

# TABLE OF CONTENTS

<b>Foreword.....</b>	<b>xiii</b>
<b>Acknowledgments.....</b>	<b>xvii</b>
<b>Introduction .....</b>	<b>1</b>
Jack's Journey .....	2
Joe's Journey .....	4
Why We Wrote This Book .....	4
A Word to the Homebrewers.....	6
<b>Chapter 1 – What Exactly Is a Lager?.....</b>	<b>9</b>
Defining Lager Beer .....	9
The Major Lager Traditions: A Quick Tour.....	12
To the Pale.....	14
Bavarian Lagers Today.....	15
České Pivo (Czech Beer) .....	17
American Lager: The Old Guard and the New .....	20
Drinkability in Lager.....	22
Lager as Process-Driven Beer.....	23

<b>Chapter 2 – Raw Materials.....</b>	<b>29</b>
<b>Yeast.....</b>	<b>31</b>
Origins of Lager Yeast.....	32
Types of Lager Yeast .....	35
Characteristics of Lager Yeast Fermentation .....	37
How to Select a Lager Yeast Strain.....	39
<b>Malt.....</b>	<b>40</b>
Malt Analysis Parameters.....	41
Malt Modification.....	41
Modification and Other Factors Affecting Malt Quality.....	44
Historical Regional Trends in Barley Malt .....	47
Traditional Specialty Malts .....	55
<b>Adjuncts .....</b>	<b>56</b>
<b>Water.....</b>	<b>61</b>
Hardness and Alkalinity .....	62
Residual Alkalinity .....	64
Water Treatment .....	66
<b>Hops .....</b>	<b>67</b>
First Wort/Early Kettle Hopping.....	74
Dry Hopping Lager .....	75
<b>Chapter 3 – Fermenting with Lager Yeast .....</b>	<b>79</b>
<b>What to Expect from Traditional Lager Fermentations.....</b>	<b>82</b>
<b>Historical Fermentation Process .....</b>	<b>85</b>
<b>Working with Lager Yeast in Modern Breweries.....</b>	<b>88</b>
Types of Fermentation.....	90
<b>Fermentation Variables .....</b>	<b>94</b>
Aeration .....	94
Free Amino Nitrogen .....	96
Pitching Rates.....	97
Top Pressure.....	100
Temperature.....	102
<b>Harvesting and Repitching Lager Yeast .....</b>	<b>104</b>
<b>Lagering .....</b>	<b>106</b>
Factors That Determine Lagering Time .....	107
Finding the Right Balance: Time versus Temperature .....	109
Knowing When Lagering Is Done.....	111
Yeast Health During Lagering .....	112

Autolysis .....	114
Sulfur Compounds .....	115
Attenuation .....	118
<b>Tips for Homebrewing .....</b>	<b>119</b>
<b>Chapter 4 – Got Decoction? .....</b>	<b>123</b>
<b>Malt Before Mashing.....</b>	<b>126</b>
<b>What Is a Decoction Mash? .....</b>	<b>128</b>
Triple Decoction .....	130
Double Decoction.....	131
Single Decoction .....	132
Simplified Decoction .....	132
Examples of Unconventional Decoction Programs .....	134
Double/Adjunct Mash, or Cereal Cook.....	135
<b>History of Decoction Mashing.....</b>	<b>138</b>
Historical Lager, Malt, and Mashing Principles.....	139
Addressing Explanations for the Origins of Decoction.....	140
So Why Decoction? .....	142
Decoction Starts to Be Questioned .....	144
Modern Misconceptions of Decoction .....	146
<b>Considerations for Decoction .....</b>	<b>147</b>
Deciding to Decoct.....	147
Designing a Grist for Decoction.....	149
Malt Modification.....	151
Extract and Attenuation.....	155
Maillard and Caramelization Reactions.....	158
Dark Malts and Astringency .....	159
Color Impact.....	160
Water-to-Grist Ratio.....	162
Mash Quantity .....	163
Decoction Portion.....	163
Mixing the Grains .....	164
Hot Side Aeration .....	164
<b>Homebrewing Tips.....</b>	<b>166</b>
Decoction Homebrewing .....	166
Step-Infusion Homebrew Process .....	167

<b>Chapter 5 – Carbon Dioxide: The Fifth Ingredient.....</b>	<b>173</b>
Understanding Carbon Dioxide Sources .....	174
Impact of Carbonation .....	175
Beer Foam.....	176
Understanding Carbonation in Beer .....	176
Natural versus Force Carbonation Process .....	179
Executing Natural Carbonation .....	184
Bunging: How and When.....	185
Spunding: Primary Fermentation.....	186
Krausening: Secondary Fermentation.....	190
Working with a Bunging Apparatus/Spunding Valve .....	195
Forced Fermentation Test .....	199
Spunding and Krausening for Homebrewers.....	200
<b>Chapter 6 – Other Traditional Lager Techniques .....</b>	<b>203</b>
Kellerbier.....	205
Serving from Wooden Barrels .....	209
Open Fermentation .....	211
Coolships and other Wort Cooling Devices .....	214
Cold Break: Sedimentation and Flotation Tanks.....	217
Biological Acidification .....	219
Steinbier .....	220
<b>Chapter 7 – The Future of Lager Brewing.....</b>	<b>225</b>
Hops for the Future .....	227
Future of Yeast .....	231
Future of Malt .....	233
A New Type of <i>Landbier</i> .....	235
Lager Aged on Wood .....	236
Serving Lager.....	238
Lager, and Beyond .....	240
<b>Chapter 8 – Recipes .....</b>	<b>242</b>
Adjunct Pale Lagers .....	244
Riggs Beer Company American Lager: American Corn Lager....	244
F.X. Matt Utica Club 1933 Pilsener: Prohibition-Era Pilsner.....	246
pFriem Japanese Lager: Rice Lager .....	248

<b>German-Inspired Pale Lagers.....</b>	<b>250</b>
Goldfinger Original Lager: Helles-Style Lager.....	250
Riegele Feines Urhell: Helles Lager.....	252
Seitz-Brau Hallertauer Hof-Bier Hell: Landbier .....	254
Jack's Abby Post Shift: Bavarian-Style Pilsner .....	256
Weihenstephaner Helles: Helles Lager .....	258
<b>Czech-Inspired Pale Lagers.....</b>	<b>260</b>
Břevnov Monastic Brewery Benedict Pale Lager:	
Pilsner-Style Pale Lager (Světlý Ležák) .....	260
Live Oak Pilz: Czech-Style Pilsner .....	262
Cohesion 12° – Pale Czech Lager: Czech-Style Pilsner.....	264
<b>Copper to Brown Lagers.....</b>	<b>266</b>
Rittmayer Kellerbier: Kellerbier .....	266
Brandholz Brauerei Golden Brown: Franconian Märzen Lager....	268
Utepils Brewing Broomstacker: Red Lager.....	270
Jack's Abby Red Tape Amber Lager: Munich-Style Dunkel.....	272
Heater Allen Dunkel: Munich-Style Dunkel.....	274
<b>Strong Pale Lagers .....</b>	<b>276</b>
Privatbrauerei Stöttner Export “Hell”: Export-Style Lager .....	276
Jack's Abby and Weihenstephan Fest of Both Worlds: Festbier.....	278
Enegren Brewing Company Maibock: Maibock.....	280
<b>Dark and/or Strong Lagers.....</b>	<b>282</b>
Brauerei Hofstetten Granitbock: Historical Stone Beer (Steinbier)..	282
Jack's Abby Framinghammer: Baltic Porter .....	284
East Rock Black Lager: German-Style Schwarzbier .....	286
Human Robot Tmavy 13°: Czech-Style Dark Lager .....	288
Bierstadt Lagerhaus Snüpinator Doppelbock: Doppelbock Dunkel...	291
<b>Nouveau Lagers.....</b>	<b>293</b>
Highland Park Brewery Timbo Pils: West Coast-Style Pilsner .....	293
Jack's Abby Hoponius Union: India Pale Lager .....	296
Threes Kicking and Screaming Foeder Lager: Foeder-Aged Pilsner ..	298
<b>Smoked Lagers .....</b>	<b>300</b>
Jack's Abby Fire in the Ham: Rauchbier Hell.....	300
Counter Weight Brewing Drudenhaus Rauchbier: Märzen .....	
Rauchbier .....	302
<b>Bibliography.....</b>	<b>305</b>
<b>Index .....</b>	<b>317</b>