Communic Acid, a New Diterpene Acid from Juniperus communis L.

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A new diterpene acid, communic acid (Ia) has been isolated as its sodium salt, C_{28}H_{50}O_{12}Na·H_{2}O, m.p. 228–230°, [α]_D +25° (methanol) from the bark of the common juniper, Juniperus communis L. The free acid, which easily polymerises, furnishes with diazomethane a stable methyl ester C_{28}H_{50}O_{12}, m.p. 105–106°, [α]_D +47°, λ_max 232 μm (ε 25 000). The ester gave a maleic anhydride adduct, C_{28}H_{50}O_{13}, m.p. 169–171°, [α]_D +85° and on ozonisation furnished formaldehyde in an amount indicative of the presence of two terminal methylene groups.

Methyl communate rapidly consumed one mole of hydrogen on catalytic hydrogenation (Pd/C, ethanol) giving methyl dihydrocommunate (II), C_{28}H_{50}O_{12}, b.p. 148–149°/0.5 mm, n_D^20 1.5062, [α]_D +55° which gave formaldehyde on ozonolysis in an amount indicative of one terminal methylene group.

Other products of ozonolysis of methyl dihydrocommunate and methyl communate include a keto-acid, C_{18}H_{30}O_{2} (III), m.p. 171–172°, [α]_D +12°, semicarbazone, C_{18}H_{30}O_{2}N_{2}, m.p. 200–201°.

Methyl communate was reduced with lithium aluminium hydride to communol (IV), C_{28}H_{50}O, b.p. 65°/0.01 mm, [α]_D +18°, λ_max 233 μm (ε 22 000), 3,5-dinitrobenzoate, C_{26}H_{40}O_{3}N_{3}, m.p. 115–117°, maleic anhydride adduct, C_{26}H_{40}O_{4}, m.p. 185–187°, [α]_D +49°. Reduction of communol in propanol with sodium gave iso-dihydrocommunol (V), C_{26}H_{40}O, b.p. 95°/0.1 mm, 3,5-dinitrobenzoate, C_{26}H_{40}O_{3}N_{3}, m.p. 107–108°.

Torulosol (VI), a new diterpene alcohol, which has been correlated with manool and with agathene dicarboxylic acid, gave on treatment with acetic anhydride and acetic acid mixture (1:1), the triene-ol (VII), λ_max 227 μm (ε 27 000), 3,5-dinitrobenzoate, C_{26}H_{40}O_{3}N_{3}, m.p. 73–74°. Reduction of this triene-ol in propanol with sodium gave the dihydroderivative (V), the 3,5-dinitrobenzoate of which was identical with iso-dihydrocommunol 3,5-dinitrobenzoate.

The identity of the two dihydro-derivatives (V) of (IV) and (VII), the difference (5 μm) between the U.V. absorption maxima of (IV) and (VII) and the formation of the C_{18} keto-acid (III) on ozonolysis of methyl communate show that communic acid possesses the structure and configuration (Ia).

Full details of this work including spectral data and direct correlations to agathene dicarboxylic acid will be described shortly elsewhere.

The U.V. spectra were taken in ethanol and optical rotations in chloroform solutions, unless otherwise stated. We thank Miss G. Hammarberg for these measurements. Satisfactory analyses were obtained for the compounds described, and we are grateful to Dr. A. Wettstein, Ciba Ltd., Basel, for several of them.

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Cytochrome c from Salmonella typhimurium
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In the course of growth experiments with Salmonella typhimurium, it was found that organisms grown in a simple synthetic medium with L-glutamate as sole carbon source were pink when looked at in bulk by transmitted light. Glucose grown organisms of the same strain were white or pale cream under similar conditions and a difference spectrum (glutamate cells/glucose cells) taken at high suspension densities showed strong absorption bands in the regions 400—420, 515—530 and 540—560 mµ for glutamate grown cells. These absorption bands suggested that the pink colour was due to cytochromes. Treatment of a dense suspension of glutamate grown bacteria (ca. 8 g wet weight of bacteria in all) as described by Tissières produced material with the absorption spectrum shown in Fig. 1. Sharp peaks were found at 416, 525 and 551 mµ in the reduced form and at 409 mµ in the oxidised form. These peaks are located in exactly the same positions as the absorption peaks of the cytochrome C₄ isolated by Tissières from Azoto bacter vinelandii.

Comparison of the quantitative relationship between the extinction coefficients at the absorption peaks for these cytochromes (see Table 1) shows that the Salmonella typhimurium cytochrome is very similar to that from Azoto bacter vinelandii, at least as far as absorption properties are concerned.

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Table 1. Relative extinction coefficients of bacterial cytochrome c preparations.

<table>
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<th>Organism</th>
<th>Reduced E₄₁₅</th>
<th>Reduced E₅₅₅</th>
<th>Reduced E₆₄₁</th>
<th>Oxidised E₄₄₀</th>
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<tr>
<td>A. vinelandii</td>
<td>9.0</td>
<td>1.0</td>
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<td>6.8</td>
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<td>S. typhimurium</td>
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<td>1.0</td>
<td>1.3</td>
<td>7.1</td>
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</table>

Fig. 1. Absorption spectra (1.0 cm light path) of the oxidised (+) and reduced (●) forms of the cytochrome preparation extracted from Salmonella typhimurium. The cytochrome was reduced with Na₂S₂O₄.