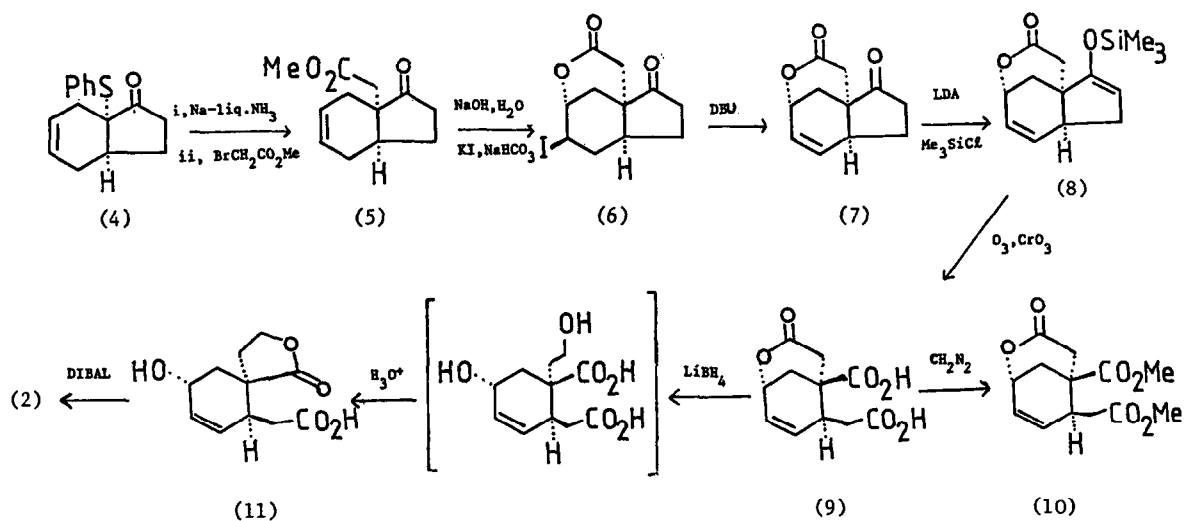


65% of the dicarboxylic acid (9). This product was fully characterized as the diester (10), formed by treatment of the diacid with diazomethane, and exhibiting two distinct singlets at $\delta 3.73$ and $\delta 3.67$ in the nmr⁵. Selective reduction of the lactone in (9) with lithium borohydride gave, after acidic work up, 60% of the spiro lactone (11) exhibiting characteristic ir absorptions at 1780 and 1710 cm^{-1} . A consideration of the other lactones that could be formed in this sequence shows that their formation is disfavoured on steric grounds. By this selective lactonisation we have essentially 'internally activated' one of the two carboxylic acid functions to further reaction. Thus reduction with a five-fold excess of diisobutylaluminium hydride of the spiro lactone (11) gave, after acidic work up, the required δ -lactone (2) in 45% yield. In conclusion, this differentiation of two equivalent functions permits the facile preparation of a general intermediate for the synthesis of the elemanolide lactones. The route is enhanced by the avoidance of any formal protection-deprotection sequence which is unusual in the synthesis of such a highly oxygenated compound.

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REFERENCES AND NOTES

- Some of this work was carried out at Brunel University, Uxbridge, England.
- For example, see: a) P.A. Grieco, M. Nishizawa, T. Oguri, S.D. Burke and N. Marinovic, *J. Amer. Chem. Soc.*, (1977), **99**, 5773. b) S. Danishefsky, P.F. Schuda, T. Kitahara and S.J. Etheredge, *J. Amer. Chem. Soc.*, (1977), **99**, 6066. c) R.M. Schlessinger and G.R. Kieczkowski, *J. Amer. Chem. Soc.*, (1978), **100**, 1938. d) M. Isobe, H. Iio, T. Kawai and T. Goto, *J. Amer. Chem. Soc.*, (1978), **100**, 1940.
- M. Ando, K. Tajima and K. Takase, *J. Org. Chem.*, (1983), **48**, 1210 and references therein.
- T.V. Lee and J. Toczek, *J.C.S. Chem. Commun.*, (1982), 968.
- All new compounds gave satisfactory spectral and analytical data.

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