A. BACTERIAL GROWTH ESTIMATED NEPHELOMETRICALLY, EXPRESSED IN UNITS OF TURBIDITY. NEPHELOMETRIC ESTIMATIONS WERE CONTROLLED BY CELL COUNTING. B. PHENOL CONCENTRATION, ESTIMATED COLORIMETRICALLY ACCORDING TO FOLIN. C. pH OF CULTURE

tained. The rate of growth of bacteria in phenol depends on pH and reaches its peak at pH 7; at this pH also phenol disappears most rapidly (see chart).

The strain which has been described, while growing on medium containing 0.2 per cent of glucose and 0.1 per cent of phenol, used both substrates simultaneously. The increase in the number of bacteria was greater than in the case of phenol alone, and the disappearance of phenol markedly decreased.

Achromobacter exhibits high specificity in the utilization of different aromatics as the sole source of carbon. It cannot utilize unsubstituted aromatic hydrocarbons, since it does not grow on benzene or toluene when they are used in the media as free hydrocarbons or their sulphonic acids. The hydrogenation of the benzene ring makes it available to bacterial enzymes, as was shown in the case of cyclohexane, which is a good source of carbon. The introduction into the benzene ring of chlorine, nitro, amino or sulpho groups does not make the compounds available to the bacteria investigated; but the introduction of oxygen enables the benzene ring to be split.

Nearly all the mono-, di- and tri-phenols examined up to now (for example, phenol, *o*-, *m*- and *p*-cresols, catechol, resorcinol, 3,4-xylene-1,2-diol, orcinol, pyrogallol) are good sources of carbon for such bacteria, and the essential factor is the presence of the free phenolic group. The phenolic ethers (anisol, phenetol, diphenyl-ether) are not attacked by this strain. The esters of phenol—sulphuric, acetic, benzoic—are readily utilized as the source of carbon. Most probably the enzymatic system of the bacterial cell contains esterases which split the ester linkage, and so render the free phenol available to the bacterial cell.

The introduction of oxygen makes the aromatic ring available for bacteria not only when it is present as a phenolic group, but also as an alcoholic group, for example, benzyl alcohol, or as a carboxyl group. The mono-carboxylic acids derived from benzene (for example, benzoic, phenyl-acetic, anthranilic, salicylic acids) produced even better bacterial growth than phenols. In this connexion it is curious that the two dicarboxylic acids examined, phthalic and terephthalic acids, are not attacked by these bacteria. The keto-derivatives benzophenone and benzil also were not utilized.

The ability to split the aromatic ring is limited to mono-cyclic compounds; all hydroxy and carboxy derivatives of naphthalene examined have failed to maintain bacterial growth when they are the sole source of carbon.

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Urease in the Gastric Mucosa and its Increase after a Meat Diet, Soya Bean Flour Diet or Urogastrone Injections

THERE is good reason for believing that gastric hydrochloric acid is neutralized by ammonia formed most probably by urease from circulating urea. This enzyme is present in the mucosa. This mechanism was first noted by Luck¹ and by Luck and Seth² in the dog and cat, and Linderström-Lang and Ohlsen³ noted also that in the dog the urease was most potent in the superficial rather than the deep mucosa. Furthermore, Linderström-Lang and Ohlsen³ held that urease was not present in all animals; for example, they held there

was none present in the pig. From personal work we have shown that this ferment exists in at least man, dog, cat, rabbit, pig and rat. The amount in the first three species of animal appears to be much greater than in the latter three. Rigoni⁴ had shown its presence in man, and, like Linderström-Lang and Ohlsen, had speculated on its possible significance.

At room temperature as much as 66 mgm. ammonia nitrogen can be formed per hour from the total mucosa of a cat's stomach, this being sufficient ammonia to neutralize 47 ml. *N*/10 hydrochloric acid, far more acid than is formed by any cat's stomach in that time. We know that this quantity of ammonia is not released into the stomach (except, perhaps, in disease) so presumably the ammonia-hydrochloric acid reaction occurs intracellularly. There is some increase in intragastric ammonia coincidental with neutralization in both man and the cat at any rate, but not at all enough to explain the observed degree of neutralization. The urease seems to be present in largest amounts in the fundus, less in the pylorus and very little indeed in the duodenum or small intestine proper (cf. Table 1).

TABLE 1. AMMONIA NITROGEN (MG.) RELEASED FROM UREA PER GRAM OF DRIED MUCOSA PER HOUR AT ROOM TEMPERATURE FROM CATS FED ONLY ON MILK AND FROM CATS FED ON MILK PLUS EXCESS MEAT IN THE FORM OF LUNGS AND LIVER. FIGURES IN BRACKETS SHOW NUMBER OF ANIMALS USED

	Sup. upper stomach	Deep upper stomach	Sup. lower stomach	Deep lower stomach	Sup. duodenum	Deep duodenum
Milk fed	4.03 (7)	1.99 (8)	4.43 (8)	0.47 (8)	0.26 (5)	0.30 (5)
Meat fed	16.25 (15)	17.31 (15)	11.94 (14)	16.86 (14)	0.18 (11)	0.31 (11)

The amount of urease which is present varies from species to species, as has been noted above; but inside the same species the concentration of mucosal urease can be increased by any one of the three following methods: by high protein diet, by soya bean flour diet or by injections of concentrated pregnancy urine. Of the first of these, experiments in cats have shown that if an animal be placed on a high protein diet, it accumulates a far higher concentration of urease at the end of as little as a week, compared with the animal placed on a milk diet (cf. Table 1). It will be noted from the table that the concentration increase is quite definite and that apparently this increase in concentration is more remarkable in the deeper part of the mucosa of the stomach, both upper and lower, than it is in the superficial. The effect on the duodenal content of urease seems to be negligible.

TABLE 2. AMMONIA NITROGEN (MG.) RELEASED PER GRAM PER HOUR FROM DRIED GASTRIC MUCOSA OF RATS INCUBATED AT 37° C. WITH UREA. ANIMALS FED PREVIOUSLY ON SOYA BEAN FLOUR OR INJECTED WITH 0.3-0.6 ML. ANTUITRIN S. FIGURES IN BRACKETS SHOW NUMBER OF ANIMALS USED

	Upper stomach	Lower stomach	Duodenum plus intestine
Soya bean fed	2.38 (7)	1.10 (6)	0.67 (5)
Control normal fed	1.29 (6)	0.66 (5)	0.71 (5)
Antuitrin S injected	1.85 (5)	1.42 (5)	0.40 (5)

The second finding, in relation to soya bean flour, was tried only on rats; in these animals it is not practicable to divide the mucosa into superficial and deep, while mucosa had to be analysed in groups of at least three, owing to the very small amounts obtainable (cf. Table 2). Again, there is little change in the intestinal content of the ferment. Soya bean flour was used as, though it is not active itself as a urease enzyme, the enzyme having been destroyed in preparation, it presumably contains a good remnant of the specific protein of urease which normally is present in the soya bean.

Finally, concentrated pregnancy urine was used in the form of Parke Davis Antuitrin S. in amounts varying in different experiments from 0.3-0.6 ml./rat/day from 10-20 days. This extract probably contains a high content of urogastrone. Again, this work has had to be done on rats, and the results are tabulated in Table 2. A definite increase in concentration can be noted.

These three groups of experiments are interesting in so far as they show that the content of a ferment can be varied at the will of the investigator. The presence of urease in such concentrations in the gastric mucosa must have a role in the protection of the mucosa from digestion by acid pepsin. Its involvement in neutralization of hydrochloric acid is being further studied.

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