

摘要

本篇論文主要探討利用分子對稱的觀念來協助一些吲哚生物鹼之合成研究。我們使用了 Pictet–Spengler 反應，以色胺與具有對稱性的醛來建立這類天然物之 tetrahydro- β -carboline 之架構。

(i) Tangutorine **1** 之全合成：經由關鍵的中間體**2**；化合物**2**具有與**1** 相同的立體化學。**2** 本身是由色胺與醛**3** 一從對稱的 1,3-環己二酮製備—以 Pictet–Spengler 及分子內 Michael 加成反應來製造。

(ii) Eburnamonine **7** 之全合成：經由螺環中間體**12**。

(iii) Vallesamidine **20** 之 formal 合成：經由中間體**25**。

Aspidospermidine **39** 之合成研究：經由螺環中間體**47**。

(iv) Oxogambirtannine **40** 之合成研究：經由中間體**55**。

化合物 **12**, **25**, **47**及**55** 的製備都使用 Pictet–Spengler 反應由色胺及對稱的醛，分別是**11c**, **24c**, **49c** 及 **51**來製造。

ABSTRACT

Synthetic studies towards several indole alkaloids were pursued, utilizing molecular symmetry to guide the synthetic design. All tetrahydro- β -carbolines intermediates described in this dissertation were constructed by reacting tryptamine with symmetrical aldehydes *via* acid-induced Pictet-Spengler reaction:

- Total synthesis of tangutorine **1** started from the reaction of tryptamine with aldehyde **3** - derived from symmetrical 1,3-cyclohexadione - to build the key intermediate **2** that has the correct stereochemistry of tangutorine **1**.
- Total synthesis of Eburnamonine **7** was conducted *via* a spirocyclic intermediate **12**, formed by reacting tryptamine with symmetrical 5-membered ring aldehyde **11c**.
- Formal synthesis of vallesamidine **20** was conducted *via* intermediate **25**, formed by reacting tryptamine with symmetrical 7-membered ring aldehyde **24**.
- Synthetic study on aspidospermidine **39** was conducted *via* a spirocyclic intermediate **47**, formed by reacting tryptamine with symmetrical tetrahydropyranyl aldehyde **49c**.
- Synthetic study on oxogambirtannine **40** was conducted by reacting tryptamine with symmetrical 2-aryl substituted acetaldehyde **51**.

PREFACE

Prelog wrote in his *'My 132 Semesters of Chemistry Studies'* that the best way to learn science is as an apprentice to a master who is a model both in his field and in his personal characteristics. He also emphasized that it was important for a chemist to be confronted with reality and that sometimes it is better to follow the maxim, "*Work now, understand later*", later than the reverse.

I could still remember my discussion with Prof. Ho Tse-lok when I took a leave from BASF in Indonesia and returned to Taiwan for possibility of pursuing PhD programme under his guidance. It was in December 2001. About half years later, after being involved in colorants (pigments and dyes) for nearly 5 years, I resigned and started my PhD programme.

The research did not work out as smooth as was expected. I was not in touch with organic chemistry and its laboratory experiments for about 7 years. My job experience in the colorants, included formulation development, but I was involved mainly in the application area, where the main emphasis is on how to grind, disperse the colorants and stabilize the dispersion; basically, no chemical reactions are welcomed during the process, as when they happened, that meant you destroyed the colorants. During those years in colorants, as I was busy with day-to-day management work, I was used to delegate all my ideas on formulation development to my fully-trained laborants. So it took some time before I could accustom myself back to the 'normal' life of organic chemistry experiments.

Time went so fast. After about 3 years, finally this research has come to an end. I could say that after several years of living a colorful life with colorants, I have also experienced another 'colorful' life with organic synthesis. To this, I would like to express my deep appreciation and thanks to my mentor, Prof. Ho Tse-lok for his advice and in-time (painstaking) guidance, especially when I encountered 'bottle-necked' problems in my projects. Also for the arrangement of the financial support from National Science Council of

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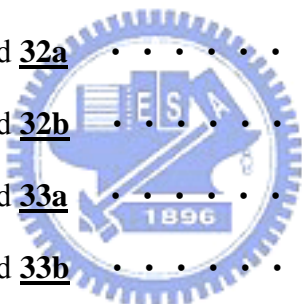
CONTENTS

	頁次
Abstract (in Chinese)	i
Abstract (in English)	ii
Preface	iii
Contents	v
List of NMR Spectra	vi
Abbreviations	ix
I. Introduction	1
I.1. Alkaloids	1
I.1.1. Definitions	1
I.1.2. Classification	2
I.2. Molecular Symmetry in Organic Syntheses	14
I.3. Formation of tetrahydro- β -carboline	16
II. Indole Alkaloids Syntheses	19
II.1. Tangutorine	19
II.1.1. Introduction	19
II.1.2. Results and Discussions	22
II.2. Eburnamonine	26
II.2.1. Introduction	26
II.2.2. Results and Discussions	28
II.3. Vallesamidine	31
II.3.1. Introduction	31
II.3.2. Results and Discussions	37
II.4. Aspidospermidine	53
II.4.1. Introduction	53
II.4.2. Results and Discussions	54
II.5. Oxogambirtannine	57
II.5.1. Introduction	57
II.5.2. Results and Discussions	62
III. Experimental Parts	64
IV. References	130
V. Appendix: NMR Spectra	135

LIST OF NMR SPECTRA

	page
1. NMR Spectra of tangutorine <u>1</u>	136
2. NMR Spectra of compound <u>3</u>	137
3. NMR Spectra of compound <u>4</u>	138
4. NMR Spectra of compound <u>5</u>	139
5. NMR Spectra of compound <u>6</u>	140
6. NMR Spectra of eburnamonine <u>7</u>	141
7. NMR Spectra of eburnamine <u>8</u>	142
8. NMR Spectra of isoeburnamine <u>9</u>	143
9. NMR Spectra of compound <u>11a</u>	144
10. NMR Spectra of compound <u>11b</u>	145
11. NMR Spectra of compound <u>11c</u>	146
12. NMR Spectra of compound <u>12</u>	147
13. NMR Spectra of compound <u>13</u>	148
14. NMR Spectra of compound <u>14a</u>	149
15. NMR Spectra of compound <u>15</u>	150
16. NMR Spectra of <i>epi-eburnamonine</i> <u>16</u>	151
17. NMR Spectra of compound <u>17a</u>	152
18. NMR Spectra of compound <u>17b</u>	153
19. NMR Spectra of compound <u>18</u>	154
20. NMR Spectra of compound <u>23a</u>	155
21. NMR Spectra of compound <u>23b</u>	156
22. NMR Spectra of compound <u>24a</u>	157
23. NMR Spectra of compound <u>24b</u>	158

24. NMR Spectra of compound <u>24c</u>	159
25. NMR Spectra of compound <u>25</u>	160
26. NMR Spectra of compound <u>26</u>	161
27. NMR Spectra of compound <u>28a</u>	162
28. NMR Spectra of compound <u>28b</u>	163
29. NMR Spectra of compound <u>29a</u>	164
30. NMR Spectra of compound <u>29b</u>	165
31. NMR Spectra of compound <u>30a</u>	166
32. NMR Spectra of compound <u>30b</u>	167
33. NMR Spectra of compound <u>31a</u>	168
34. NMR Spectra of compound <u>31b</u>	169
35. NMR Spectra of compound <u>32a</u>	170
36. NMR Spectra of compound <u>32b</u>	171
37. NMR Spectra of compound <u>33a</u>	172
38. NMR Spectra of compound <u>33b</u>	173
39. NMR Spectra of compound <u>34a</u>	174
40. NMR Spectra of compound <u>35a</u>	175
41. NMR Spectra of compound <u>35b</u>	176
42. NMR Spectra of compound <u>36</u>	177
43. NMR Spectra of compound <u>37</u>	178
44. NMR Spectra of compound <u>42</u>	179
45. NMR Spectra of compound <u>43a</u>	180
46. NMR Spectra of compound <u>43b</u>	181
47. NMR Spectra of compound <u>44a</u>	182
48. NMR Spectra of compound <u>44b</u>	183
49. NMR Spectra of compound <u>45a</u>	184



50. NMR Spectra of compound 45b	185
51. NMR Spectra of compound 46a	186
52. NMR Spectra of compound 47	187
53. NMR Spectra of compound 49b	188
54. NMR Spectra of compound 49c	189
55. NMR Spectra of compound 51	190
56. NMR Spectra of compound 53a , 53b , and 54	191
57. NMR Spectra of compound 55	192



ABBREVIATIONS

Ac	acetyl
Ar	aryl
Bn	benzyl
BOC	<i>t</i> -butoxycarbonyl
Bz	benzoyl
DIBAL-H	diisobutylaluminum hydride
DMAP	4-(<i>N,N</i> -dimethylamino)pyridine
DMF	dimethylformamide
DMSO	dimethyl sulfoxide
LAH	lithium aluminum hydride
LDA	lithium diisopropylamide
LTA	lead tetraacetate
MCPBA	<i>m</i> -chloroperbenzoic acid
Ms	methanesulfonyl
NMO	<i>N</i> -methylmorpholine <i>N</i> -oxide
PCC	pyridinium chlorochromate
PDC	pyridinium dichromate
PTSA	<i>p</i> -toluenesulfonic acid
Py	pyridine
TFA	trifluoroacetic acid
THF	tetrahydrofuran
TMS	trimethylsilyl
TLC	thin layer chromatography