whom the normal homozygous condition is not expected.

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Symbiosis in Thermophilic Cellulose Fermentation

AN elective culture of anaerobic thermophilic cellulose bacteria was examined by plating with potato infusion agar, to which 0·04 per cent sodium thioglycollate was added. The plates were incubated at 55° C. in carbon dioxide under reduced pressure. It was found that the culture is composed of three different bacteria, only one of which is capable of fermenting cellulose. The cells of the latter are thin rods with spherical terminal spores. On cellulose–dextrin agar, prepared from water-insoluble or water-soluble cellulose dextrin according to Fuller and Norman[1], this organism (provisionally named type *c*) forms small distinct, disk-shaped colonies, surrounded by circular, well-developed decomposition zones (visible also when water-soluble dextrin is used).

That type *c* really was obtained as a pure culture is evident, *inter alia*, from the fact that only colonies with decomposition zones are formed on plating with cellulose–dextrin agar containing potato infusion. When type *c* is transferred to liquid cellulose medium, the solution itself remains perfectly transparent, suggesting that the bacteria are located on the cellulose fibres. Also the appearance of reducing sugars in the medium after the fermentation ceases indicates that the culture is pure.

Besides type *c* the culture contained another morphologically similar organism, provisionally named type *s*. On potato-infusion agar, type *s* forms colonies of the same appearance as type *c*, but does not attack cellulose dextrin. Thus type *s* can easily be separated from type *c*. Unlike type *c*, bacterium *s* produces butyric acid from dextrose.

The cells of the third bacterium of the culture, named type III, are comparatively thick rods with ovoid terminal spores. Unlike the two others, this organism grows well on nutrient agar and can easily be isolated by plating, when this medium is used. Further, types *c* and *s* are obligate anaerobes, but type III must be considered as microaerophilic.

The accompanying table shows the products of the fermentation of cellulose by type *c*, and from dextrose by types *s* and III in pure cultures. In addition, the table shows the products formed when type *c* breaks down cellulose in symbiosis with *s* as well as with *s* and III together.

Type *c* produces mainly lactic acid and also ethanol, formic acid and acetic acid, but no butyric acid. The reducing substance, which is calculated as dextrose in the table, seems to be cellobiose and dextrose.

Type *s* is very similar to type *c* but produces butyric acid too. Type III is the most marked lactic acid producer of the three organisms. It gives no butyric acid.

Fermentation products (gm. per 100 gm. cellulose (or dextrose)) decomposed
Added cellulose: 10 gm. per litre medium.
Added dextrose: 20 gm. per litre medium.
c = pure culture of cellulose-fermenting bacterium.
s = pure culture of dextrose fermenter producing butyric acid.
III = pure culture of dextrose fermenter producing lactic acid.

Culture	*c*	*s*	III	*c*+*s*	*c*+*s*+III
Incubation time (days)	10	6	4	8	6
Carbohydrate source	cellulose	dextrose	dextrose	cellulose	cellulose
Carbohydrate fermented (%)	40·1	100·0	83·1	70·1	100·0
Fermentation products: (gm. per 100 gm. fermented carbohydrate)					
Ethanol	16·0	14·8	8·9	13·7	15·0
Formic acid	5·4	5·4	4·8	1·1	1·7
Acetic acid	19·1	10·4	3·9	42·2	29·0
Butyric acid	0·0	2·5	0·0	14·2	30·0
Lactic acid	43·1	52·5	73·6	9·6	4·8
Reducing substance calculated as dextrose	11·7	—	—	0·0	0·0

When the cellulose medium is inoculated with type *c* and also type *s*, or types *s* and III together, the fermentation time is remarkably shortened. In a liquid cellulose medium containing 1 per cent of cellulose wadding, type *c* did not ferment more than 40 per cent of the cellulose in ten days. In symbiosis with type *s*, type *c* fermented 70 per cent in eight days, and in symbiosis with both *s* and III, 100 per cent was fermented in six days.

The importance of the symbiosis is also evident from the butyric acid production. As a pure culture, type *s* produces only small amounts of butyric acid from dextrose. Together with the cellulose fermenter, it increases the butyric acid production, and when type III is added too, butyric acid is one of the main products. At the same time, the amount of lactic acid decreases, which indicates that the formation of butyric acid is in some way connected with the lactic acid formation.

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Trichinosis in Arctic Animals

IN the spring of 1947 a series of outbreaks of a disease, which at first was considered to be a paratyphoid fever, spread among the native population along the coast of north-western Greenland, particularly in the settlements around Disko Bay. More than three hundred cases with thirty-three deaths occurred. The main clinical symptoms were exanthema, generalized œdema, fever, muscular pain, gastro-intestinal symptoms and myocarditis. A special investigation was made by the State Serum Institute in Copenhagen, and it was proved that the disease was, in fact, trichinosis[1,2]. The diagnosis was verified by the positive reaction of the sera to microscopic precipitin tests with living larvæ of *Trichinella spiralis*[3,4], by demonstration of eosinophilia in the blood picture, by positive skin tests with trichina antigen, and, finally, by the finding of the parasites in the musculature of a patient who had succumbed to the infection. Most of the cases were apparently due to the consumption of walrus meat. Thus, at the settlement of Sukkertoppen, where only two cases occurred, both patients had eaten walrus meat,

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