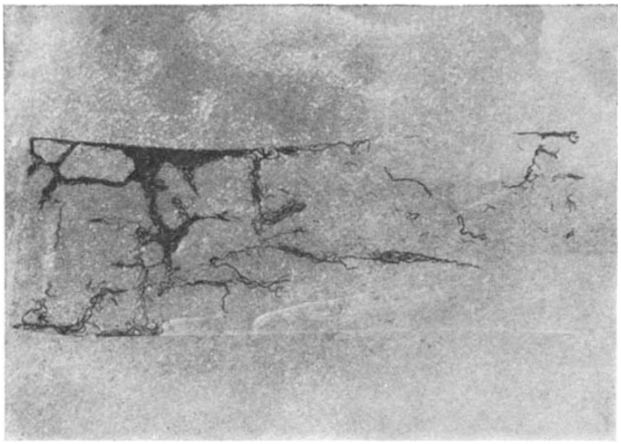
consists of two parts, joined perhaps by only a single exposed loop of polypeptide chain, that can be cleaved without other damage to either half of the molecule. This evidently is a case in which two different functional subunits are tethered together. The advantage to the cell of this arrangement is not at this stage clear.

INVERTEBRATES

Worms on Ice

ALTHOUGH ice worms (*Mesenchytraeus solifugus*) have been reported from Alaska, Yukon Territory, British Columbia and Washington State, few have been seen alive in their natural habitat by zoologists. Dr M. Tynen of the University of Alberta has recently found some in the ice of the Cliffe Glacier in Central Vancouver Island and on the Snow Dome of Mount Olympus, Washington State.



Ice worms in the snow of the Cliffe Glacier, Vancouver Island.

During the day, ice worms, which are black and about three quarters of an inch long, were found clumped together 6–12 inches deep under the drainage furrows of the névé. Although they were in hard crystalline ice, which could only be removed with the aid of an ice axe, the worms seemed to move with considerable ease. Tynen thinks that they may have crawled along the crystal boundaries. At dusk, the worms rose to the surface and started to disperse from the drainage furrows into the mounds between. They all disappeared, however, as the Sun rose. This nocturnal activity has been noted before.

The worms probably feed on the "redsnow" algae (*Chlamydomonas nivalis*) which collect in the drainage furrows together with windblown dust and other debris. The furrows seem to be self perpetuating: they tend to collect dust which imparts a darker colour to their surface, and this in turn results in increased ablation. The growth of the algae may be enhanced by mineral nutrients present in the dust, made mobile by rapidly melting ice. The drainage furrows could also trap windblown organic particles, such as pollen grains, which would be another possible source of food for the worms.

If the worms feed on algae and pollen grains, there is, of course, the question of how they digest cellulose. Many of those found had large ciliates in the fore-part of the gut, and these may have been symbionts that digest cellulose. Their occurrence, however, is by no means universal in ice worms, and they have not been noted before. Possibly, the mineral particles which are ingested, and can be seen in serial sections of the worm, act with the movements of the gut to triturate the food and break down cellulose.

The Cliffe Glacier, like all those in which ice worms have been recorded, is temperate, so that during the summer its temperature is never below 0° C. In winter the surface may be covered with 20–30 feet of insulating snow, so that the level where the worms live probably maintains a temperature at or very near the freezing point of water. Worms held in the hand with a piece of ice became very agitated as the ice melted, but Tynen thinks that this may have been a response as much to the change in consistency as to any increase in temperature.

Samples of the ice worm population of the Cliffe Glacier collected at the end of July contained a large proportion of immature individuals. It is not possible, however, to do more than speculate as to the pattern of the annual life cycle, for samples were not collected at other times of the year. There seems to be no reason why the worms could not feed throughout the winter on the resting stages of the snow algae, trapped with them under the winter snowfall. The immature individuals observed in July would then be mature by the following spring.

BACTERIA

The Stuff of Cell Walls

from our Microbiology Correspondent

MICROBIOLOGISTS are finding that changes in the chemical and physical environments can induce profound changes in microbial cell walls. Schleifer, for example, has noticed that changes in the nature and amount of the amino-acid complement of culture media can affect the type of substitution on the L-lysyl residues and the extent of interpeptide linkage in the walls of staphylococci (*J. Gen. Microbiol.*, **57**, xiv; 1969). Such modifications may be crucial in determining the susceptibility or resistance of bacteria to lytic enzymes.

Ellwood and Tempest did pioneering work when they described modifications in the anionic polysaccharide content of the walls of *Bacillus* which are dependent on magnesium and phosphate. Recently they obtained similar results with Gram positive cocci (*J. Gen. Microbiol.*, **57**, xv; 1969). And Garrett found that when *Bacillus subtilis* is starved of magnesium, not only is teichoic acid synthesized in the cell wall, but the synthesis of peptidoglycan is inhibited (*Biochem. J.*, **115**, 419; 1969). The likely explanation for this is that the protoplasmic membrane loses some of its structural and functional integrity when magnesium is lacking, and that the activity of membrane-bound peptidoglycan synthetases is precluded.

Peptidoglycan, which comprises about 5–10 per cent of the wall of Gram negative bacteria, and up to 80 per cent of the wall of Gram positive organisms, has been thought to be chiefly responsible for the mechanical strength and morphology of the cells. Rogers and his colleagues, for example, found an increase in the degree of cross-linking in peptidoglycan when certain mutants of *Bacillus subtilis* were converted from the spherical to the rod form by supplementing the medium