is borne out in the poor surface-tension lowering properties of the bile acid salts.

The details of this work will be published elsewhere.

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Toxic Effects of Certain Bacterial Metabolic Products on Soil Protozoa

THE chemotherapeutic value of the antibacterial substances produced by micro-organisms has attracted much attention in recent years. Very little is known concerning the effect of these antibacterial substances on Protozoa. For the past few years I have carried out work[1,2,3] on the selectivity of bacterial food by soil Protozoa, with special reference to amœbæ. In an attempt to correlate the non-edibility of pigmented bacteria, a suggestion[3] has been made that pigment formation by bacteria exerts a protective action against protozoal attack.

The extracted pigment from *Serratia marcescens*, *Chromobacterium violaceum* and a red pigmented bacterium 5654 (the characters of which are given by me[1]), when mixed with edible bacterial suspensions on an agar plating, apparently prevents the amœbæ from eating the edible food. Within a few days the amœbæ either encyst or die without destroying more than a few of them. Non-pigmented strains of *Serratia marcescens* are slowly but completely destroyed by amœbæ. The pigment of *Serratia marcescens* diffusing through agar has also a toxic effect on soil amœbæ and prevents them from eating edible bacteria.

Some interesting observations have been made on the toxic effect of the metabolic products of *B. pyocyaneum* on soil Protozoa. When the organism is grown on glycerol-peptone agar for 3–30 days, a chloroform extract of the bacterial growth, redissolved in water, is very toxic in strong concentrations to soil amœbæ, flagellates and ciliates, which are killed in a few minutes. At dilutions of 1/2,000 and 1/4,000, it takes 3–8 hours and 12–48 hours respectively to kill Protozoa, the effect at a given dilution varying with the type of protozoan. At dilutions of 1/8,000 and above, some types of Protozoa are killed within forty-eight hours while others are unaffected. Schoental[4] has studied the antibacterial agents present in cultures of *Ps. pyocyanea*, which include α-hydroxyphenazine. The chemically pure pyocyanin and α-hydroxyphenazine are less toxic to soil Protozoa than the above-mentioned crude chloroform extract. The chemically pure pyocyanin is slightly more toxic than α-hydroxyphenazine.

The more toxic nature of the crude extract is thus probably due to the fact that it contains other substances in addition to pyocyanin. When the crude chloroform extract of pyocyanin, dissolved in water, is passed through an *L* 5 Chamberland candle, the pyocyanin is adsorbed by the candle, and a light tea-coloured filtrate is obtained, the toxicity of which on Protozoa is increased by autoclaving at 15 lb. pressure for 15 min. The nature of this substance is being studied.

A fluorescent pigment, which is quite different from pyocyanin, obtained by growing *B. pyocyaneum* in liquid media, is also toxic to soil Protozoa.

A detailed study of the work carried out on the toxic effect of bacterial products on soil Protozoa will be published later, and it is hoped to extend this study to the effects of other antibacterial substances produced by micro-organisms on pathogenic and soil Protozoa.

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A Useful Abnormality of the Pollen in a Pear

THE exceptionally low number of good seeds obtained when the pear variety Beurré Bedford is used as pollen parent in breeding experiments[1] led me to observe a series of developmental aberrations in this variety which may prove of value in producing new and improved forms.

The variety is a diploid ($2n = 34$). but, following normal meiosis, cell walls fail to develop between the four haploid nuclei, and thus the pollen mother cells are transformed directly into giant four-nuclear pollen grains.

Immediately before the first pollen grain mitosis these nuclei begin to fuse with one another, so that the following five types of mature grains, classified according to the number and constitution of the generative nuclei, are produced:

Types	$4x$	$3x+x$	$2x+2x$	$2x+x+x$	$x+x+x+x$
Percentage	81·5	9·3	6·9	1·9	0·4

The pollen grains of all these types germinate readily in culture (more than 90 per cent germination) and with more vigour than pollen from normal diploid and tetraploid varieties. The pollen tubes are almost invariably branched, although generative nuclei can be observed in only one of the branches. Such branching cannot be attributed to the multi-nuclear nature of the cells, since more than 80 per cent of the pollen grains have the vegetative as well as the generative nuclei single.

Growth of these pollen grains is also vigorous in stylar tissue and the tubes enter the embryo-sac in the normal manner[2], but very few good seeds are obtained[1].

In crosses with diploid and tetraploid varieties