of all the other organic and inorganic nitrogenous compounds tested, alone approached nitrate in its effectiveness as the sole source of nitrogen. Moreover, when nitrate and sucrose were present in optimal concentrations, and when other environmental and nutritional conditions were optimal[6], the addition of aspartic acid caused a stimulation of growth proportional to the amount added, up to 0·032 *M*. Concentrations higher than this have not been tested. It is apparent that the stimulation of growth caused by aspartic acid in the presence of optimal amounts of carbon (sucrose) and nitrogen (nitrate) is due to some other reason than simply its utilization as a source of carbon or nitrogen or both. It is possible that aspartic acid, so important in the metabolism of many plant tissues, is in the present instance the limiting factor when the other optimal conditions are met. It might be mentioned, also, that when aspartic acid is present in the medium, the colour of the tumour tissue is much greener than when grown under any other conditions, except when starch is utilized as the carbon source. This suggests that aspartic acid may have some effect on the synthesis of chlorophyll in this tissue.

From the results presented above, it is suggested that in this case, too, aspartic acid can be assimilated intact by the tumour tissue.

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[1] White, J., and Munns, D. J., *Nature*, **165**, 111 (1950).
[2] Thorne, R. S. W., *J. Inst. Brew.*, **55**, 201 (1949).
[3] Nickell, L. G., and Burkholder, P. R., *Amer. J. Bot.* (in the press).
[4] Black, L. M., *Nature*, **158**, 56 (1946).
[5] Black, L. M., 6th Growth Symposium, 79 (1947).
[6] Burkholder, P. R., and Nickell, L. G., *Bot. Gaz.*, **110**, 426 (1949).

In vitro Inhibition of Growth of a Pathogenic Protozoan by a Derivative of Glutamic Acid

DL-N-(gamma-glutamyl)-ethylamine has been found to act as an antimetabolite of glutamic acid in the growth of *Staphylococcus aureus*[1]. The object of the present investigation was to study the influence of this substance on the multiplication of the parasitic flagellate *Trichomonas vaginalis*.

DL-N-(gamma-glutamyl)-ethylamine was prepared, as previously described, from DL-pyrrolidonecarboxylic acid and aqueous ethylamine[2]. *T. vaginalis* was grown in the absence of bacteria according to the method of Adler and Pulvertaft[3]. The medium described by Johnson[4] consists of a solid phase (liver infusion agar slant) and a liquid phase containing sodium chloride, phosphates, proteose peptone, blood serum and penicillin. The cultures were kept at 37° and passages were made every three to four days.

Various proportions of DL-N-(gamma-glutamyl)-ethylamine and L-glutamine were added to tubes containing 6 c.c. of the liquid medium over a liver infusion slant and nine–ten drops of the culture. Parallel experiments were carried out with the same amounts of DL-N-(gamma-glutamyl)-ethylamine and sodium L-glutamate.

Table 1. Effect of DL-N-(Gamma-Glutamyl)-Ethylamine on the Development of *T. vaginalis*

DL-N-(γ-glutamyl)-ethylamine	Development of *T. vaginalis* after 96 hr.
50 mgm.	+ + +
100	− − −
100	+ + +
135	− − −
150	− − −

Table 2. Effect of L-Glutamine and of Sodium-L-Glutamate on Inhibition of Development of *T. vaginalis* by DL-N-(Gamma-Glutamyl)-Ethylamine

DL-N-(γ-glutamyl)-ethylamine	L-glutamine	Development of *T. vaginalis* after 96 hr.
150 mgm.	10 mgm.	− − −
,,	20	− − −
,,	30	+ + +
	Sodium-L-glutamate	
150 mgm.	30 mgm.	− − −
0 ,,	60	− − −
,,	,,	+ + +

As shown in Table 1, 135 mgm. of DL-N-(gamma-glutamyl)-ethylamine completely inhibited the multiplication of *T. vaginalis*, whereas 100 mgm. inhibited the growth occasionally. Table 2 shows that this inhibition is reversed by the addition of 30 mgm. of L-glutamine; while twice this amount of sodium-L-glutamate was without effect.

These results seem to indicate that in *T. vaginalis* DL-N-(gamma-glutamyl)-ethylamine acts as a competitive antagonist of glutamine rather than of glutamic acid, and that glutamine is obligatory for the development of a culture of *T. vaginalis*.

It was found necessary to use relatively high concentrations of the antagonist, probably because blood serum and liver infusion contain relatively high concentrations of glutamine[5]. Moreover, the varying results obtained with smaller amounts of the antagonist could be explained as due to variations in the concentration of glutamine in the media employed.

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[1] Lichtenstein, N., and Grossowicz, N., *J. Biol. Chem.*, **171**, 387 (1947).
[2] Lichtenstein, N., *J. Amer. Chem. Soc.*, **64**, 1021 (1942).
[3] Adler, S., and Pulvertaft, R., *Ann. Trop. Med.*, **38**, 188 (1944).
[4] Johnson, G., *J. Parasitol.*, **28**, 369 (1942).
[5] Hamilton, P. B., *J. Biol. Chem.*, **158**, 397 (1945).

Problem of Wheat-Rust

Prof. Stakman in the United States, by continual breeding of resistant strains of wheat and by application of effective spraying at the appropriate time, has been able to minimize loss by rust; but in spite of his devoted labours for more than three decades and the ample facilities given by the U.S. Government, he has not been able to eradicate the wheat-rust from the country.

Examination of some samples of fresh and healthy Indian wheat seeds of this year showed the invariable presence of distinctly septate and branched fungal hyphæ in the subepidermal region of the seeds, just

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