Steric Configuration of the α, β-Diaminobutyric Acid Isolated from the Antibiotic Glumamycin

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Inoue[1] previously isolated α, β-diaminobutyric acid from the acid hydrolysate of glumamycin, an acidic peptide antibiotic. Martin et al.[2] also reported the separation of α, β-diaminobutyric acid from Aspartocin, an antibiotic resembling glumamycin. Although both products seem to have the same configuration from their optical rotation, this has so far not been studied. Inoue has shown[3] that only one β-amino group of the two α, β-diaminobutyric acids* of glumamycin is free.

The configuration of the α-amino group has been studied by conversion of free amino group of glumamycin into a hydroxyl group and subsequent hydrolysis to α-amino-β-hydroxybutyric acid, and that of the β-amino group by oxidation of α, β-diaminobutyric acid to alanine.

Glumamycin was treated with sodium nitrite in 80% acetic acid to convert the free amino group into hydroxyl and the resulting hydroxy-glumamycin was hydrolyzed with hydrochloric acid. The reaction mixture was developed on a column of Dowex 50x4 (200 ~ 400 mesh) with ammonium formate buffer (pH 3.4)[4] and the crystals obtained from the threonine fraction of the eluate were recrystallized from aqueous ethanol (Found: C, 40.06; H, 7.81; N, 11.90. Calcd. for $C_4H_9O_3N$: C, 40.33; H, 7.62; 11.76%). The product was found to be a mixture of threonine and allothreonine by paper chromatography with *n*-butalnol·acetone·ammonia·water (50: 6.25: 6.25: 37.5)[5]. However, since the β-position of α, β-diaminobutyric acid of glumamycin may undergo partial Walden inversion under the conditions, it is impossible to decide the configuration of the α-carbon atom directly from the optical rotation of the product. But DNP-L-threonine and DNP-L-allothreonine exhibit the same optical rotation, $[M]_D^{25} = +305°$ (4% sodium bicarbonate)[6]. The above product was converted into its DNP-derivative by the method of Levy[7] and then subjected to chromatography on Amberlite IRC-50 according to the method of Seki[8] to remove the DNP-OH which formed as a by-product. DNP-derivative showed an optical rotation of $[M]_D^{24} = -294° \pm 14$ (*c* 0.48, 4% sodium bicarbonate) and its yield was 92%. This fact shows that above product is a mixture of D-threonine and D-allothreonine, therefore α-carbon atom of α, β-diaminobutyric acid has the D-configuration. Further, as α, β-diaminobutyric acid obtained from the hydrolysate of hydroxy-glumamycin, and that obtained from the hydrolysate of glumamycin have the same optical rotation and physical properties, the two moles of α, β-diaminobutyric acid in glumamycin evidently have the same steric configuration.

Oxidation of α, β-diaminobutyric acid with hydrogen peroxide was conducted by the method of Dakin[9]. Namely, the compound was allowed to react with 2 mol. of 3% hydrogen peroxide at 50°C for one hour. The reaction mixture was passed through a column of Amberlite IR-120, the column was eluted with N-ammonium hydroxide, and the effluent was concentrated to give D-alanine (Found: C, 40.51; H, 7.88; N, 15.44%), $[\alpha]_D^{20} = -16$, (*c* 1, 6 N hydrochloric acid) which was confirmed by infrared spectrum and paper chromatography.

Thus, it was found that the β-carbon atom of α, β-diaminobutyric acid belongs to the D-series, and consequently α, β-diaminobutyric acid takes D-erythro-configuration.

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* It is already recognized that glumamycin contains two moles of α, β-diaminobutyric acid and both amino groups of one mole are not free.
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