The Configuration of Communic Acid*

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Except for the configuration of the diene grouping the full structure of the bicyclic diterpene acid, communic acid (*1 a*), has been completely elucidated.[1,2] In this communication evidence will be presented for the *trans* configuration in the side chain of communic acid as shown in formula (*1 a*).

From the oleoresin of slash pine (*Pinus elliottii*) Joye and Lawrence have isolated a diterpene acid, elliotinoic acid,[3] with properties resembling those of communic acid. The two acids have recently been shown to be identical.[4]

Communic acid preparations from various sources, purified by recrystallisation processes according to the method of Erdtman *et al.*[2], have slightly different properties due to the presence of various amounts of impurities which can be detected by vapour phase or thin layer chromatography. Column chromatography on silver nitrate impregnated silica or preparative vapour phase chromatography of a methylated sample of such an impure communic acid preparation yielded pure methyl communate.

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The acyclic monoterpenes *trans*-α-, *trans*-β-, *cis*-α-, and *cis*-β-ocimene (*2—5*, respectively) have recently been studied by Ohloff *et al.*[5] The ocimenes of the *cis*-series possess spectral properties different from those of the *trans*-series.[3] The NMR spectra (Table 1) reveal that the H_A-proton of a *cis*-ocimene has its resonance position at a considerably lower field (δ 6.7 ppm) than that of the corresponding proton of a *trans*-ocimene (δ 6.3 ppm). Other minor differences in the NMR-spectra concern the resonance positions of the H_C- and H_D-protons and the coupling constants J_{AB}, J_{AC}, and J_{BC} (*cf.* Table 1). The UV-spectra (Table 2) show that the *cis*-ocimenes exhibit absorption at a longer wave length with a lower intensity than do the *trans*-ocimenes. These NMR- and UV-spectral properties are characteristic not only for the configuration of the diene grouping but also upon its conformation. The position of the non-conjugated double bond of an ocimene has almost no effect on these spectral properties. Thus, structural changes at positions more than two carbon atoms apart from the diene grouping have very little influence on the conformation of this grouping. The side chain of communic acid should therefore possess a conformation, and spectral properties, similar to those of the same structural unit of a corresponding ocimene if the compounds are observed under identical conditions. The very close agreement between spectral data of methyl communate and those of the *trans*-ocimenes (*cf.* Tables 1 and 2) leaves little doubt that communic acid possesses the *trans*-configuration shown in formula (*1 a*).

Table 1. Nuclear magnetic resonance data for the olefinic protons of the diene-groupings of methyl communate and ocimenes.

Compound		Chemical shifts, ppm[a]				spin-spin splittings cps				Ref.
		H_A	H_B	H_C	H_D	J_{AB}	J_{AC}	J_{BC}	J_{DE}	
Methyl communate	(*1b*)	6.28	5.02	4.85	5.40	17	10	1	6	This work[b]
trans-α-Ocimene	(*2*)	6.31	5.02	4.88	5.42	17	10	1.2	6	5
trans-β-Ocimene	(*3*)	6.30	5.00	4.87	5.39	17	10	1.2	7	5
cis-α-Ocimene	(*4*)	6.65	5.04	4.97	5.23	18	11	1.8	6	5
cis-β-Ocimene	(*5*)	6.73	5.11	5.03	5.28	18	11	1.8	7	5

[a] Chemical shifts ("δ-values") are given in ppm from TMS used as internal standard.

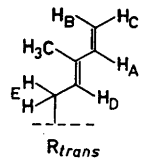
[b] Conditions as in Ref. 5 (Varian A-60, 60 Mc/s; 20 % solution in carbon tetrachloride at 25—30°).

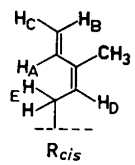
Table 2. Ultraviolet spectra of methyl communate and ocimenes.

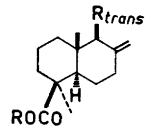
Compound	λ_{max}^{EtOH} mμ	ε	References
Methyl communate (*1b*)	232	27 600	This work[a] (*cf.* also Ref. 3)
trans-α-Ocimene (*2*)	231	27 300	5
trans-β-Ocimene (*3*)	232	27 600	5
cis-α-Ocimene (*4*)	234.5	21 600	5
cis-β-Ocimene (*5*)	237.5	21 000	5

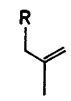
[a] The ultraviolet spectrum was recorded in ethanol (*cf.* Ref. 5).

The *trans*-form of communic acid should be a naturally occurring isomer since the conditions used for the isolation and purification of the acid and the various chromatographic treatments of the methyl ester do not affect a *cis-trans*-transformation (*cf.* the stability of the ocimenes [5]).









1a. R=H
b. R=CH_3

2. trans-α-ocimene, R=R_{trans}
4. cis-α-ocimene, R=R_{cis}

3. trans-β-ocimene, R=R_{trans}
5. cis-β-ocimene, R=R_{cis}

Experimental. The communic acid used in this investigation was isolated from the bark of *Juniperus arizonica* according to the procedure of Arya, Erdtman and Kubota.[2] The acid was esterified with ethereal diazomethane. The methyl ester was sublimed under reduced pressure (*ca.* 10^{-3} mm Hg; 95°) and recrystallised from methanol-ether, yielding a product with m.p. 104–106°, $[\alpha]_D$ + 48° (*c* 1.5 in $CHCl_3$), and λ_{max}^{EtOH} 232 mμ (ε 25 800). Ref. 2: m.p. 105–106°, $[\alpha]_D$ + 48° (*c* 2.0 $CHCl_3$), and λ_{max}^{EtOH} 232 mμ (ε 25 500). However, this product was shown to be slightly impure by VPC (1 % "E301" on "deactivated" 100–120 mesh "Gas-Chrom P"; column temperature, 150°) [6] and TLC (silver nitrate impregnated silica;[6] solvent, benzene-ether 50:1) analysis. Column chromatography on silver nitrate impregnated silica [6] (solvent, 2 % ether in light petroleum) followed by a recrystallisation from methanol-ether gave a homogeneous sample with the following properties: m.p. 105–106°, $[\alpha]_D$ + 48° (*c* 1.8 in $CHCl_3$), and λ_{max}^{EtOH} 232 mμ (ε 27 600); *cf.* the literature values reported by Joye *et al.*[4]: m.p. 105–106°, $[\alpha]_D^{25}$ + 48° (EtOH), λ_{max}^{EtOH} 232 mμ (ε 27 800).

Pure methyl communate could also be obtained by preparative VPC (10 % "E301" on "deactivated" 60–80 mesh "Gas-Chrom P"; column length, 2.5 m; column temperature 185°) similar to the procedure described by Joye *et al.*[4]

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1. Arya, V. P., Enzell, C., Erdtman, H. and Kubota, T. *Acta Chem. Scand.* **15** (1961) 225.
2. Arya, V. P., Erdtman, H. and Kubota, T. *Tetrahedron* **16** (1961) 255.
3. Joye, Jr., N. M. and Lawrence, R. V. *J. Org. Chem.* **28** (1963) 3274.
4. Joye, Jr., N. M., Roberts, E. M., Lawrence, R. V., Gough, L. J., Soffer, M. D. and Korman, O. *J. Org. Chem.* **30** (1965) 429.

5. Ohloff, G., Seibl, J. and Kováts, E. sz. *Ann.* **675** (1964) 84.
6. Norin, T. and Westfelt, L. *Acta Chem. Scand.* **17** (1963) 1828.

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Phosphatides of Normal Human Serum. Part II. Fatty Acids of Phosphatidyl Inositol and Other Phosphatidyl Compounds*,**

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Phosphatidyl inositol (PI) and the corresponding lyso compound (LPI) were recently isolated from a lipid extract of pooled normal serum.[1] The present report describes the analysis of fatty acids in these lipids and other phosphatidyl compounds of our serum extract.

The phospholipid samples have been described previously (the phosphatidyl ethanolamines (PE) were purified further by eliminating the plasmalogens); being both pure and representative our samples were particularly suitable for fatty acid analysis.[1] Methanolysis of the lipids, and subsequent analysis of the fatty acid methylesters were carried out by methods described elsewhere.[2] The results are shown in Table 1. Phosphatidyl inositol was rich in stearic and arachidonic acid, but it contained relatively little of palmitic and linoleic acid. Lecithin (PC) showed just the opposite figures, high palmitic and linoleic acid, but relatively low stearic and arachidonic acid. Phosphatidyl ethanolamine (PE) revealed intermediate figures, but it had a high docosahexaenoic acid value.

Table 1. Fatty acid composition of serum phosphatides

	Relative amounts of principal acids						
	16:0	18:0	18:1	18:2	20:3	20:4	22:6
PI	7.5	40	9.8	4.7	2.9	28	3.8
LPI	6.0	27	13	6.8	4.2	37	3.2
PC	32	14	16	22	2.7	6.1	3.2
LPC	54	24	11	8.0	tr.	2.1	tr.
PE	14	28	10	11	1.8	15	13
LPE	3.5	5.6	8.0	17	3.9	33	17

Table 1 shows also that lysophosphatidyl inositol had approximately the same fatty acid composition as phosphatidyl inositol, whereas lysolecithin (LPC) was more saturated, and lysophosphatidyl ethanolamine (LPE) more unsaturated than the corresponding diacyl phosphatides.

Recent work from this and other laboratories has shown that phospholipase A liberates fatty acids specifically from the C-2 position of the glycerol moiety of phosphatidyl inositol.[3-4] Positional distribution of the fatty acids could thus be determined in the serum inositide. The analysis was carried out with *Crotalus adamanteus* venom under conditions described elsewhere.[4] The results are given in Table 2 together with figures for the other phosphatidyl lipids of our extract. Phosphatidyl inositol revealed mostly saturated acids and oleic acid on the C-1 position, and mostly unsaturated acids on C-2. Thus it was similar to the other serum phospholipids. Phosphatidyl inositol from other sources too appears to have the

Table 2. Positional distribution of fatty acids in serum phosphatides

	Relative amounts of principal acids						
	16:0	18:0	18:1	18:2	20:3	20:4	22:6
C-1 position							
PI	17	74	8.0				
PC	66	26	6.1	1.0			
PE	32	51	12	3.1			
C-2 position							
PI	6.6	2.7	21	10	4.9	45	4.1
PC	2.7	tr.	22	47	4.9	12	6.1
PE	4.3	2.1	11	24	1.9	27	22.2

* Part I. *Acta Chem. Scand.* **17** (1963) 1925.
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