

# Contents

<b>Acknowledgement</b>	<b>xi</b>
 Chapter 1	
<b>Whisky's Historical Development</b>	<b>1</b>
1.1 Alchemy and the Development of Modern Chemistry	1
1.2 Ireland	4
1.3 Canada and the United States of America	14
1.3.1 Canada	14
1.3.2 United States of America	21
1.4 Japan	29
1.5 World Whisky	35
1.6 Literature	36
References	47
 Chapter 2	
<b>Scotland</b>	<b>49</b>
References	88
 Chapter 3	
<b>Crop-to-Cask—Production of New Make Spirit</b>	<b>90</b>
3.1 Introduction	90
3.2 Water and Cereals	95
3.2.1 Water	95
3.2.2 Fermentable Carbohydrate Sources	96

---

The Science and Commerce of Whisky

By Ian Buxton and Paul S. Hughes

© Buxton & Hughes, 2014

Published by the Royal Society of Chemistry, [www.rsc.org](http://www.rsc.org)

3.2.3	Preparing the Fermentable Extract	106
3.2.4	Fermentable Malt Extracts	107
3.2.5	Fermentable Grain Extracts	109
3.3	Fermentation	110
3.3.1	Key Metabolic Aspects of Distilling Fermentations	111
3.3.2	Distillery Yeast	117
3.3.3	Distilling Fermentations	118
3.4	Liquid-Liquid Separation: Ethanol (and Others) Recovery	118
3.5	Filling the Cask	127
3.6	Co-products	129
3.7	In Conclusion...	133
	References	133

## Chapter 4

### **Wood Chemistry and the Maturation of Whisky** **134**

4.1	Introduction – Why Maturation?	134
4.2	Oak and Casks	138
4.2.1	Cask Requirements and Supply	138
4.2.2	Why Oak?	140
4.2.3	Cask Fabrication	143
4.2.4	Heat Treatment of Cask Surfaces	148
4.2.5	Cask Performance	150
4.3	Whisky Maturation	152
4.3.1	Oak Wood Extracts	156
4.3.2	Changes in the Components of New-make Spirits	160
4.3.3	Changes in the Wood-derived Lignin Compounds	162
4.3.4	Changes in Spirit Properties during Maturation	163
4.3.5	Maturation and Spirit Strength	164
4.4	Warehousing of Whiskies during Maturation	164
4.5	Quality Assurance and Assessment of Matured Spirit	166
4.6	In Conclusion...	168
	Notes and References	168

## Chapter 5

### **From Blend-to-Bottle** **170**

5.1	Introduction	170
5.2	Creating the Blend	171
5.3	Finishing and Bottling	177
5.4	Quality Management	178
5.5	Instrumental Analysis	180
5.6	Sensory Evaluation of New Make Spirits and Whisky	189

5.7 Counterfeit Detection and Brand Protection	193
5.8 Product Stability	195
5.9 In Conclusion. . .	195
Notes and References	196
 Chapter 6	
<b>Marketing and Brand Development</b>	<b>197</b>
6.1 Product	198
6.2 Price	200
6.3 Promotion	208
6.4 Place	211
6.5 Brand Positioning	212
6.6 The Experience Economy: Building Relationships	214
6.7 Social Media and the Internet	222
6.8 Regulatory and Control Issues	225
References	228
 Chapter 7	
<b>New Whisky Countries</b>	<b>230</b>
References	257
 Chapter 8	
<b>Today's Global Whisky Market</b>	<b>259</b>
8.1 The UK Market for Whisky	266
8.2 Scotch Whisky – Global	268
8.3 Other Whisky	271
8.4 In Conclusion. . .	272
References	273
 <b>Subject Index</b>	<b>274</b>