Table 1. *Fractional atomic coordinates and equivalent isotropic displacement parameters (Å²)*

$U_{eq} = (1/3)\Sigma_i\Sigma_j U_{ij} a_i^* a_j^* \mathbf{a}_i.\mathbf{a}_j.$

	x	*y*	*z*	U_{eq}
S1	0.1099 (1)	0.5438 (1)	0.1841 (1)	0.0414 (4)
C2	−0.0817 (6)	0.6095 (2)	0.2912 (3)	0.0396 (7)
C3	−0.0583 (7)	0.7063 (2)	0.2655 (3)	0.0486 (8)
C4	0.1130 (6)	0.7254 (2)	0.1588 (4)	0.0491 (8)
C5	0.2200 (6)	0.6456 (2)	0.1042 (3)	0.0415 (7)
C6	0.4109 (8)	0.6393 (3)	−0.0101 (4)	0.0530 (9)
C7	−0.2523 (6)	0.5617 (2)	0.3866 (3)	0.0394 (7)
O8	−0.2671 (4)	0.47208 (13)	0.3891 (2)	0.0476 (6)
O9	−0.3845 (5)	0.61708 (15)	0.4653 (2)	0.0538 (7)

Table 2. *Selected geometric parameters (Å, °)*

S1—C2	1.710 (3)	C4—C5	1.353 (4)
S1—C5	1.715 (3)	C5—C6	1.494 (4)
C2—C3	1.376 (4)	C7—O8	1.251 (3)
C2—C7	1.448 (4)	C7—O9	1.287 (3)
C3—C4	1.394 (4)		
C2—S1—C5	91.7 (1)	C4—C5—C6	128.0 (3)
C3—C2—C7	128.4 (3)	C4—C5—S1	111.3 (2)
C3—C2—S1	111.2 (2)	C6—C5—S1	120.8 (2)
C7—C2—S1	120.3 (2)	O8—C7—O9	123.6 (3)
C2—C3—C4	112.3 (3)	O8—C7—C2	120.6 (3)
C5—C4—C3	113.6 (3)	O9—C7—C2	115.8 (3)

Table 3. *Hydrogen-bonding geometry (Å, °) and intermolecular interactions*

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
O9—H9···O8^{i}	0.90 (5)	1.72 (5)	2.617 (3)	177 (5)
C4—H4···O8^{ii}	0.93 (4)	2.65 (4)	3.558 (4)	164 (3)
C6—H63···O9^{iii}	0.86 (5)	2.73 (6)	3.559 (4)	161 (5)

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

Cell refinement: *XSCANS* (Siemens, 1992). Data reduction: *XSCANS*. Program(s) used to solve structure: *SHELXS*86 (Sheldrick, 1990*a*). Program(s) used to refine structure: *SHELXL*93 (Sheldrick, 1993). Molecular graphics: *SHELXTL-Plus* (Sheldrick, 1990*b*). Software used to prepare material for publication: *SHELXL*93.

KP acknowledges the CONACYT (Cátedra Patrimonial Nivel II) for fellowship assistance. The authors thank the Instituto de Biotecnología, UNAM, for data collection.

Lists of structure factors, anisotropic displacement parameters, H-atom coordinates and complete geometry have been deposited with the IUCr (Reference: KA1147). Copies may be obtained through The Managing Editor, International Union of Crystallography, 5 Abbey Square, Chester CH1 2HU, England.

References

Allen, F. H., Kennard, O. & Taylor, R. (1983). *Acc. Chem. Res.* **16**, 143–153.

Danielsen, J. (1969). *Acta Chem. Scand.* **23**, 2031–2036.

Desiraju, G. R. (1991). *Acc. Chem. Res.* **24**, 290–296.

Sheldrick, G. M. (1990*a*). *Acta Cryst.* A**46**, 467–473.

Sheldrick, G. M. (1990*b*). *SHELXTL-Plus. Structure Determination Software Programs*. Siemens Analytical X-ray Instruments Inc., Madison, Wisconsin, USA.

Sheldrick, G. M. (1993). *SHELXL*93. *Program for the Refinement of Crystal Structures*. University of Göttingen, Germany.

Siemens (1992). *XSCANS. X-ray Single Crystal Analysis System*. Version 2.0. Siemens Analytical X-ray Instruments Inc., Madison, Wisconsin, USA.

Simonsen, S. H., Cordell, F. R. & Boggs, J. E. (1980). *Am. Crystallogr. Assoc. Ser.* 2, **8**, 38.

Acta Cryst. (1996). C**52**, 677–679

A *de novo* Designed Possible 5-Lipoxygenase Inhibitor: α-Acetoxy-*N*-[1-(1-tricyclo[3.3.1.1^{3,7}]dec-1-yl)ethyl]benzeneacetamide

STAVROS J. HAMODRAKAS,[a] ANASTASSIS PERRAKIS[b]*† AND EIKATERINI ANTONIADOU-VYZAS[c]

[a]*Department of Biochemistry, Cell and Molecular Biology and Genetics, University of Athens, Panepistimiopolis, Kouponia 157 01, Athens, Greece,* [b]*EMBL – Hamburg Outstation, Notkestrasse 85, 22603 Hamburg, Germany, and* [c]*Department of Pharmaceutical Chemistry, University of Athens, Panepistimiopolis, Kouponia 157 01, Athens, Greece*

(*Received 18 July 1995; accepted 20 September 1995*)

Abstract

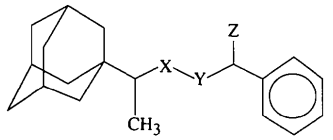
The structure of the title compound {alternative IUPAC name: α-[1-(tricyclo[3.3.1.1^{3,7}]dec-1-yl)ethylaminocarbonyl]benzyl acetate}, $C_{22}H_{29}NO_3$, a *de novo* designed non-acidic anti-inflammatory agent, has been determined. Data collection was performed utilizing methods common in macromolecular crystallography (rotation method and an imaging plate area detector) and provided data of good quality.

Comment

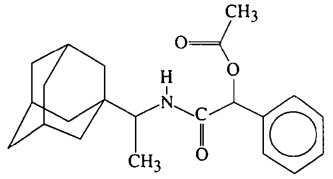
Leukotrienes are products of arachidonic acid metabolism and are frequently mediators of inflammation. They are derived from arachidonic acid through the action of the enzyme 5-lipoxygenase (5-LO). Pharmacological intervention in the conversion of arachidonic acid to leukotrienes by the development of 5-LO inhibitors seems to be a promising clinical approach (Gasland & Salmon, 1991; Musser & Kreff, 1992). In an attempt to produce possible 5-LO inhibitors, we are involved in a study of the design and synthesis of compounds of the general type (*A*). Linkage of the highly hydrophobic adamantane ring or the 1-adamantylethyl group to a phenyl ring through different bridges produces molecules with anti-inflammatory activity. The title compound, (*B*), a member of the series (*A*) compounds,

† Current address: NKI, Dept. H2, Plesmanlaan 121, 1066 CX, Amsterdam, The Netherlands. E-mail: perrakis@nki.nl

having an α-acetoxyacetamino bridge, proved to be a potent non-acidic anti-inflammatory agent. We present here its crystal and molecular structure (Fig. 1).



(*A*)



(*B*)

The conformation of the molecule is described by the torsion angles given in Table 2. The crystal is stabilized *via* a rather simple hydrogen-bonding network involving the N3 and O1 atoms of adjacent unit cells. This is the only kind of intermolecular hydrogen bond found and results in the formation of long chains of molecules which run along the *b* axis of the cell. The crystal packing is dominated by van der Waals interactions between adamantyl groups of symmetry-related molecules (Fig. 2).

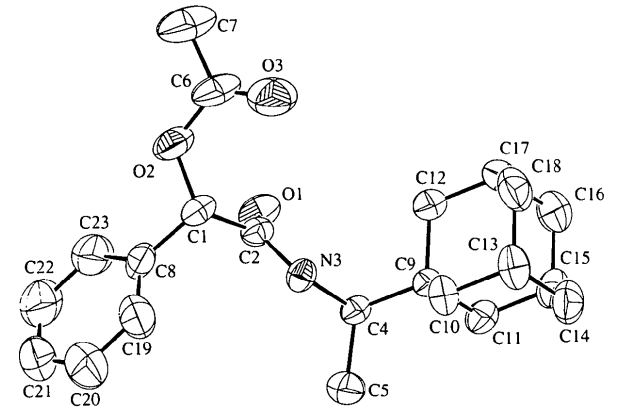


Fig. 1. The structure of the title compound showing 50% probability displacement ellipsoids. H atoms are excluded and all atoms are labelled.

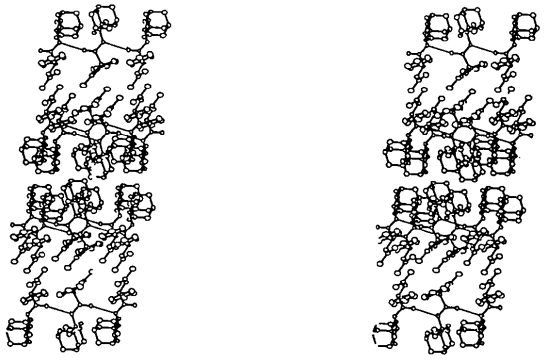


Fig. 2. The crystal packing and hydrogen-bond network.

Experimental

The title compound was synthesized by the reaction of α-acetoxyphenylacetic acid chloride with 1-(1-adamantyl)ethylamine. The required acid chloride was prepared according to known literature methods and 1-(1-adamantyl)ethylamine was obtained from the catalytic induction of the corresponding oxime. Crystals were obtained by evaporation of a methanol solution.

Crystal data

$C_{22}H_{29}NO_3$
M_r = 355.46
Monoclinic
$C2/c$
a = 38.40 (5) Å
b = 11.00 (5) Å
c = 9.60 (5) Å
β = 97.00 (10)°
V = 4025 (28) Å^3
Z = 8
D_x = 1.173 Mg m^{-3}
D_m not measured
Monochromatic radiation
λ = 0.92000 Å
Cell parameters from all reflections
θ = 1.38–24.56°
μ = 0.077 mm^{-1}
T = 293 (2) K
Long thin needle
2.00 × 0.05 × 0.05 mm
Transparent

Data collection

MAR image-plate area-detector
Rotation scans
Absorption correction: none
4307 measured reflections
1427 independent reflections
1286 observed reflections [$I > 2\sigma(I)$]
R_{int} = 0.053
θ_{max} = 24.56°
$h = 0 \rightarrow 34$
$k = 0 \rightarrow 9$
$l = -7 \rightarrow 7$

Refinement

Refinement on F^2
$R(F)$ = 0.0442
$wR(F^2)$ = 0.2770
S = 0.938
1418 reflections
236 parameters
H-atom parameters not refined
$w = 1/[\sigma^2(F_o^2) + (0.0358P)^2 + 6.2140P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max}$ = 0.155 e Å^{-3}
$\Delta\rho_{min}$ = −0.189 e Å^{-3}
Extinction correction: none
Atomic scattering factors from *International Tables for Crystallography* (1992, Vol. C, Tables 4.2.6.8 and 6.1.1.4)

Table 1. *Fractional atomic coordinates and equivalent isotropic displacement parameters (Å^2)*

$U_{eq} = (1/3)\Sigma_i\Sigma_j U_{ij} a_i^* a_j^* \mathbf{a}_i.\mathbf{a}_j.$

	x	y	z	U_{eq}
O1	0.35962 (5)	0.9898 (2)	0.2126 (3)	0.0506 (7)
O2	0.29393 (5)	1.0143 (3)	0.0791 (2)	0.0605 (8)
O3	0.30391 (7)	0.8249 (3)	0.0173 (3)	0.0878 (10)
C1	0.32250 (7)	1.0527 (3)	0.0082 (3)	0.0432 (9)
C8	0.32286 (7)	1.1876 (3)	0.0086 (4)	0.0491 (10)
C20	0.33692 (11)	1.3715 (5)	−0.0986 (6)	0.0901 (13)
C7	0.25855 (10)	0.8658 (4)	0.1579 (5)	0.103 (2)

C19	0.33498 (9)	1.2482 (4)	−0.0988 (4)	0.0693 (11)
C21	0.32667 (12)	1.4357 (4)	0.0085 (8)	0.0960 (15)
C23	0.31329 (9)	1.2533 (5)	0.1187 (5)	0.0820 (13)
C22	0.31507 (11)	1.3767 (6)	0.1172 (7)	0.105 (2)
C6	0.28749 (9)	0.8963 (6)	0.0775 (4)	0.0689 (12)
N3	0.38187 (6)	0.9913 (2)	0.0066 (2)	0.0374 (8)
C4	0.41785 (7)	0.9636 (3)	0.0618 (3)	0.0373 (9)
C5	0.44116 (8)	1.0624 (3)	0.0154 (3)	0.0574 (10)
C11	0.46488 (7)	0.8062 (3)	0.0913 (3)	0.0461 (9)
C18	0.41083 (9)	0.5995 (3)	−0.1039 (4)	0.0668 (11)
C9	0.42779 (6)	0.8343 (2)	0.0246 (3)	0.0328 (9)
C10	0.42589 (8)	0.8141 (3)	−0.1324 (3)	0.0476 (10)
C14	0.47280 (8)	0.6598 (3)	−0.0965 (4)	0.0636 (11)
C17	0.41327 (8)	0.6159 (3)	0.0530 (4)	0.0564 (10)
C12	0.40327 (7)	0.7450 (3)	0.0842 (3)	0.0470 (9)
C15	0.47474 (8)	0.6773 (3)	0.0599 (4)	0.0565 (10)
C13	0.43588 (9)	0.6850 (3)	−0.1634 (4)	0.0566 (10)
C16	0.45016 (8)	0.5909 (3)	0.1188 (4)	0.0632 (11)
C2	0.35655 (7)	1.0057 (2)	0.0863 (5)	0.0366 (9)

Table 2. *Selected geometric parameters (Å, °)*

O1—C2	1.216 (7)	C11—C9	1.520 (4)
O2—C6	1.321 (8)	C18—C13	1.506 (6)
O2—C1	1.424 (4)	C18—C17	1.508 (9)
O3—C6	1.199 (5)	C9—C10	1.517 (9)
C1—C8	1.484 (8)	C9—C12	1.519 (5)
C1—C2	1.517 (5)	C10—C13	1.510 (7)
C7—C6	1.467 (6)	C14—C15	1.507 (9)
N3—C2	1.318 (5)	C14—C13	1.509 (5)
N3—C4	1.451 (4)	C17—C16	1.505 (5)
C4—C5	1.509 (5)	C17—C12	1.511 (7)
C4—C9	1.526 (7)	C15—C16	1.498 (6)
C11—C15	1.507 (7)		
C6—O2—C1	116.1 (3)	C12—C9—C4	109.3 (3)
O2—C1—C8	107.7 (3)	C11—C9—C4	109.8 (2)
O2—C1—C2	109.3 (3)	C13—C10—C9	110.5 (2)
C8—C1—C2	109.4 (2)	C15—C14—C13	109.3 (3)
C19—C8—C1	119.6 (4)	C16—C17—C18	109.8 (3)
C23—C8—C1	121.8 (4)	C16—C17—C12	109.7 (3)
O3—C6—O2	122.7 (4)	C18—C17—C12	108.9 (3)
O3—C6—C7	125.5 (5)	C17—C12—C9	110.4 (3)
O2—C6—C7	111.8 (5)	C16—C15—C11	109.7 (4)
C2—N3—C4	123.4 (4)	C16—C15—C14	109.7 (3)
N3—C4—C5	108.3 (3)	C11—C15—C14	109.6 (3)
N3—C4—C9	111.4 (2)	C18—C13—C14	109.5 (3)
C5—C4—C9	115.4 (3)	C18—C13—C10	108.8 (4)
C15—C11—C9	110.6 (3)	C14—C13—C10	109.7 (3)
C13—C18—C17	109.8 (3)	C15—C16—C17	109.3 (3)
C10—C9—C12	108.8 (3)	O1—C2—N3	125.0 (3)
C10—C9—C11	108.5 (3)	O1—C2—C1	121.0 (3)
C12—C9—C11	107.6 (3)	N3—C2—C1	114.0 (4)
C10—C9—C4	112.7 (2)		
C6—O2—C1—C8	173.9 (3)	C15—C11—C9—C12	59.2 (4)
C6—O2—C1—C2	−67.3 (4)	C15—C11—C9—C4	178.0 (2)
O2—C1—C8—C19	−149.6 (3)	N3—C4—C9—C10	62.2 (3)
C2—C1—C8—C19	91.7 (4)	N3—C4—C9—C12	−58.9 (4)
C1—O2—C6—O3	−1.9 (5)	N3—C4—C9—C11	−176.7 (2)
C2—N3—C4—C5	−121.8 (3)	C4—N3—C2—C1	171.2 (2)
C2—N3—C4—C9	110.3 (3)	O2—C1—C2—N3	153.7 (3)
C15—C11—C9—C10	−58.4 (3)	C8—C1—C2—N3	−88.6 (3)

Data collection was performed on synchrotron beamline X31 at EMBL – Hamburg, HASYLAB, DESY. The crystals did not diffract in a standard sealed-tube generator, but diffracted reasonably well in the synchrotron beam. The rotation method, standard for macromolecular crystallography, was employed since it provides accurate data in a fraction of the time necessary for conventional diffractometry (Grochowski, Serda, Wilson & Dauter, 1994). Data were collected with an image plate area detector, with 5° rotation per image and a total of 120°, which was enough to give 92% complete data. Space-group determination, intensity integration for diffraction spots from the images and reduction of data to the asymmetric unit were carried out using *DENZO* software (Otwinowski, 1993), widely used in macromolecular crystallography. The data quality was high as judged by R_{merge} [$R_{merge} = \Sigma(|I-\langle I\rangle|)/(\Sigma I)$], which showed that the internal agreement for all symmetry-related and multiply recorded reflections was 5.3%. The total amount of time used was a slot of 2 h of machine-studies beam time.

Cell refinement: *DENZO SCALEPACK* (Otwinowski, 1993). Program(s) used to solve structure: *SHELXS*86 (Sheldrick, 1985). Program(s) used to refine structure: *SHELXL*93 (Sheldrick, 1993). Molecular graphics: *ORTEP*II (Johnson, 1976).

Zbigniew Dauter is thanked for help in the data collection and indexing of the rotation images.

Lists of structure factors, anisotropic displacement parameters, H-atom coordinates and complete geometry have been deposited with the IUCr (Reference: AS1211). Copies may be obtained through The Managing Editor, International Union of Crystallography, 5 Abbey Square, Chester CH1 2HU, England.

References

Gasland, L. G. & Salmon, J. A. (1991). *Drugs Future*, **16**, 547.
Grochowski, J., Serda, P., Wilson, K. S. & Dauter, Z. (1994). *J. Appl. Cryst.* **27**, 722–726.
Johnson, C. K. (1976). *ORTEP*II. Report ORNL-5138. Oak Ridge National Laboratory, Tennessee, USA.
Musser, J. H. & Kreff, A. F. (1992). *J. Med. Chem.* **35**, 2501–2524.
Otwinowski, Z. (1993). *DENZO. An Oscillation Data Processing Program for Macromolecular Crystallography*. Yale University, New Haven, USA.
Sheldrick, G. M. (1985). *SHELXS*86. *Program for the Solution of Crystal Structures*. University of Göttingen, Germany.
Sheldrick, G. M. (1993). *SHELXL*93. *Program for the Refinement of Crystal Structures*. University of Göttingen, Germany.

Acta Cryst. (1996). C**52**, 679–681

Coumarin 343, $C_{16}H_{15}NO_4$

TERUYUKI HONDA,[a] ISAO FUJII,[a] NORIAKI HIRAYAMA,[a]* NORIHITO AOYAMA[b] AND AKIRA MIIKE[b]

[a]*Department of Biological Science and Technology, Tokai University, 317 Nishino, Numazu, Shizuoka 410-03, Japan, and* [b]*Research Laboratories, Kyowa Medex Co. Ltd, 600-01 Minami-Ishiki, Nagaizumi-cho, Sunto-gun, Shizuoka 411, Japan*

(*Received 7 July 1995; accepted 14 September 1995*)

Abstract

In the title compound, 2,3,6,7-tetrahydro-11-oxo-1*H*,5*H*,11*H*-[1]benzopyrano[6,7,8-*ij*]quinolizine-10-carboxylic acid, the coumarin moiety is planar. The two piperidine rings take flattened sofa conformations. There