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2-(2-Chloroacetyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline

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Key indicators

Single-crystal X-ray study
T = 296 K
Mean σ(C–C) = 0.004 Å
R factor = 0.053
wR factor = 0.141
Data-to-parameter ratio = 15.3

For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

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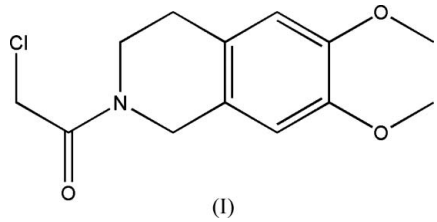
In the molecule of the title compound, $C_{13}H_{16}ClNO_3$, the N-containing ring is not planar and has a flattened boat form. Intermolecular C—H···O hydrogen bonds link the molecules to form infinite chains and may be effective in the stabilization of the crystal structure.

Comment

Some of the substituted tetrahydroisoquinolines are known to produce a variety of pharmacological and biochemical actions on the adrenergic nervous system (Smissman *et al.*, 1976). The pharmacological effects of tetrahydroisoquinolines include lypolytic (Shonk *et al.*, 1971), bronchial relaxant (Miller *et al.*, 1975) and hypotensive activities (Holtz *et al.*, 1964). In recent years, recognition of the importance of tetrahydroisoquinolines as antihypertensive or anti-arrhythmic agents has resulted in increased interest in related compounds (Harrold *et al.*, 1988). Tetrahydroisoquinoline intermediates have been prepared in order to search for novel biological activity acting on calcium or potassium channels (Dai *et al.*, 1996). We report here the crystal structure of the title compound, (I), which is a substituted tetrahydroisoquinoline.



(I)

In the molecule of (I) (Fig. 1), the bond lengths and angles are within normal ranges (Allen *et al.*, 1987). Ring *A* (N/C6–C10) is not planar, having a total puckering amplitude Q_T = 1.016 (5) Å and a flattened boat form [φ = −0.59 (4)° and θ = 39.77 (3)°] (Cremer & Pople, 1975). Ring *A* has a pseudo-mirror plane passing through atoms C8 and C10, as can be deduced from the torsion angles (Table 1). Ring *B* (C3–C6/C10/C11) is, of course, planar.

As can be seen from the packing diagram (Fig. 2), intermolecular C—H···O hydrogen bonds (Table 2) link the molecules to form infinite chains, in which they may be effective in the stabilization of the crystal structure. Dipole–dipole and van der Waals interactions are also effective in the molecular packing.

Experimental

The title compound, (I), was prepared from a mixture of 6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline (6.0 g, 31 mmol), synthe-

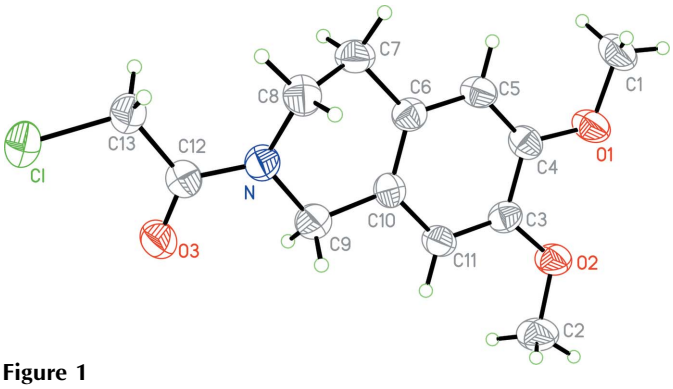


Figure 1
The molecular structure of (I), with the atom-numbering scheme. Displacement ellipsoids are drawn at the 50% probability level.

sized through the Pictet–Spengler reaction (Smissman *et al.*, 1976), and $ClCH_2COCl$ (25.5 g, 226 mmol) stirred in CH_2Cl_2 (100 ml) in an ice-bath for 3 h. Saturated aqueous $NaHCO_3$ solution (100 ml) was added to this mixture. The layers were separated, and the aqueous layer was further extracted with CH_2Cl_2 (50 ml). The combined organic phases were washed with brine (100 ml), dried ($MgSO_4$), and concentrated *in vacuo*. The flaxen crude product was recrystallized from EtOH and afforded (I) as a white solid (yield 7.3 g, 87.4%; m.p. 386 K). Crystals were obtained by dissolving the white solid (0.3 g) in AcOEt–EtOH (2:1, 20 ml) and evaporating the solvents slowly at room temperature for about 15 d.

Crystal data

$C_{13}H_{16}ClNO_3$
M_r = 269.72
Monoclinic, $P2_1/a$
a = 8.6561 (9) Å
b = 17.7944 (18) Å
c = 9.3090 (11) Å
β = 117.22 (3)°
V = 1275.1 (4) Å^3
Z = 4
D_x = 1.405 Mg m^{-3}
Mo $K\alpha$ radiation
μ = 0.30 mm^{-1}
T = 296 (2) K
Block, colourless
0.30 × 0.20 × 0.10 mm

Data collection

Enraf–Nonius CAD4 diffractometer
$\omega/2\theta$ scans
Absorption correction: ψ scan (North *et al.*, 1968)
T_{min} = 0.916, T_{max} = 0.971
2662 measured reflections
2496 independent reflections
1541 reflections with $I > 2\sigma(I)$
R_{int} = 0.023
θ_{max} = 26.0°
3 standard reflections
every 200 reflections
intensity decay: 1%

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.053
$wR(F^2)$ = 0.141
S = 1.03
2496 reflections
163 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.06P)^2 + 0.34P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max}$ = 0.28 e Å^{-3}
$\Delta\rho_{min}$ = −0.24 e Å^{-3}

Table 1
Selected torsion angles (°).

C10—C6—C7—C8	27.9 (4)	C8—N—C9—C10	−28.0 (4)
C9—N—C8—C7	58.7 (3)	C7—C6—C10—C9	1.9 (4)
C6—C7—C8—N	−56.4 (3)	N—C9—C10—C6	−3.1 (4)

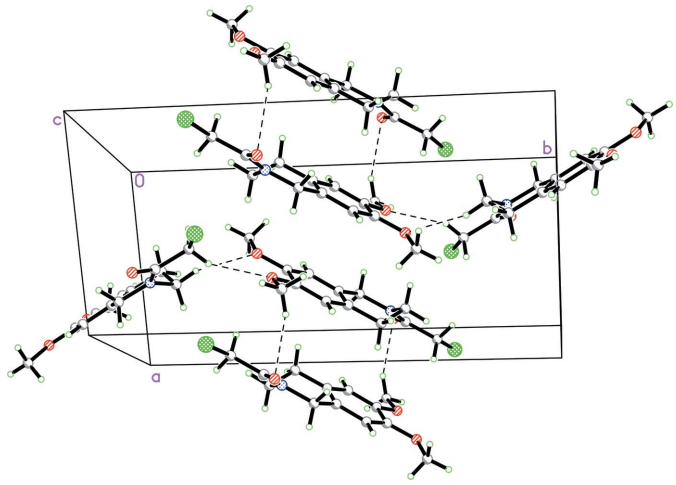


Figure 2
A packing diagram for (I). Hydrogen bonds are shown as dashed lines.

Table 2
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
C1—H1C···O3^{i}	0.96	2.57	3.473 (5)	156
C2—H2C···O3^{ii}	0.96	2.58	3.308 (4)	133
C8—H8B···O2^{iii}	0.97	2.53	3.431 (4)	155
C13—H13B···O1^{iii}	0.97	2.50	3.364 (4)	148

Symmetry codes: (i) $-x+1, -y, -z+1$; (ii) $-x+2, -y, -z+2$; (iii) $-x+\frac{3}{2}, y+\frac{1}{2}, -z+1$.

H atoms were positioned geometrically, with C—H = 0.93, 0.96 and 0.97 Å for aromatic, methylene and methyl H, respectively, and constrained to ride on their parent atoms, with U_{iso}(H) = xU_{eq}(C), where x = 1.5 for methyl H and x = 1.2 for all other H.

Data collection: *CAD-4 Software* (Enraf–Nonius, 1989); cell refinement: *CAD-4 Software*; data reduction: *XCAD4* (Harms & Wocadlo, 1995); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *SHELXTL* (Bruker, 2000); software used to prepare material for publication: *SHELXTL*.

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