is the case with single amino-acids; this has been found to be true. (4) Certain amino-acids which yeast is unable to deaminate, for example, lysine, are nevertheless rapidly assimilated by yeast from complex mixtures[5].

A full account of this work will be published elsewhere.

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[1] Ehrlich, F., *Ber.*, **40**, 1027 (1907); **44**, 139 (1911); **45**, 883 (1912).
[2] For example, see Baldwin, E., "Dynamic Aspects of Biochemistry" 327 (Cambridge, 1948).
[3] Thorne, R. S. W., *J. Inst. Brew.*, **38**, 255 (1941).
[4] Thorne, R. S. W., *J. Inst. Brew.*, **46**, 18 (1949).
[5] Barton-Wright, E. C. (private communication).

Earthworm Chætæ

It is now established[1-3] that the hard cuticle of insects owes its rigidity and to some extent its colour to the tanning of its protein constituents by an orthoquinone. Similar tanning takes place to a less extent in Crustacea[4]. This type of hardening is not, however, confined to the Arthropoda, for Stephenson[5] has shown that in the Trematoda the egg capsules may be similarly hardened, and the following observations on the chætæ of the earthworm *Allolobophora longa*, suggested by their amber colour, indicate that they, too are hardened by quinone tanning.

Like the insect cuticle, the chætæ consist basically of a chitin-protein complex. As reported by Goodrich[6] for the chætæ of *Lumbricus*, they give positive reactions to the xanthoproteic and Millon tests, and, further, they are strongly positive to the Campbell chitin test. Evidence that the amber coloration of the chætæ is due to tanning by an orthoquinone is given by the fact that, even after boiling, they induce rapid oxidation of a mixture of dimethyl*para*phenylene-diamine and α-naphthol (Nadi reagent) found useful as an indicator of the presence of orthoquinones in insect and crustacean cuticles[2,4]. The amber-coloured distal portion of the chæta becomes deep blue, whereas the pale or colourless portion proximal to the nodulus remains uncoloured. The argentaffine reaction for polyphenols, aminophenols and polyamines is only moderately positive and is uniform over the length of the chæta. As might be expected from the staining reactions of the hard insect cuticle[2], the amber portion of the chæta does not stain with acid fuchsin, whereas the proximal portion stains readily. In view of these indications of quinone tanning, it is not surprising that the chætæ are bleached and softened by diaphanol (chlorine dioxide in glacial acetic acid), and it is evident that they strongly resemble the insect exocuticle in general chemical constitution.

Like the insect exocuticle, the chætæ are covered. possibly as a protection against abrasion, by a resistant surface layer of different composition. As noted by Goodrich[6], chætæ boiled in concentrated potassium hydroxide solution and then treated with cold concentrated hydrochloric acid dissolve at their proximal ends. On boiling the acid the distal end dissolves, but a thin sheath or covering cap remains. This sheath covers precisely that part of the chæta which is extruded in locomotion, and its resistance to solution in hydrochloric acid suggests a resemblance to the thin epicuticle of an insect[2].

It seems probable that quinone tanning of protein structures may be of widespread occurrence in the invertebrates, and it will be of interest to learn whether future observations confirm this view.

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[4] Dennell, R., *Proc. Roy. Soc.*, B, **134**, 485 (1947).
[5] Stephenson, W., *Parasit.*, **38**, 128 (1947).
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A Factor Limiting Downward Spread of some Scottish Mountain Plants

Some species of flowering plants on Scottish mountains are rarely found below 2,000 ft., and one factor which may limit their downward spread is sensitivity to winter rain. These plants have rarely been cultivated in the wetter parts of Britain, which may explain why this factor has received little or no attention, although it is quite familiar with many high alpines from the Himalayas.

The only relevant rainfall figure available is for the top of Ben Nevis, where the mean annual rainfall for a period of years exceeded 160 in., and fell as rain or snow on an average of 263 days a year. Plants growing above 2,500 ft. are subjected to almost daily rain in summer; but between October and May they are under a more or less continuous cover of dry snow, and the mean January temperature on the summit of Ben Nevis for the same period was 21° F. Conditions are, therefore, comparable with high alpine regions in other parts of the world, and in a mild lowland situation with only 40 in. of rain a year some Scottish mountain plants are difficult to keep in cultivation through the winter.

The following species are sensitive to winter wet and are liable to die off: *Veronica fruticans, Cerastium alpinum, C. arcticum, Arenaria rubella, Cherleria sedoides, Lychnis alpina* and *Gnaphalium supinum*. The latter species may be found on bare screes as low as 1,000 ft.; but at such levels it usually grows as an annual. Higher up, marked plants have been known to survive for five years. If protected from winter rain, the species listed above survive the winter and are quite unaffected by frost.

During the winter of 1946–47, the grass minimum temperature reached 0° F. at Auchincruive, but of more than a hundred plants grown in pots in the open, only *Athyrium flexile* was killed. Except for some littoral species growing in gritty soil (*Mertensia maritima, Primula scotica*), none of the arctic-alpines found at sea-level on the north Scottish coast are sensitive to heavy winter rain, nor are some of the high mountain plants. Among others, the following have survived for several years in the open: *Draba rupestris, D. incana, Saxifraga cernua, S. aizoides, S. oppositifolia, S. stellaris, Potentilla Crantzii, Veronica alpina*, all mountain species of *Salix, Oxytropis uralensis, O. campestris* and *Astragalus alpinus*.

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