We wish to thank to Mr. S. Ohsako of the Research Laboratory of the Dainippon Pharmaceutical Industries for technical assistance in the measurement of the infrared spectra. The spectra were determined on a Perkin-Elmer Model 21 double beam spectrometer.

Summary

The same correlations as have been derived between the infrared spectra of optical antipodes and diastereoisomers have also been established for such complex compounds as biscoclaurine-type alkaloids possessing two asymmetric centers in their molecules.

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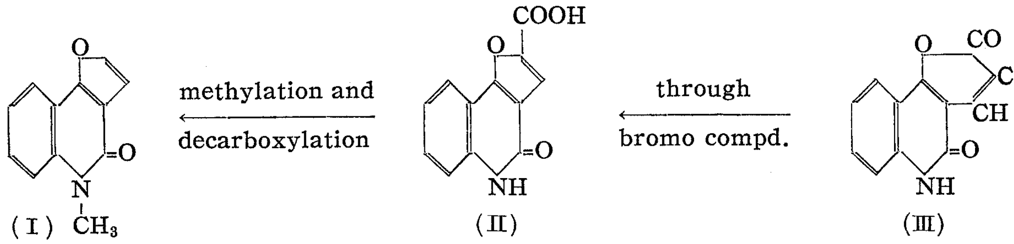
Tatsuo Ohta and Yo Mori: Furoquinolines. VII.*

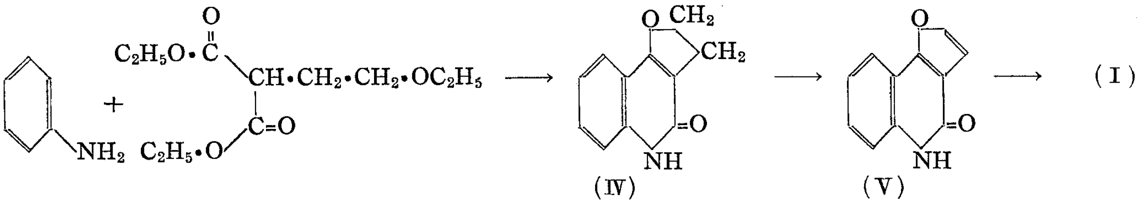
On the Synthesis of 5-Methylfuro[3, 2-*c*]quinolin-4-one.

(*Tokyo College of Pharmacy***)

In 1932, Asahina and Inubuse¹⁾ published the synthesis of the so-called ψ-dictamnine, 5-methylfuro[3, 2-*c*]quinolin-4-one (I), by the methylation and subsequent decarboxylation of 2-carboxy compound (II), which was obtained from the bromo derivative of coumalinoquinolinone (III) by treatment with alkali.



The simple synthesis of (I), as shown in the formulae, was reported recently by British chemists.²⁾



A synthesis of (I) by different route was carried out stepwise by the present authors utilizing the preparation of dihydrofuropyridines from 3-phenoxyethyl-³⁾ and 3-ethoxyethyl-hydroxypyridines⁴⁾ as follows: Methyl N-(ω-ethoxybutyryl)anthranilate (VI) was cyclized to 3-(β-ethoxyethyl)-4-hydroxycarbostyril (VII) by treatment with metallic sodium, then (VII) was converted to 2, 3-dihydrofuro[3, 2-*c*]quinolin-4(5*H*)-one (IV), m.p. 286~287°(reported, 280~281°(decomp.)) by boiling with conc. HCl. Dehydrogenation of (IV) with Pd-charcoal gave furo[3, 2-*c*]quinolin-4(5*H*)-one (V), and (V) was derived to

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* Part VI: T. Ohta, Y. Mori: Ann. Rept. Tokyo Coll. Pharm., **5**, 336(1955).

** Kashiwagi 2-Chome, Shinjuku-ku, Tokyo (太田達男, 森　陽).

1) Y. Asahina, M. Inubuse: Ber., **65**, 61(1932).

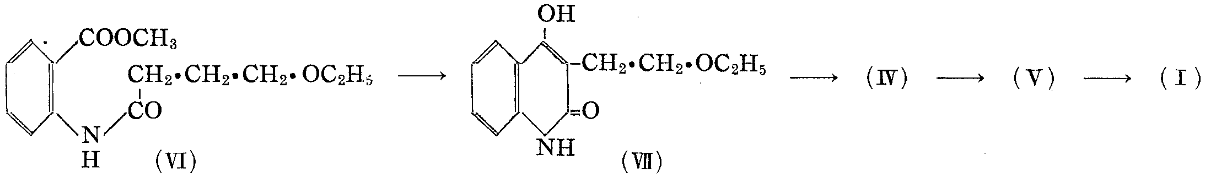
2) Personal communication from Dr. M. F. Grundon to T. Ohta, and further publication: M. F. Grundon, N. J. McCorkindale, M. N. Rodger: J. Chem. Soc., **1955**, 4284.

3) K. Matejka, R. Robinson, J. S. Watt: *Ibid.*, **1932**, 2019.

4) J. R. Stevens, R. H. Beutel, E. Chamberlin: J. Am. Chem. Soc., **64**, 1093(1942).

the N-methyl compound (I), m.p. 132~133°, with dimethyl sulfate and 50% KOH solution. All furo[3, 2-*c*]quinolinones hereby obtained do not show fluorescence in the usual organic solvents, whereas furo[2, 3-*b*]quinolines, such as dictamnine, dihydrodictamnine, nordictamnine, isodictamnine, etc., exhibit a blue-violet fluorescence. The above facts suggest that ψ-dictamnine, m.p. 225°, obtained by Asahina and Inubuse has some other structure, as Grundon *et al.* have already pointed out, or it is probably an impure compound because of an insufficient methylation. Reëxamination of Asahina's ψ-dictamnine synthesis starting with nordictaminal is under way.

We wish to express our gratitude to Dr. M. F. Grundon, The Queen's University, Belfast, who provided us with the specimens for the mixed fusion tests.



Experimental

All temperatures are uncorrected. Microanalyses are by Mrs. Baba and Miss Oka in the Women's Department of this College.

Methyl N-(ω-Ethoxybutyryl)anthranilate (VI)—A mixture of ω-ethoxybutyric acid, b.p. 230~240° (20 g.), prepared according to the literature [Noyes: J. Am. Chem. Soc., **19**, 766, b.p. 230~240°; Fittig, Störm: Ann., **267**, 200, b.p. 231°; Prelog, Bozicvic: Ber., **72**, 1103, b.p. 208~210°], and methyl anthranilate (23 g.) was heated in an oil bath at 200~210° during 12 hrs. After cool, the content was fractionated under reduced pressure and the distillate of b.p$_{9\sim10}$ 195~198° was collected. Yield, 12 g. Slightly yellow liquid. It is easily soluble in EtOH and ether. *Anal.* Calcd. for $C_{14}H_{19}O_4N$: C, 63.38; H, 7.22; N, 5.28. Found: C, 63.12; H, 6.75; N, 5.05.

3-(β-Ethoxyethyl)-4-hydroxycarbostyril (VII)—To a solution of 12 g. of N-(γ-ethoxybutyryl)-anthranilate dissolved in 75 cc. of dehyd. toluene, 1.1 g. of metallic Na was added at 60~65°. After refluxing for 3 hrs., the remaining Na was dissolved by the addition of EtOH and the content was poured into water. The sparated aqueous layer and aqueous washings from toluene layer were combined and filtered. The alkaline filtrate was acidified with 10% H_2SO_4 and the separated orange colored oil which solidified gradually on standing was treated with $NaHCO_3$ solution. The insoluble matter was collected, washed with water, and dried. Yield, 3 g. This was crystallized from EtOH with charcoal to give colorless prisms, m.p. 139~140°. *Anal.* Calcd. for $C_{13}H_{15}O_3N$: C, 66.93; H, 6.48; N, 6.01. Found: C, 66.60; H, 6.39; N, 6.24.

4-Acetoxy-3-(β-ethoxyethyl)carbostyril—Prepared from the crude crystals (3.6 g.) of (VII) by boiling it with Ac_2O (36 cc.) for 2 hrs. Colorless needles (from EtOH), m.p. 209~210°. Yield, 2.4 g. *Anal.* Calcd. for $C_{15}H_{17}O_4N$: C, 65.44; H, 6.22; N, 5.09. Found: C, 65.70; H, 6.35; N, 5.06.

2, 3-Dihydrofuro[3, 2-c]quinolin-4(5*H*)-one (IV)—2.7 g. of 3-(β-ethoxyethyl)-4-hydroxycarbostyril was boiled with 54 cc. of conc. HCl for 2 hrs. The acid solution, which deposited some crystals on cooling, was rendered alkaline with 10% KOH solution. Repeated crystallization of the precipitate from pyridine gave colorless rectangular plates. It melted at 286~287° and no decomposition was observed as reported by Grundon *et al.* It shows no fluorescence in the usual organic solvents. On admixture with the specimen, m.p. 281°, of dihydrofuro[3,2-*o*]quinolin-4-one[1:2-4′:5′-tetrahydro-2-oxofurano(3′:2′-3:4)quinoline] of Grundon, it melted at 285°. *Anal.* Calcd. for $C_{11}H_9O_2N$: C, 70.58; H, 4.85; N, 7.48. Found: C, 70.94; H, 4.96; N, 7.71.

Furo[3, 2-c]quinolin-4(5*H*)-one (V)—Prepared by the procedure of Grundon *et al.* from (IV) by dehydrogenation with 10% Pd-C in boiling diphenyl ether. Colorless prismatic crystals, m.p. 249~250° (from EtOH) (reported., m.p. 249~250°). It shows no fluorescence in ether, EtOH, AcOH, etc. while nordictamnine exhibits a blue-violet fluorescence.

5-Methylfuro[3, 2-c]quinolin-4-one (I)—Using a glass rod, 0.5 g. of (V) was kneaded thoroughly with 50% KOH solution (4 cc.) and dimethyl sulfate (2 cc.) by their alternate addition. The resultant pale yellow pasty reaction mixture was extracted with benzene. The benzene solution was washed with water, dried, and the solvent was removed by distillation. Repeated crystallization of the residue from petroleum benzine (b.p. 60~80°) afforded colorless needles, m.p, 132~133°, which showed no depression on admixture with the sample, m.p. 130° of 5-methylfuro[3, 2-*c*]quinolinone[1:2-dihydro-1-methyl-2-oxofurano(3′:2′-3:4)quinoline] synthesized by Grundon *et al.* This compound shows no fluorescence in the usual organic solvents.

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