were a cloudy swelling of the liver and of the kidneys and a marked oedema of the lungs.

Full details of this case will be published elsewhere*.

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* See *B.M.J.*, Dec. 15, p. 845.—Editors.

Adsorption of Enzymes on Solid Nucleic Acid

IN the course of experiments on an improved method for isolating and purifying the amylases of malt, I have found that solid yeast nucleic acid is a very powerful adsorbent of these enzymes. The figure shows an experiment in which varying quantities of the solid nucleic acid (B.D.H.) were added to a diluted malt extract containing 0.12 mgm. nitrogen per mil, most of which is protein. The solution was gently shaken for a few minutes and then filtered. It can be seen that 1 mgm. of nucleic acid per ml. of solution removes the greater part of the enzymic activity. The enzyme can be recovered from the residue by the simple expedient of dissolving it in a few mls of dilute phosphate buffer of pH 6. For example, the following figures were obtained by the addition of 10 mgm. of nucleic acid to a malt solution containing 0.24 mgm. nitrogen per mil.

Activity in original solution	2.2
Activity in filtrate	0.6
Activity recovered from nucleic acid	1.5
Activity in wash water	0.2

The presence of nucleic acid in the solution appears to have no effect on the enzymic activity.

The malt extract used in these experiments contains both α - and β -amylases, but predominantly the latter. The activity was determined by adding 1 c.c. of the solution to 10 c.c. of 1 per cent soluble starch in a *M*/10 phosphate buffer of pH 6, for 10 (or 20) minutes at 37°, when the amount of maltose formed is determined by the method of Willstätter *et al.*¹. This method determines primarily the β -amylase; but observations of the colour of the products with iodine indicates that the nucleic acid does not differentiate between the α - and β -amylases.

Compound formation between proteins and nucleic acid has been demonstrated in the past² by mixing solutions of protein and of nucleic acid and precipitating the complex with acid, and nucleic acid has been used in this way to precipitate enzyme as a step in purification³. I have not found any record of the observation of the reversible adsorption of enzymes on the solid acid. In view of the probable importance of nucleic acid in the processes of gene reduplication and protein synthesis⁴, this phenomenon appears to

be of considerable interest and is being further investigated.

I am much indebted to Mr. Adam Tait, of Messrs. Wm. Younger and Co., Ltd., for the gift of the malt.

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Edinburgh, 9. Aug. 23.

¹ Willstätter *et al.*, *Z. physiol. Chem.*, **126**, 143 (1923).

² Hammersten, *Biochem. Z.*, **144**, 383 (1923). Przybecki and Grynberg, *Biochem. Z.*, **251**, 248 (1932); **258**, 79, 389 (1933).

³ Kubowitz and Ott, *Biochem. Z.*, **314**, 94 (1943).

⁴ Cf. Greenstein and Chalkley, *Ann. Missouri Bot. Garden*, **32**, 179 (1945). Emerson, *Ann. Missouri Bot. Garden*, 243 (1945).

Inhibition of the Development of *Fusarium oxysporum cubense* by a Growth Substance produced by Meredith's Actinomycetes

IN a discussion which we had early this year with Dr. Portheim of Kew Gardens, the latter raised the question of the use of antibiotics in the control of plant diseases caused by bacteria and fungi, and suggested that preliminary work which he had carried out supported his contention that gliotoxin-producing fungi might be found useful in combating such diseases. Dr. Portheim's views would appear to have been in part substantiated by the recent observation of Brian and McGowan¹.

At the suggestion of Dr. Portheim, we undertook to determine the gliotoxin production of a culture of *Trichoderma viridans*, supplied by him, when grown on the waste water used in the cleaning of beer casks, a medium claimed by him to be suitable for the cultivation of this fungus. As test organism for gliotoxin production a standard strain of *Bac. subtilis* was used which, on trial, had been proved to be inhibited in its growth by gliotoxin, supplied by Dr. Portheim, in concentrations of 6 parts per million.

Though the culture of *Trichoderma viridans* used grows abundantly on the beer wash water at temperature between 25° and 30° C., at no time did the growth liquid have an inhibitory action on the development of *Bac. subtilis*; and it was concluded that, under the conditions employed, the *Trichoderma* culture had failed to produce gliotoxin.

When these experiments were in progress, we became acquainted with Meredith's² observation that certain Jamaican soils are inhibitory to the spread of Panama disease, caused by *Fusarium oxysporum cubense*, and that certain Actinomycetes inhabit such soils. On isolation and subsequent cultivation of these Actinomycetes in extracts from their own soils, some of these organisms were found by Meredith to inhibit or retard the development of *Fusarium oxysporum cubense*.

Though Meredith does not ascribe the function of his antagonistic Actinomycetes to growth-inhibiting substances produced by them, we felt it worth while to explore to what extent this might be the case, and in this way possibly to bring further evidence in support of Dr. Portheim's contention that certain plant diseases can be controlled by antibiotics. For this purpose we secured cultures of Meredith's Actinomycetes from the National Type Culture Collection and grew them on Portheim's beer wash medium and on the waste liquors resulting from food yeast manufacture.

In both these media the Actinomycetes grew well; in the latter particularly when the liquor was diluted with equal parts of water.