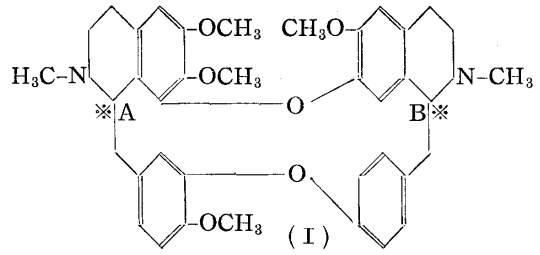
U.D.C. 547.833.9 : 582.675.4

Masao Tomita and Yasuo Inubushi : Studies on the Alkaloids of Menispermaceous Plants. CXL.[1] Infrared Spectra of Isotetrandrine, Tetrandrine, and Phaeanthine.

(*Pharmaceutical Institute, Medical Faculty, University of Kyoto**)

It has been shown from the results of a variety of degradative reactions that tetrandrine,[2] phaeanthine,[3] and isotetrandrine[4] have the same structure (I) of the berbamine series and that, since on Hofmann degradation they furnish identical methine bases, they are optical isomers which differ from one another in the stereochemical arrangements about the two asymmetric centers (A※, B※) in their molecules. Final proof of the structures of tetrandrine,[5] phaeanthine,[6] and isotetrandrine[7] came when these alkaloids were subjected to the sodium-in-liquid-ammonia reaction, and furthermore, the specific rotations of their cleavage products of two coclaurine units favored the view that tetrandrine is an antipode of phaeanthine and that both tetrandrine and phaeanthine are diastereoisomers of isotetrandrine.



(I)

	mp.	$[\alpha]_D$ in $CHCl_3$	A※	B※
Tetrandrine	217°	$[\alpha]_D^{24}$: +263.1°	+	+
Phaeanthine	210°[8]	$[\alpha]_D^{30}$: −278°	−	−
Isotetrandrine	187°	$[\alpha]_D^{17}$: +146°	−	+

It is a matter of interest to consider here the influence of optical isomerism on the infrared spectrum. So far it is known that although the spectra in the solid phase are often found to exhibit differences, the spectra of enantiomorphs in the solution phase are identical, while the spectra[9] of diastereoisomers will, in general, differ from one another no matter what the physical state may be. However, no spectral instances have been reported with the optical isomers between those biscoclaurine type molecules, in which two centers of asymmetry and also the molecular asymmetry would be existent, and which constitute a large ring with the molecule as a whole.

In this experiment, the infrared spectra of the above three alkaloids were measured in Nujol and in chloroform solution. As shown in Fig. 1, the spectra of these alkaloids in Nujol were observed to be dissimilar to one another, whereas in the solution phase, tetrandrine(+, +) and phaeanthine(−, −) gave identical infrared spectra, indicating them to be enantiomorphic with each other. Moreover, it was confirmed that in the

* Yoshida-Konoe-cho, Sakyo-ku, Kyoto (富田真雄, 犬伏康夫).

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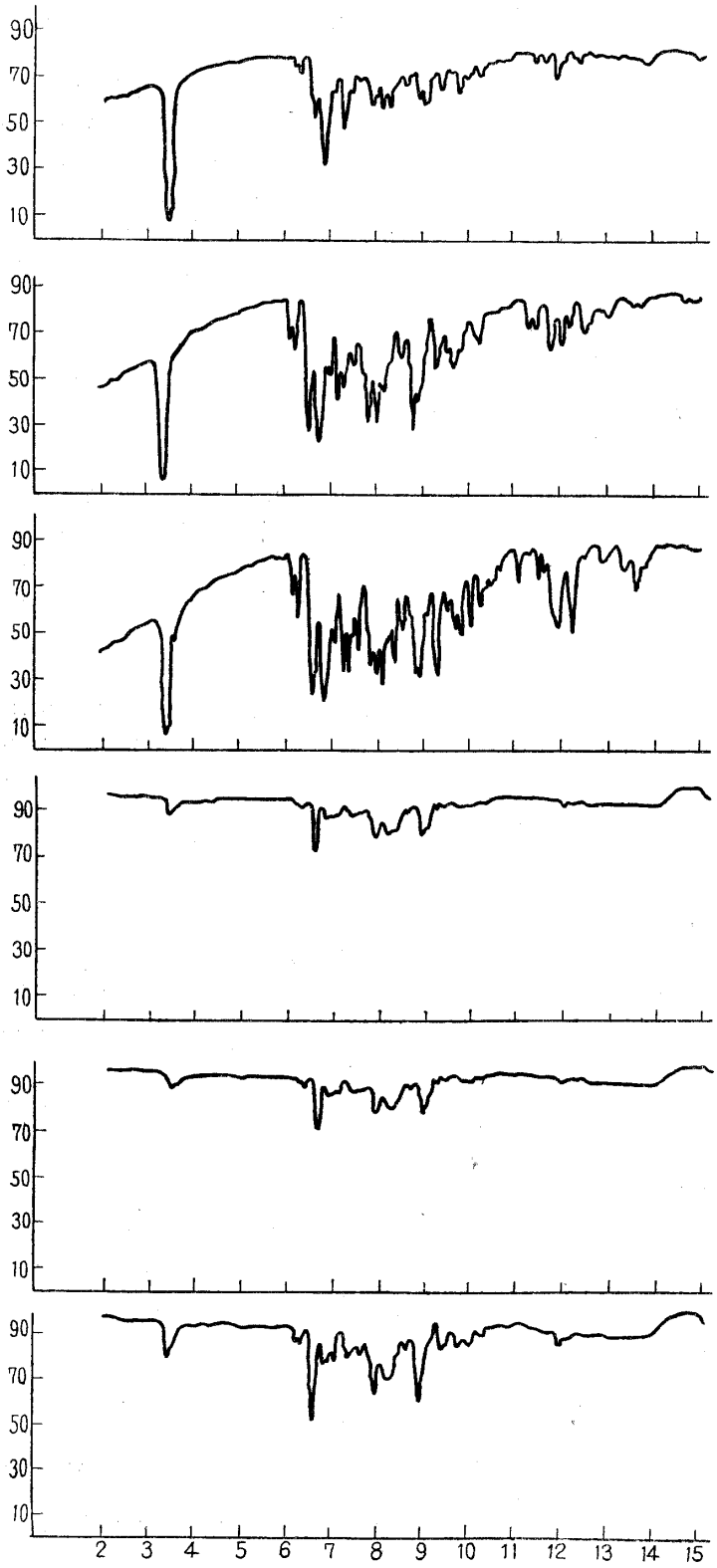
3) A. C. Santos : Rev. Filipina Med. Farmac., **22**, 11(1931); Ber., **65**, 472(1932); F. Faltis : Ann., **497**, 69(1932); H. Kondo, I. Keimatsu : J. Pharm. Soc. Japan, **55**, 121(1935); Ber., **68**, 1503(1935); J. Pharm. Soc. Japan, **55**, 894(1935).
4) H. Kondo, I. Keimatsu : J. Pharm. Soc. Japan, **55**, 234, 894(1935).
5) E. Fujita, F. Murai : *Ibid.*, **71**, 1039(1951).
6) D. A. A. Kidd, J. Walker : J. Chem. Soc., **1954**, 669.
7) M. Tomita, E. Fujita, F. Murai : J. Pharm. Soc. Japan, **71**, 226, 1035(1951).
8) A. W. McKenzie, J. R. Price : Australian J. Chem. **6**, 180(1953). Phaeanthine from *Gyrocarpus americanus* Jacq. bark is colorless needles from MeOH, mp. 222～224°(corr.) $[\alpha]_D^{25}$: −272°($CHCl_3$).
9) E. A. Miller, "Organic Chemistry. An Advanced Treatise" (H. Gilman, Editor-in-Chief), Vol. **3**, pp. 136～137.

solution phase, the spectra of these enantiomorphic alkaloids are not identical with that of isotetrandrine(−, +), the diastereoisomer of the former alkaloids. Thus the same correlations as have been derived between the infrared spectra of optical antipodes and diastereoisomers have also been established for such complex molecules as biscoclaurine type alkaloids.

Fig. 1.



Tetrandrine(+, +) in Nujol

Phaeanthine(−, −) in Nujol

Isotetrandrine(−, +) in Nujol

Tetrandrine(+, +) in $CHCl_3$

Phaeanthine(−, −) in $CHCl_3$

Isotetrandrine(−, +) in $CHCl_3$

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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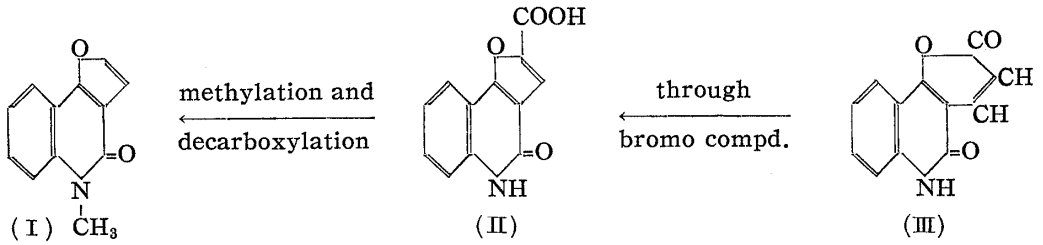
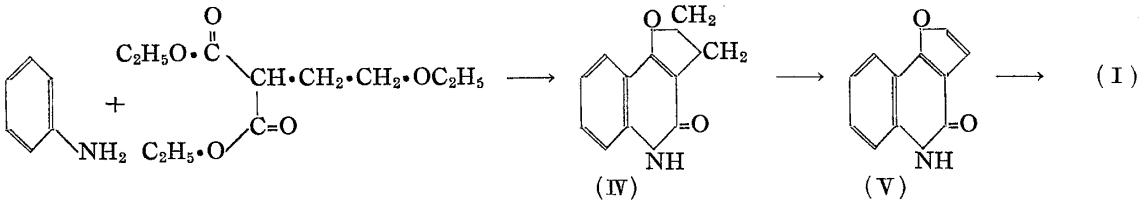
Tatsuo Ohta and Yo Mori: Furoquinolines. VII.* On the Synthesis of 5-Methylfuro[3, 2-*c*]quinolin-4-one.

(*Tokyo College of Pharmacy***)

In 1932, Asahina and Inubuse[1] 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-hydroxypyridines[4] 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

* 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).

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