marvellous skill as an operator making it possible for the animal which he was studying to remain in good condition for a very long time. When his experiments on a particular point were finished, he would absent himself from the laboratory until the paper was written—I am now speaking of the days before he was professor; when it had gone to press he would take up the next point. He was essentially a worker who did one thing at a time and developed his thesis, or allowed his thesis to develop itself point by point.

Langley was never content not to look too closely into detail. "The exception which proved the rule" had no meaning for him. It just upset the rule, and Langley was always more content to remain ignorant of "the rule" than to compromise in the slightest degree with the detailed statement of facts. His attitude was possibly born of his experience in making his survey of the autonomic system. That was his great work, and alone it would have formed a sufficient basis for his equally great reputation. Whether or not it was a feat of anatomy rather than of physiology is a matter which might provoke discussion. I have thought at times that had Langley labelled himself as an anatomist he would have been accorded an outstanding position in that subject. It would have been difficult for him to adopt that label, for he was not a qualified medical man, and indeed I suppose he was one of the first men who were pre-eminent in physiology without being medical practitioners. As time has passed, Langley's example has been followed by many another, and I imagine that as chemistry plays an increasing rôle in physiology, an increasing number of physiologists will be "unqualified."

To return, however, to the autonomic system; the methods by which Langley explored it were partly physiological and partly anatomical. On the physio-

logical—or perhaps even the pharmacological side—he discovered that nicotine abolished the conductivity of a synapse. This discovery provided a method for the charting of all stations throughout the autonomic system. One such still bears his name—Langley's ganglion in the submaxillary gland. Also, of course, much of his routine consisted in the stimulation of nerve-trunks with the object of ascertaining what response was produced in the peripheral endings attached to them. But a great deal of the method was frankly anatomical. It consisted in cutting a nerve-trunk and seeking out through the innumerable ramifications of the sympathetic system the destination of all the cut fibres. These might amount to hundreds or even thousands. The cut fibres were allowed to degenerate and so could be recognised from their sound fellows by their histological appearance. When the fibres had degenerated the animal was killed, all the peripheral nerves involved were examined, and the sound fibres were separated from the degenerate ones and the latter were teased out into rows under the microscope and counted.

It is not very easy to appraise the value of Langley as a lecturer; in my student days he did not give elementary lectures; therefore I can only speak of his advanced lectures at first hand. My memory of these is that they were mines of information, and the notes which I took from them were of the utmost use to me in subsequent teaching. But I remember also that to get a clear idea of the lectures required very close attention on the part of the student. Langley's method was to pass from one subject to another by a very gentle gradation rather than by an abrupt change; so gradual indeed was the passage that unless the student was attending pretty closely he ran the chance of missing it altogether. If that happened—if, for example, you thought he was still lecturing about the spleen when he had really passed to the thymus—it was not very easy to pick up the threads. This habit, which provided an occasional stumbling-block to advanced men, presented, I imagine, much more difficulty to a class more ignorant and less able to concentrate. At all events it is certain that different persons derived very different amounts of benefit from his elementary course. No one, however, regarded the lectures as in any way trivial, or Langley as anything but the great physiologist which he was. It was a matter of conscience with him to demonstrate in person throughout the whole of every practical class in histology, and also many of those in the "machine room," his object being to get to know each man individually in so far as that object could be attained.

Langley was seventy-three years of age at the time of his death on November 5. He and Sir Edward Sharpey-Schafer formed the remaining two of a generation of experimenters which really placed British physiology in the position which it now occupies. That position has been amply sustained by a brilliant group of men ten years or so their juniors. Langley's whole life as a physiologist was spent in Cambridge, excepting a short time after the taking of his degree when he worked in Heidenhain's laboratory. It was there, I think, that his interest in the salivary and other secreting glands commenced. That interest, by a gradual transition, led to an investigation of the nerves which operated them. Those were days of antagonistic nerves; the salivary glands provided an outstanding example of their action, and it was not unnatural to hope that if the action of the chorda tympani and the sympathetic respectively on the protoplasm of the submaxillary gland was understood, a great stride would have been achieved towards the comprehension of living processes in general. It was not to be. Nearly fifty years have passed; much work has been done (the most recent being that of Anrep and Harris), and the submaxillary gland now appears rather the example of an anomalous meeting-place of the cutaneous and internal innervations than the *venue* of a typical process of life. Langley, I think, saw this. At any rate, he forsook the study of its cells and was led by that of its nervous supply to the investigation of the autonomic system as a whole.

In Cambridge, Langley took an active part in the organisation of the scientific side of things. He was chairman, at the time of his death, of the Special Board of Biology and Geology, and at an earlier period he served a term in the Council of the Senate. Langley's "distinctions" were so numerous as to make their mere recital tedious; they occupy about a dozen lines of small print in the year book of the Royal Society. Probably there was none that he valued more than the Royal Medal of the Royal Society itself.

The above account of Langley has of necessity dealt chiefly with his scientific work. It would be incomplete without emphasising the fact that, scientist as he was, he was singularly many-sided and the very antithesis of the stage professor. Excellent company, whether as a host or as a guest, and fond of outdoor exercise of many kinds, he excelled as a skater. At one time it was his custom to go to Switzerland for the winter, and in the early 'nineties possibly there were not a dozen such good skaters as he in England.

Langley has left two material monuments, the *Journal of Physiology* and the Cambridge Physiological Laboratory. Of the former he became owner and editor. By universal consent there is no better journal; it was rigorously edited, papers were ruthlessly pruned of anything which was redundant or confusing —"woolly," as Langley used to say. Yet as an editor Langley had a wonderful sense for the important, and, severe as was his critical faculty, he had a generous appreciation of any grains of real merit in a man's work. The Physiological Laboratory at Cambridge is no less the product of his power of minute organisation. He, aided by Dr. (now Sir Walter) Fletcher, set himself the task of producing a laboratory which should be adapted, down to the minutest details, for the very various kinds of work which went on in Cambridge at that time, the work of Gaskell, of Anderson, of Hardy, of Mines, of Fletcher, of Keith Lucas, of Rivers, of Hopkins,[1] of Hill, and of quite a number of others. Greater than any material monument, however, is that of the school of workers over which he presided.

J. BARCROFT.

PROF. A. V. HILL writes: "Attention has been directed recently in the Press to the faculty of prophecy which—within limits—mankind possesses. The

[1] The physiological laboratory as originally designed included a wing for biochemistry.