

CONTENT

	Page
1. Barley : Taxonomy, Origin, Distribution, Production, Genetics, and Breeding	1
Introduction	1
Taxonomy, History, Origin, and Evolution	2
Adaptation, Distribution, and Production	4
Cytology, Genetics, Cytogenetics	8
Breeding	18
2. Formation of the Barley Grain – Morphology, Physiology, and Biochemistry	31
Introduction	31
Embryo Development	33
Carbohydrate Metabolism in the Developing Embryo	34
Role of Nucellar Tissue in Grain Development	34
Development of the Testa or Seed Coat	37
Pericarp Development	39
Pericarp Photosynthesis	42
The Husk	43
Endosperm Development	43
Nutrient Supply to the Developing Caryopsis	56
Grain Catabolic Processes	59
Overall Changes in Chemical Composition of Grains During Development and Maturation	61
Environmental Effects on Grain Growth and Development	65
Conclusions	67
3. Carbohydrates of the Barley Grain	73
Introduction	73
Barley Starch	74
Cell Wall Polysaccharides	96
Other Carbohydrates	116
4. Barley Seed Proteins	131
Introduction	131
Classification of barley Seed Proteins	131
Nonstorage Proteins	132
Storage Proteins	158
Seed Protein Polymorphism in Varietal Identification and Fingerprinting	181
Summary	183
5. Barley Lipids	199
Introduction	199
Methods of Analysis	199
Lipids in the Whole Grain	201
Distribution of Lipids in the Caryopsis	204
Composition of Lipids	214
Enzymes Acting on Lipids	220
Lipids in Developing Grain	227
Changes in Lipids in Stored Grain	228
Changes in Lipids in Germinating Barley	229
Technological Aspects of Lipids	232
Summary	236

6.	Physiology and Biochemistry of Germination in Barley	247
	Introduction	247
	Hormone Action	248
	Aleurone Function During Germination	251
	Scutellar Function During Germination	256
	Mobilization of Reserves in the Starchy Endosperm	257
	Structure and Regulation of Genes Encoding Hydrolytic Enzymes	270
	Protection of the Grain Against Microbial and Insect Attack	273
	Potential for Genetic Engineering	280
7.	Malting Technology and the Uses of Malt	297
	Introduction	297
	Biochemistry and Chemistry of Malting	299
	Properties of Barley with Regard to its Matability	311
	Evaluation and Selection of Barley for Malting	314
	Malting Technology	315
	Uses for Malt	332
8.	Nonmalting Uses of Barley	355
	Introduction	355
	Food Uses of Barley	356
	Barley Food Products	357
	Malted and Germinated Barley Food Products	364
	Industrial (Nonmalting) Utilization of Barley	366
	Hypocholesterolemic Effects	368
	Feed Uses of Barley	375
	Chemical Factors	378
	Barley for Poultry Feeding	386
	Barley for Swine Feeding	393
	Barley for Ruminants	400
	Conclusions and Future Directions	402
9.	Potential Improvement of Barley Quality Through Grnetic Engineering	419
	Introduction	419
	Potential Areas of Improvement for Malting, Brewing, Feed, and Food Uses	420
	Biotechnological Approaches to Genetic Modification of Barley	424
	Future Considerations	431
10.	Whole-Crop Utilization of Barley, Including Potential New Uses	437
	Introduction	437
	Barley as an Industrial Raw Material	440
	Inventories to Ascertain the Potential Use of Barley and Other Cereals	444
	Dry and Wet Milling of Barley for Starch	445
	Utilization of Starch	450
	Utilization of Cereal Straw	453
	Realizing the Industrial Potential of Starch and Cellulose from Cereal Plants	467
	Economic Considerations of the Use of Starch and Cellulose	469
	Conclusion	471
	Index	475