it in the Leeds beds, though the insect is otherwise fairly common in the district. In the spot under consideration there are complaints that it has turned up in bread, and the medical officer of health showed me a fly paper that had been exposed in a small shop and was so densely covered with Anisopus (no other fly present) that it could have held few more. In another locality it is said to oviposit on such things as dish-cloths and green salads.

The information gathered was that the insect became common some eight years ago at about the time when an extensive system of sedimentation tanks was abandoned in favour of a single small patent tank. About this time, apparently, the springtail insect (*Achorutes viaticus* probably) which had been very common disappeared, and this fly made its appearance. My conclusion was that too much solid was being fed to the beds, as each piece of clinker was capped by a heap of slimy débris which was a wriggling mass of enchytræid and nematode worms, while a few inches down in the medium was an almost continuous layer of developing Psychoda and Anisopus flies. The final effluent, however, was good and settled quickly, satisfying the Rivers Board. Far removed from dwellings there would have been no real fault to find.

Chemical control of the flies was not desirable as such could not be selective, and any depletion of the fauna would have been followed by choking of the beds and ponding. It could not be certain that drastic reduction of the solids would lead to the disappearance of the established pest, and therefore an experimental approach was suggested by reducing the solids fed to one filter and subjecting another to double filtration to obtain a cleaner medium. Thus it could be found whether modification of the existing system would be justified, but it was pointed out that there must always be a lot of flies about bacteria beds and the only radical cure was substitution of an activated sludge system.

The matter is brought to light because it forms such an excellent illustration of the shortcomings of the small unit in sewage purification in congested areas. The system is most costly to set up, and once set up the local authorities are naturally reluctant to make a change. Ignorance or the cost of land often brings the works too near the town. It is not possible to provide the requisite scientific supervisor with laboratory facilities. Too often the small unit is in charge of a foreman under the supervision of an official who has many and varied duties and experience but not that very specialized knowledge required in sewage purification; engineering, chemistry, bacteriology and biology being all involved. Also since the best system is very wasteful, the research instinct is desirable so that economies can be sought[1]. In a sound system of town planning these small units should be grouped into big undertakings, as has been done with so much success at Mogden. Numerous nuisances are thus removed and economies such as the recovery of fuel gas can be effected. Especially space can be afforded so that odours, and flies when the system is by percolating filters, can be dispersed without annoyance and possible danger.

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[1] Reynoldson, T. B., *J. and Proc. Inst. Sewage Purification*, 109 (1941).
[2] Reynoldson, T. B., *J. and Proc. Inst. Sewage Purification* (in the press)
[3] Lloyd, Ll. Graham, J. F., and Reynoldson, T. B., *Ann. App. Biol.*, **27**, 122 (1940).
[4] Wishart, J. M., *Surveyor*, **95**, 283 (1939).

Accuracy of Boyle's Original Observations on the Pressure and Volume of a Gas

THE following statement occurs in the Dictionary of National Biography, 2 (1908), in regard to Robert Boyle's famous law: "This approximately true principle, *although but loosely demonstrated*, was at once generalized and accepted, and was confirmed by Mariotte in 1676" [italics mine]. From this I hoped to find in Boyle's original observations a striking application of a statistical theory of error elimination from the mathematical expression of physical laws, on which he had been working[1]. On reference to the original paper[2] this hope was not realized, for the reason that Boyle's observations were so accurate and so conclusive as to render error elimination a work almost of supererogation. Though there are a few obvious printer's errors in the paper, the results are presented in a manner which is a model for workers in experimental science in any age.

Formal application of the theory of Boyle's first table of observations (p. 101) gave the equation

$$-\log P = 1{\cdot}00404 \log V + C,$$

where P and V are the pressure and the volume respectively, and C is a numerical constant. With only twenty-five pairs of observations it is evident that the numerical coefficient is not significantly different from unity. The words italicized in the above quotation do less than justice to the work of a great man of science.

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[1] "Inherent Relations between Random Variables", *Proc. Roy. Irish Acad.*, **47**, A, 6, 63.
[2] "Works", **1**, 100 (fol. ed. 1744).

Human Vitality and Efficiency

IN 1919 the Carnegie Institution of Washington published a comprehensive report in which Prof. F. G. Benedict and his colleagues remarked that "it is indeed surprising that after 15 years' search for a nutritional level with man markedly different from that of the normal individual, such a level should not have been found in all the researches conducted by this and other laboratories".

It is worthy of note that the 'laboratory of war' has now revealed such a nutritional level: from Belgium, for example, there is news that in 1941 the normal intake of food had sunk from 2,850 calories a day to 950. This is comparable with the dietary standard of the poor of Munich, as recorded by Rumford at the end of the eighteenth century; and, as I pointed out in 1936[1], must mean that the basal metabolism of a man is capable of being reduced to a level far below what physiologists have believed to be possible.

Data on human vitality and efficiency under prolonged restricted diet are doubtless being collected in the occupied countries.

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March 21.

[1] Dufton, A. F., *Lancet*, **231**, 1535 (1936).