These possibilities are being investigated by following the titration curves of the native and denatured protein and the changes in amino-nitrogen accompanying denaturation and coagulation.

This work was carried out as part of the programme of the Food Investigation Board, and is published by permission of the Department of Scientific and Industrial Research.

E. C. Bate-Smith.
J. R. Bendall.

Low Temperature Research Station,
Cambridge. July 10.

[1] Bull, *Cold Spring Harbor Symp. Quant. Biol.*, **6**, 140 (1938).
[2] Pauli and Koelbl, *Kolloid-Beiheft*, **41**, 417 (1935).
[3] Bate-Smith, *J. Physiol.*, **92**, 336 (1938).
[4] Bate-Smith, *Proc. Roy. Soc.*, B **124**, 136 (1937).

Activity of Helvolic Acid against *Mycobacterium tuberculosis*

The earliest account of an action by *Aspergillus fumigatus* on the tubercle bacillus appears to be that of Vaudremer, who found that *Myco. tuberculosis* incubated for 24 days in a filtered extract of *A. fumigatus* lost to a large extent its acid-fast staining properties and its virulence for animals, as compared with bacilli incubated in Raulin's culture fluid or in saline[1]. The active principle was thermostable[2]. He used similar extracts to treat more than two hundred patients with tuberculosis, but clinical results were equivocal[3]. He also pursued the idea of using the attenuated bacilli for the preparation of vaccines[4,5].

Zorzoli[6] found that medium on which *A. fumigatus* had grown interfered with the growth of *Myco. tuberculosis*; the active substance withstood 100° C. for one hour. Soltys[7] similarly found that medium from this mould inhibited the growth of human, bovine and avian *Myco. tuberculosis* and *Myco. phlei*, and that it had the same heat stability. By partial purification Asheshov and Strelitz[8] obtained an extract from culture filtrates which killed B.C.G. at 1 in 500,000 and inhibited its growth at 1 in 1,400,000 under the conditions of their experiments, though avian *Myco. tuberculosis* was not killed by a concentration even as strong as 1 per cent. Kallós[9] and Gerber and Gross[10] each reported that culture filtrate from an unidentified strain of *Aspergillus* contained a substance active against *Myco. tuberculosis*, and Miller and Rekate[11] found an unidentified mould of which the mycelium inhibited its growth.

There is little information from the chemical evidence presented in these reports as to how far the activity of crude extracts against the tubercle bacillus might be accounted for by any of the antibiotic substances already isolated from the metabolic products of *A. fumigatus*. It may therefore be of interest to workers in this field to report the activity, under a given set of experimental conditions, of helvolic acid[12,13], the only one of these antibiotics which approaches the status of a chemotherapeutic agent. Mr. T. I. Williams, who had been working with helvolic acid, suggested making these observations.

Human *Myco. tuberculosis* in sputum was cultured by Muller's[14] adaptation of the slide culture technique[15], the medium being distilled water with 25 per cent packed human red blood cells from citrated blood, incorporating serial dilutions of helvolic acid (1 in 1,000, 10,000 and 100,000). The activity of the helvolic acid did not deteriorate during the incubation period of one week. When at this time the preparations were fixed and stained, some colonies, though fewer and smaller than in the controls, had developed in the presence of 1 in 100,000 helvolic acid, but the higher concentrations, 1 in 10,000 and 1 in 1,000, had suppressed multiplication completely.

Thus under these conditions of experiment, helvolic acid inhibits the growth of the tubercle bacillus partially at a dilution of 1 in 100,000 and completely at at least 1 in 10,000.

M. A. Jennings.

Sir William Dunn School of Pathology,
University of Oxford. Aug. 16.

[1] Vaudremer, A., *C.R. Soc. Biol. Paris*, **74**, 278 (1913).
[2] Vaudremer, A., *C.R. Soc. Biol. Paris*, **73**, 501 (1912).
[3] Vaudremer, A., *C.R. Soc. Biol. Paris*, **74**, 752 (1913).
[4] Vaudremer, A., Puthomme, E., and Paulin, J., *Bull. Acad. Méd.*, **97**, 202 (1927).
[5] Vaudremer, A., *Bull. Acad. Méd.*, **103**, 622 (1930).
[6] Zorzoli, G., *Ann. Inst. Carlo Forlanini*, **17**, iv, 3-4, 208, 221 (1940).
[7] Soltys, M. A., *Nature*, **154**, 550 (1944).
[8] Asheshov, I. N., and Strelitz, F., *Science*, **101**, 119 (1945).
[9] Kallós, P., *Nature*, **155**, 300 (1945).
[10] Gerber, I. E., and Gross, M., *Science*, **101**, 616 (1945).
[11] Miller, D. K., and Rekate, A. C., *Science*, **100**, 172 (1944).
[12] Chain, E., Florey, H. W., Jennings, M. A., and Williams, T. I., *Brit. J. Exp. Path.*, **24**, 108 (1943).
[13] Menzel, A. E. O., Wintersteiner, O., and Hoogerheide, J. C., *J. Biol. Chem.*, **152**, 419 (1944).
[14] Muller, H., *J. Path. Bact.*, **56**, 429 (1944).
[15] Pryce, D. M., *J. Path. Bact.*, **53**, 327 (1941).

A Polysaccharide from *Gigartina stellata*: the Isolation of Crystalline 2 : 6-Dimethyl-β-*d*-Galactopyranose from the Methylated Polysaccharide

Through the kindness of Dr. A. P. Orr of the Marine Station, Millport, in supplying a quantity of *Gigartina stellata* which is used in the preparation of 'British Agar'[1], we have been able to investigate a polysaccharide isolated from this material.

After washing for a week in running water, the seaweed was extracted with hot water, the extract concentrated under diminished pressure and the hot extract precipitated with alcohol. The product is essentially a polysaccharide ethereal sulphate of $[\alpha]_D^{15°} + 51°$ in water, ash 17·5 per cent (as sulphate) giving Ca, 3·7; Mg, 1·0; SO_4, 12·7 per cent calculated on the weight of hot extract, whereas the total sulphate was 23·8 per cent.

Hydrolysis of the hot extract with $N/2$ oxalic acid followed by neutralization with barium carbonate gave *d*-galactose (40 per cent) together with the barium salt of an acid (30 per cent), the constitution of which has not yet been decided.

As with the polysaccharide ethereal sulphates of *Chondrus crispus*[2], which is also used in the preparation of 'British Agar', direct methylation of the hot extract was slow, but it could be acetylated readily in the cold after a preliminary treatment with pyridine[3]. Simultaneous deacetylation and methylation yielded a partly methylated product, the methoxyl content of which was raised by several similar treatments to *c.* 20 per cent. The methylated polysaccharide so obtained closely resembled the original hot extract $[\alpha]_D^{15°} + 43°$ in water, ash 18·2 per cent (as sulphate) giving Ca, 3·8; Mg, 0·9; SO_4, 12·8 per cent (calculated on the weight of the methylated hot extract); total sulphate 24·7 per cent.

Hydrolysis of this methylated polysaccharide and suitable treatment gave as the main product a