BULLETIN OF THE CHEMICAL SOCIETY OF JAPAN VOL. 39 1773—1775 (1966)

The X-Ray Structure Determination of Dihydroteleocidin B Monobromoacetate

By Hirokichi HARADA,* Noriyoshi SAKABE and Yoshimasa HIRATA

Chemical Institute, Faculty of Science, Nagoya University, Chigusa-ku, Nagoya

and Yujirō TOMIIE and Isamu NITTA

Faculty of Science, Kwansei Gakuin University, Nishinomiya

(Received December 15, 1965)

The structure of dihydroteleocidin B monobromoacetate, the derivative of a toxic substance teleocidin B produced by some streptomyces, has been determined by X-ray analysis. Crystals of the derivative, $C_{30}H_{44}O_3N_3Br$, are orthorhombic ($a=14.50$, $b=26.60$, $c=7.93$Å, $z=4$, the space group is $P2_12_12_1$). The intensities of 2053 reflections were measured using Cu$K\alpha$ radiation. The bromine position was determined by Patterson methods, and all the carbon, oxygen and nitrogen atoms were elucidated by three-dimensional minimum function methods. A three-dimensional Fourier synthesis and the least squares methods completed the refinement, giving a final R value of 16.4%. The derivative has a substituted indole nucleus with a nine-membered lactum ring.

Teleocidin B is one of the principal toxic elements isolated from the mycelia of some streptomyces.[1]

Recently, a structure containing a nine-membered lactum ring with a substituted indole nucleus has been suggested for dihydroteleocidin B,[2] which was derived from teleocidin B by catalytic hydrogenation.

In the course of that chemical investigation it, appeared desirable to confirm this rather unusual skeleton and the complete structure of this substance by X-ray crystallographic studies.

Dihydroteleocidin B monobromoacetate was selected for the X-ray crystal analysis. Three-dimensional Patterson and Fourier methods were employed for the determination of the crystal structure. Our results established the whole structure

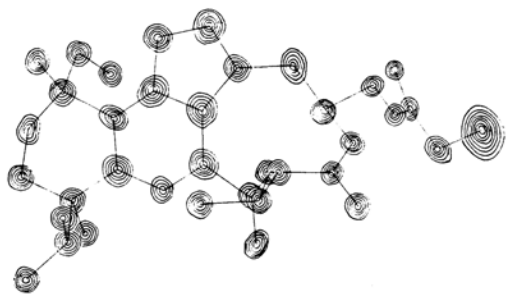

Fig. 1. The final three-dimensional electron density distribution viewed along the c axis.

* Present address: Research Laboratory, Fujisawa Pharmaceutical Co., Ltd., Higashi Yodogawa-ku, Osaka.

1) M. Takashima and H. Sakai, *Bull. Agr. Chem. Soc. Japan*, **24**, 647 (1960).

2) H. Harada, H. Nakata and Y. Hirata, *J. Chem. Soc. Japan, Pure Chem. Sect. (Nippon Kagaku Zasshi)*, **87**, 86 (1966).

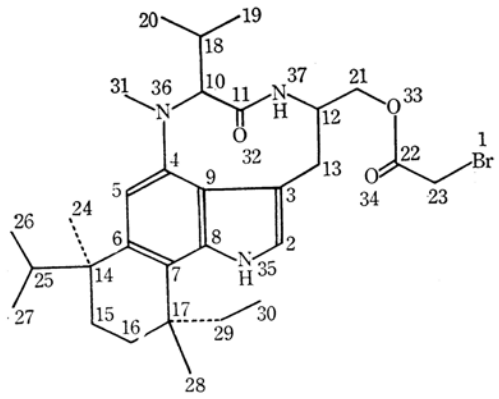

Fig. 2. The complete chemical formula of dihydroteleocidin B monobromoacetate.

TABLE I. ATOMIC CO-ORDINATES AND TEMPERATURE FACTORS

Atom	*x/a*	*y/b*	*z/c*	*B*
Br (1)	0.2987	0.0799	0.8767	5.354
C (2)	0.2285	0.4615	0.2991	3.760
C (3)	0.3216	0.4517	0.3396	3.561
C (4)	0.4040	0.3619	0.3245	2.717
C (5)	0.3888	0.3143	0.2753	3.423
C (6)	0.3001	0.2963	0.2215	2.898
C (7)	0.2260	0.3287	0.2038	3.550
C (8)	0.2428	0.3786	0.2584	2.963
C (9)	0.3319	0.3979	0.3108	2.867
C (10)	0.4958	0.4055	0.5438	3.464
C (11)	0.5742	0.4445	0.5196	3.477
C (12)	0.4810	0.4865	0.2717	4.005
C (13)	0.3855	0.4921	0.3800	3.662
C (14)	0.2918	0.2414	0.1917	2.920
C (15)	0.1913	0.2242	0.1637	4.743
C (16)	0.1393	0.2605	0.0478	4.850
C (17)	0.1327	0.3131	0.1302	4.322
C (18)	0.5186	0.3750	0.7147	3.828
C (19)	0.5057	0.4090	0.8800	5.626
C (20)	0.4495	0.3331	0.7329	4.444
C (21)	0.4916	0.5339	0.1656	3.849
C (22)	0.4158	0.0451	0.5930	3.901
C (23)	0.3229	0.0377	0.6663	4.728
C (24)	0.3459	0.2277	0.0169	4.351
C (25)	0.3362	0.2116	0.3527	4.660
C (26)	0.2965	0.2259	0.5311	5.301
C (27)	0.3293	0.1548	0.3262	5.487
C (28)	0.0576	0.3150	0.2862	5.337
C (29)	0.0966	0.3488	0.9714	5.202
C (30)	0.1702	0.3598	0.8305	6.372
C (31)	0.5709	0.3444	0.3390	4.151
O (32)	0.6491	0.4422	0.5974	4.275
O (33)	0.5794	0.5307	0.0717	4.497
O (34)	0.4831	0.0596	0.6881	6.232
N (35)	0.1804	0.4168	0.2564	4.295
N (36)	0.4937	0.3775	0.3755	2.903
N (37)	0.5602	0.4828	0.3989	4.011

of dihydroteleocidin B monobromoacetate to be as shown in Fig. 2.

TABLE II. INTERATOMIC DISTANCES AND ANGLES

(Bonded distances)

Bond	length, Å	Bond	length, Å
1—23	1.9496	12—13	1.6065
2— 3	1.4041	12—21	1.4872
2—35	1.4054	12—37	1.4903
3— 9	1.4514	14—15	1.5430
3—13	1.4552	14—24	1.5562
4— 5	1.3354	14—25	1.5660
4— 9	1.4231	15—16	1.4938
4—36	1.4188	16—17	1.5313
5— 6	1.4277	17—28	1.5907
6— 7	1.3842	18—19	1.5355
6—14	1.4817	18—20	1.5065
7— 8	1.4037	21—33	1.4570
7—17	1.5198	22—23	1.4656
8— 9	1.4403	22—34	1.2589
8—35	1.3617	25—26	1.4890
10—11	1.5478	25—27	1.5286
10—18	1.5361	29—30	1.5265
10—36	1.4505	31—36	1.4515
11—32	1.2289	17—29	1.5977
11—37	1.3709	22—33	1.2778

(Valency angles)

Bond	angle	Bond	angle
3— 2—35	111°	21—12—37	108°
9— 3—13	134	3—13—12	112
9— 3— 2	104	15—14—24	107
13— 3— 2	121	15—14—25	110
5— 4— 9	120	15—14— 6	113
5— 4—36	120	24—14—25	108
9— 4—36	120	24—14— 6	108
6— 5— 4	123	25—14— 6	111
7— 6—14	123	16—15—14	111
7— 6— 5	121	17—16—15	113
14— 6— 5	116	28—17— 7	110
8— 7—17	121	28—17—16	112
8— 7— 6	115	7—17—16	110
17— 7— 6	124	19—18—20	107
9— 8—35	109	19—18—10	109
9— 8— 7	125	20—18—10	109
35— 8— 7	126	33—21—12	107
3— 9— 4	133	23—22—34	123
3— 9— 8	107	1—23—22	112
4— 9— 8	116	26—25—27	111
11—10—18	107	26—25—14	113
11—10—36	105	27—25—14	112
18—10—36	116	2—35— 8	108
32—11—37	118	4—36—10	114
32—11—10	124	4—36—31	119
37—11—10	118	10—36—31	117
13—12—21	106	11—37—12	125
13—12—37	111		

Experimental and Structure Determination

Dihydroteleocidin B monobromoacetate, $C_{30}H_{44}O_3N_3Br$, was obtained from dihydroteleocidin B and monobromo-acetylbromide by the usual method. The crystals melt at 214—216°C. The crystal belongs to the orthorhombic system (space group $P2_12_12_1$), with four molecules in the unit cell with dimensions of $a=14.50\pm0.03$, $b=26.60\pm0.04$ and $c=7.39\pm0.03$ Å.

The intensities of the three-dimensional reflections were measured visually from integrated Weissenberg photographs around a and c axes taken by means of filtered Cu$K\alpha$ radiation. The relative values of the observed structure factors of 2053 reflections were then converted into the absolute scale by Wilson's method.[3] The position of the bromine atom was determined by the three-dimensional Patterson function. The three-dimensional minimum function[4] was calculated in order to elucidate the positions of light atoms. It seemed reasonable to regard several peaks found in this figure as light atoms. Then the projection of the electron density distribution was calculated along the b axis. However, since the distribution in some area is so complicated, another projection was calculated along the c axis, from which the positions of thirty-five atoms were determined. The structure so obtained was refined by three-dimentional Fourier syntheses and by the least-squares methods. The final atomic co-ordinates and temperature factors are listed in Table I. The interatomic distances and valency angles in Table II were then calculated.

The final R factor is 16.18%. The F_o-F_c values are shown in Table III.* Figure 1 shows the final three-dimentional electron density distribution viewed along the c axis, and Fig. 2, the complete chemical formula of dihydroteleocidin B monobromoacetate.

The calculations were performed on a NEAC-2206 electronic computer using our own programs.

The authors wish to express their deep thanks to the Takeda Chemical Industries, Ltd., for the computer used in this investigation.

3) A. J. C. Wilson, *Nature*, **150**, 152 (1942).
4) M. J. Buerger, *Acta Cryst.*, **4**, 531 (1951).

* The complete data of the F_o-F_c table are kept as Document No. 6601 at the office of the Bulletin of the Chemical Society of Japan. A copy may be secured by citing the document number and by remitting, in advance, ¥600 for photoprints. Pay by check or money order payable to: Chemical Society of Japan.