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4-Methyl-2-*n*-propyl-1*H*-benzimidazole-6-carboxylic acid

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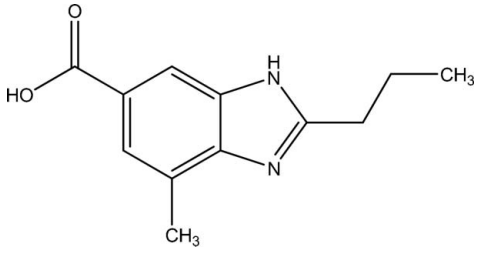
Key indicators: single-crystal X-ray study; T = 293 K; mean σ(C–C) = 0.005 Å; R factor = 0.072; wR factor = 0.195; data-to-parameter ratio = 15.8.

In the title compound, $C_{12}H_{14}N_2O_2$, the benzene ring and imidazole ring are almost coplanar, making a dihedral angle of 2.47 (14)°. Intermolecular O—H···N, N—H···O and C—H···O hydrogen bonds stabilize the crystal structure.

Related literature

For the use of the title compound as an intermediate in the preparation of telmisartan, see: Ries *et al.* (1993). For the biological activity of telmisartan, see: Engeli *et al.* (2000); Goossens *et al.* (2003). For reference structural data, see: Allen *et al.* (1987). For related literature, see: Kintscher *et al.* (2004).



Experimental

Crystal data

$C_{12}H_{14}N_2O_2$
M_r = 218.25
Tetragonal, $I4_1/a$
a = 12.0548 (17) Å
c = 31.899 (6) Å
V = 4635.5 (13) Å^3
Z = 16
Mo $K\alpha$ radiation
μ = 0.09 mm^{-1}
T = 293 (2) K
0.30 × 0.30 × 0.10 mm

Data collection

Enraf–Nonuis CAD-4 diffractometer
Absorption correction: ψ scan (North *et al.*, 1968)
T_{min} = 0.975, T_{max} = 0.991
4426 measured reflections
2105 independent reflections
1304 reflections with $I > 2\sigma(I)$
R_{int} = 0.042
3 standard reflections
every 200 reflections
intensity decay: none

Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.072
$wR(F^2)$ = 0.195
S = 1.00
2105 reflections
133 parameters
2 restraints
H-atom parameters constrained
$\Delta\rho_{max}$ = 0.62 e Å^{-3}
$\Delta\rho_{min}$ = −0.39 e Å^{-3}

Table 1
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
C3—H3B···O2^{i}	0.97	2.56	3.399 (4)	144
C11—H11A···O2^{ii}	0.96	2.66	3.587 (4)	163
O2—H2C···N1^{iii}	0.82	1.80	2.562 (3)	153
N2—H2D···O1^{iv}	0.86	1.83	2.673 (3)	165

Symmetry codes: (i) $y+\frac{3}{4}, -x+\frac{3}{4}, z-\frac{1}{4}$; (ii) $-y+\frac{5}{4}, x-\frac{1}{4}, z-\frac{1}{4}$; (iii) $y+\frac{1}{4}, -x+\frac{5}{4}, z+\frac{1}{4}$; (iv) $x, y-\frac{1}{2}, -z$.

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, 2008); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *SHELXTL* (Sheldrick, 2008); software used to prepare material for publication: *SHELXTL*.

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: SJ2567).

References

Allen, F. H., Kennard, O., Watson, D. G., Brammer, L., Orpen, A. G. & Taylor, R. (1987). *J. Chem. Soc. Perkin Trans. 2*, pp. S1–19.
Engeli, S., Negrel, R. & Sharma, A. M. (2000). *Hypertension*, **35**, 1270–1277.
Enraf–Nonius (1989). *CAD-4 Software*. Enraf–Nonius, Delft, The Netherlands.
Goossens, G. H., Blaak, E. E. & van Baak, M. A. (2003). *Obes. Rev.* **4**, 43–55.
Harms, K. & Wocadlo, S. (1995). *XCAD4*. University of Marburg, Germany.
Kintscher, U., Lyon, C. J. & Law, R. E. (2004). *Front. Biosci.* **9**, 359–369.
North, A. C. T., Phillips, D. C. & Mathews, F. S. (1968). *Acta Cryst.* A**24**, 351–359.
Ries, U. J., Mihm, G. & Narr, B. (1993). *J. Med. Chem.* **36**, 4040–4051.
Sheldrick, G. M. (2008). *Acta Cryst.* A**64**, 112–122.

supporting information

Acta Cryst. (2009). E**65**, o226 [doi:10.1107/S1600536808043420]

4-Methyl-2-*n*-propyl-1*H*-benzimidazole-6-carboxylic acid

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S1. Comment

The title compound (I), Fig. 1, 4-methyl-2-n-propyl-1*H*-benzimidazole-6-carboxylic acid is an important intermediate in the preparation of the angiotensin II receptor blocker telmisartan (Ries *et al.*,1993). Telmisartan is used as a therapeutic tool for metabolic problems, including visceral obesity (Engeli *et al.*, 2000; Goossens *et al.*, 2003). Bond lengths in the compound are within normal ranges (Allen *et al.*, 1987) and the benzene and imidazole rings are coplanar with a dihedral angle of 2.47 (14)° between them.

In the crystal structure, intermolecular O—H···N, N—H···O and C—H···O hydrogen bonds, Table 1, link the molecules, Fig. 2, and stabilise the crystal packing.

S2. Experimental

The title compound was prepared from methyl 4-(butyrylamino)-5-methyl -3-aminobenzoate (13 g 52 mmol) in xylene (60 mL) and hydrochloric acid (130 mL). The mixture was refluxed for 3 h at 423 K, concentrated under reduced pressure then 80mL of methanol and 110 mL 15% sodium hydroxide were added. This solution was further , refluxed for 5 h at 383 K. The pH was adjusted to below 7 and the product filtered. Recrystallization of product from a mixture of ethanol/water (5:1) afforded the white powder. Crystals were obtained by dissolving the product (1.0 g) in acetone (10 ml) and evaporating slowly at room temperature for about 30 d.

S3. Refinement

H All atoms were positioned geometrically, with N—H = 0.86 Å (for NH) and C—H = 0.93, 0.97 and 0.96 Å for aromatic, methine and methyl H, and constrained to ride on their parent atoms, with U_{iso}(H) = xU_{eq}(C,*N*), where x = 1.5 for methyl H, and x = 1.2 for all other H atoms.

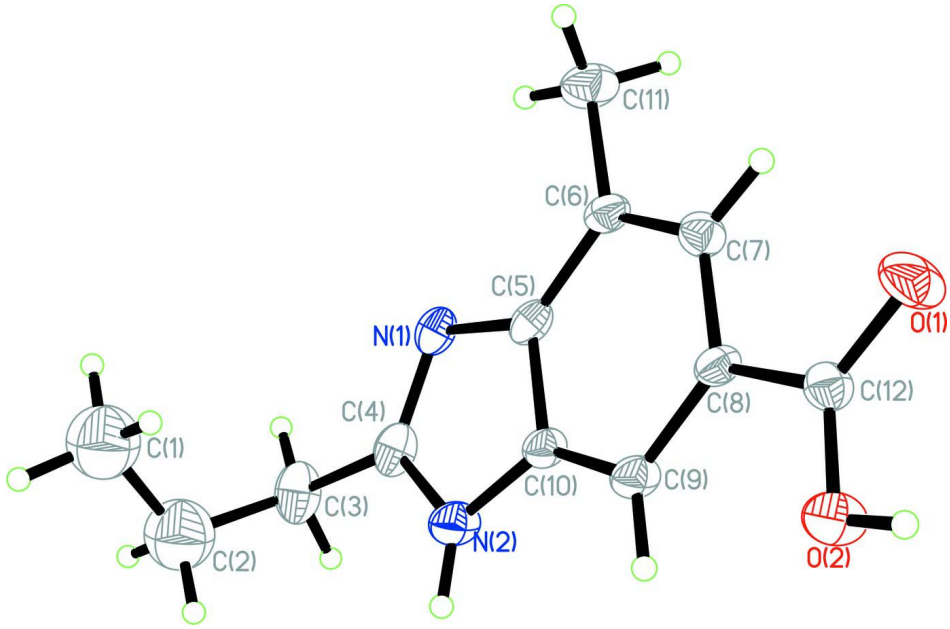

Figure 1

The molecular structure of the title molecule, with the atom-numbering scheme. Displacement ellipsoids are drawn at the 30% probability level.

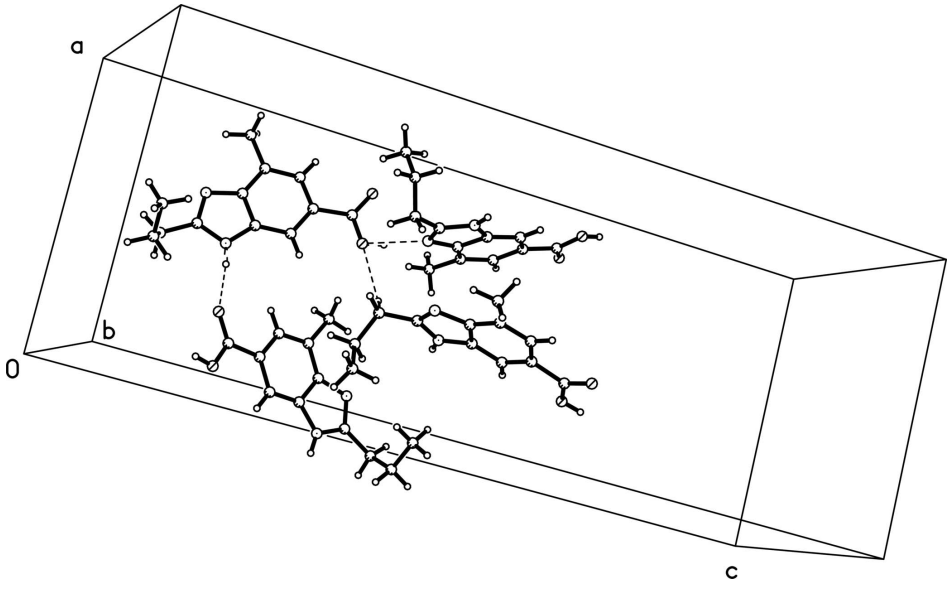

Figure 2

Crystal packing of the title compound with hydrogen bonds drawn as dashed lines.

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Crystal data

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$M_r = 218.25$
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$c = 31.899\ (6)$ Å
$V = 4635.5\ (13)$ Å^3
$Z = 16$

$F(000) = 1856$
$D_x = 1.251$ Mg m^{-3}
Mo $K\alpha$ radiation, $\lambda = 0.71073$ Å
Cell parameters from 25 reflections
$\theta = 10–13°$
$\mu = 0.09$ mm^{-1}
$T = 293$ K
Block, colorless
0.30 × 0.30 × 0.10 mm

Data collection

Enraf–Nonuis CAD-4 diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
$\omega/2\theta$ scans
Absorption correction: ψ scan (North *et al.*, 1968)
$T_{min} = 0.975$, $T_{max} = 0.991$
4426 measured reflections
2105 independent reflections
1304 reflections with $I > 2\sigma(I)$
$R_{int} = 0.042$
$\theta_{max} = 25.2°$, $\theta_{min} = 1.8°$
$h = -9 \rightarrow 10$
$k = 0 \rightarrow 14$
$l = 0 \rightarrow 38$
3 standard reflections every 200 reflections
intensity decay: none

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)] = 0.072$
$wR(F^2) = 0.195$
$S = 1.00$
2105 reflections
133 parameters
2 restraints
Primary atom site location: structure-invariant direct methods
Secondary atom site location: difference Fourier map
Hydrogen site location: inferred from neighbouring sites
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.1P)^2 + 5P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max} = 0.62$ e Å^{-3}
$\Delta\rho_{min} = -0.39$ e Å^{-3}
Extinction correction: *SHELXL97* (Sheldrick, 2008)
Extinction coefficient: 0.039 (3)

Special details

Geometry. All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

Refinement. Refinement of F^2 against ALL reflections. The weighted R-factor wR and goodness of fit S are based on F^2, conventional R-factors R are based on F, with F set to zero for negative F^2. The threshold expression of $F^2 > \sigma(F^2)$ is used only for calculating R-factors(gt) *etc*. and is not relevant to the choice of reflections for refinement. R-factors based on F^2 are statistically about twice as large as those based on F, and R- factors based on ALL data will be even larger.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å²)

	x	*y*	*z*	U_{iso}*/U_{eq}
O1	0.7815 (2)	0.4947 (2)	0.07388 (7)	0.0591 (8)
O2	0.7256 (2)	0.32125 (18)	0.07006 (6)	0.0471 (7)
H2C	0.7077	0.3341	0.0944	0.071*
N1	0.8807 (2)	0.3584 (2)	−0.11544 (7)	0.0376 (7)
N2	0.8170 (2)	0.2123 (2)	−0.08282 (7)	0.0420 (7)
H2D	0.7940	0.1458	−0.0785	0.050*
C1	0.6545 (5)	0.2486 (5)	−0.18175 (17)	0.104
H1B	0.5891	0.2171	−0.1941	0.155*
H1C	0.6843	0.3042	−0.2001	0.155*

H1D	0.6358	0.2818	−0.1553	0.155*
C2	0.7407 (4)	0.1577 (5)	−0.17491 (18)	0.100
H2A	0.7097	0.1043	−0.1554	0.120*
H2B	0.7513	0.1195	−0.2014	0.120*
C3	0.8501 (3)	0.1904 (3)	−0.15925 (10)	0.0561 (10)
H3A	0.8860	0.2355	−0.1805	0.067*
H3B	0.8945	0.1239	−0.1557	0.067*
C4	0.8509 (3)	0.2525 (3)	−0.11926 (9)	0.0402 (8)
C5	0.8656 (2)	0.3874 (3)	−0.07355 (9)	0.0324 (7)
C6	0.8820 (2)	0.4885 (2)	−0.05283 (9)	0.0341 (7)
C7	0.8539 (2)	0.4896 (3)	−0.01107 (9)	0.0351 (7)
H7A	0.8653	0.5543	0.0042	0.042*
C8	0.8085 (2)	0.3966 (2)	0.00960 (9)	0.0315 (7)
C9	0.7938 (3)	0.2969 (2)	−0.01128 (9)	0.0353 (8)
H9A	0.7645	0.2350	0.0021	0.042*
C10	0.8246 (3)	0.2941 (2)	−0.05289 (9)	0.0325 (7)
C11	0.9269 (3)	0.5876 (3)	−0.07572 (11)	0.0523 (10)
H11A	0.9410	0.5681	−0.1044	0.078*
H11B	0.9947	0.6112	−0.0627	0.078*
H11C	0.8737	0.6467	−0.0747	0.078*
C12	0.7704 (3)	0.4069 (2)	0.05433 (9)	0.0352 (7)

Atomic displacement parameters (Å²)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
O1	0.097 (2)	0.0411 (14)	0.0391 (14)	−0.0157 (14)	0.0171 (13)	−0.0130 (11)
O2	0.0713 (17)	0.0394 (13)	0.0306 (12)	−0.0073 (12)	0.0238 (11)	−0.0056 (10)
N1	0.0401 (16)	0.0475 (17)	0.0250 (13)	0.0030 (13)	0.0022 (11)	0.0055 (12)
N2	0.0599 (19)	0.0366 (15)	0.0295 (13)	−0.0022 (13)	0.0098 (13)	0.0006 (12)
C1	0.104	0.104	0.104	0.000	0.000	0.000
C2	0.100	0.100	0.100	0.000	0.000	0.000
C3	0.062 (2)	0.079 (3)	0.0275 (18)	0.006 (2)	0.0032 (16)	−0.0106 (17)
C4	0.0392 (19)	0.056 (2)	0.0250 (16)	0.0079 (16)	0.0066 (14)	0.0000 (15)
C5	0.0309 (16)	0.0392 (18)	0.0271 (15)	0.0063 (13)	0.0052 (13)	0.0077 (13)
C6	0.0356 (17)	0.0303 (17)	0.0365 (17)	−0.0015 (13)	0.0005 (14)	0.0093 (13)
C7	0.0379 (18)	0.0330 (17)	0.0345 (16)	−0.0008 (13)	0.0032 (13)	−0.0027 (13)
C8	0.0410 (18)	0.0273 (16)	0.0261 (15)	0.0038 (13)	0.0033 (13)	0.0040 (12)
C9	0.0472 (19)	0.0318 (17)	0.0269 (16)	−0.0020 (14)	0.0091 (13)	0.0032 (13)
C10	0.0454 (19)	0.0293 (16)	0.0229 (14)	0.0015 (13)	0.0046 (13)	0.0015 (12)
C11	0.064 (2)	0.041 (2)	0.052 (2)	−0.0089 (17)	0.0104 (18)	0.0146 (17)
C12	0.0430 (19)	0.0321 (17)	0.0305 (16)	0.0009 (14)	0.0040 (14)	−0.0042 (14)

Geometric parameters (Å, º)

O1—C12	1.237 (4)	C3—H3A	0.9700
O2—C12	1.268 (3)	C3—H3B	0.9700
O2—H2C	0.8200	C5—C10	1.394 (4)
N1—C4	1.332 (4)	C5—C6	1.400 (4)

N1—C5	1.393 (4)	C6—C7	1.374 (4)
N2—C4	1.324 (4)	C6—C11	1.501 (4)
N2—C10	1.376 (4)	C7—C8	1.411 (4)
N2—H2D	0.8600	C7—H7A	0.9300
C1—C2	1.526 (6)	C8—C9	1.385 (4)
C1—H1B	0.9600	C8—C12	1.504 (4)
C1—H1C	0.9600	C9—C10	1.379 (4)
C1—H1D	0.9600	C9—H9A	0.9300
C2—C3	1.465 (6)	C11—H11A	0.9600
C2—H2A	0.9700	C11—H11B	0.9600
C2—H2B	0.9700	C11—H11C	0.9600
C3—C4	1.479 (4)		

C12—O2—H2C	109.5	N1—C5—C6	130.7 (3)
C4—N1—C5	107.0 (2)	C10—C5—C6	121.9 (3)
C4—N2—C10	109.1 (3)	C7—C6—C5	115.5 (3)
C4—N2—H2D	125.5	C7—C6—C11	123.5 (3)
C10—N2—H2D	125.5	C5—C6—C11	120.9 (3)
C2—C1—H1B	109.5	C6—C7—C8	122.7 (3)
C2—C1—H1C	109.5	C6—C7—H7A	118.6
H1B—C1—H1C	109.5	C8—C7—H7A	118.6
C2—C1—H1D	109.5	C9—C8—C7	120.9 (3)
H1B—C1—H1D	109.5	C9—C8—C12	119.2 (3)
H1C—C1—H1D	109.5	C7—C8—C12	119.8 (3)
C3—C2—C1	118.0 (5)	C10—C9—C8	116.7 (3)
C3—C2—H2A	107.8	C10—C9—H9A	121.6
C1—C2—H2A	107.8	C8—C9—H9A	121.6
C3—C2—H2B	107.8	N2—C10—C9	131.9 (3)
C1—C2—H2B	107.8	N2—C10—C5	105.9 (2)
H2A—C2—H2B	107.2	C9—C10—C5	122.1 (3)
C2—C3—C4	115.8 (4)	C6—C11—H11A	109.5
C2—C3—H3A	108.3	C6—C11—H11B	109.5
C4—C3—H3A	108.3	H11A—C11—H11B	109.5
C2—C3—H3B	108.3	C6—C11—H11C	109.5
C4—C3—H3B	108.3	H11A—C11—H11C	109.5
H3A—C3—H3B	107.4	H11B—C11—H11C	109.5
N2—C4—N1	110.7 (3)	O1—C12—O2	122.9 (3)
N2—C4—C3	124.8 (3)	O1—C12—C8	121.1 (3)
N1—C4—C3	124.5 (3)	O2—C12—C8	116.0 (3)
N1—C5—C10	107.3 (3)		

C1—C2—C3—C4	56.3 (6)	C6—C7—C8—C12	−174.6 (3)
C10—N2—C4—N1	−0.2 (4)	C7—C8—C9—C10	−0.6 (5)
C10—N2—C4—C3	−177.3 (3)	C12—C8—C9—C10	176.5 (3)
C5—N1—C4—N2	0.5 (4)	C4—N2—C10—C9	175.5 (3)
C5—N1—C4—C3	177.5 (3)	C4—N2—C10—C5	−0.1 (4)
C2—C3—C4—N2	63.9 (5)	C8—C9—C10—N2	−176.8 (3)
C2—C3—C4—N1	−112.7 (4)	C8—C9—C10—C5	−1.8 (5)

C4—N1—C5—C10	−0.5 (3)	N1—C5—C10—N2	0.4 (3)
C4—N1—C5—C6	−178.6 (3)	C6—C5—C10—N2	178.6 (3)
N1—C5—C6—C7	177.2 (3)	N1—C5—C10—C9	−175.7 (3)
C10—C5—C6—C7	−0.6 (4)	C6—C5—C10—C9	2.5 (5)
N1—C5—C6—C11	−2.5 (5)	C9—C8—C12—O1	−179.5 (3)
C10—C5—C6—C11	179.7 (3)	C7—C8—C12—O1	−2.4 (5)
C5—C6—C7—C8	−1.8 (4)	C9—C8—C12—O2	−0.4 (4)
C11—C6—C7—C8	177.9 (3)	C7—C8—C12—O2	176.7 (3)
C6—C7—C8—C9	2.4 (5)		

Hydrogen-bond geometry (Å, º)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
C3—H3*B*···O2^{i}	0.97	2.56	3.399 (4)	144
C11—H11*A*···O2^{ii}	0.96	2.66	3.587 (4)	163
O2—H2*C*···N1^{iii}	0.82	1.80	2.562 (3)	153
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Symmetry codes: (i) *y*+3/4, −*x*+3/4, *z*−1/4; (ii) −*y*+5/4, *x*−1/4, *z*−1/4; (iii) *y*+1/4, −*x*+5/4, *z*+1/4; (iv) *x*, *y*−1/2, −*z*.