

Contents

Preface	ix
Valérie GAGNAIRE and Thomas CROGUENNEC	
Chapter 1. Infant Formulae: Ingredient Selection, Manufacturing Technology, Innovation, Challenges and Opportunities	1
Nicolas MALTERRE, Loreto M. ALONSO-MIRAVALLS and James A. O'MAHONY	
1.1. Introduction	1
1.1.1. Context for formula-feeding	1
1.1.2. Human and bovine milk	2
1.2. Types of infant formula and respective regulations.	4
1.2.1. Infant or first-age formula	4
1.2.2. Follow-on or second-age formula	7
1.2.3. Cereal-based foods and baby foods	8
1.2.4. Available formats of infant and follow-on formulae.	11
1.2.5. Formulae for special medical purposes	11
1.3. Ingredients	13
1.3.1. Proteins	13
1.3.2. Lipids	15
1.3.3. Carbohydrates.	16
1.3.4. Minor nutrients	16
1.3.5. Ingredient innovation for infant formula	17
1.4. Technological options for manufacture of infant nutritional products	20
1.4.1. Powders versus liquids	20
1.4.2. Innovation in processing technologies for infant formula.	27
1.5. Conclusion	28
1.6. References	28

Chapter 2. Strengths and Limitations of Current In Vitro Models Used for Studying Infant Digestion	41
Amira HALABI, Thomas CROGUENNEC and Amélie DEGLAIRE	
2.1. Introduction	41
2.2. Specificities of infant digestion.	43
2.2.1. Anatomy and function	43
2.2.2. Protein digestion	45
2.2.3. Lipid digestion	47
2.2.4. Carbohydrate digestion	51
2.3. In vitro gastrointestinal digestion models	51
2.3.1. In vitro static and semi-dynamic models	58
2.3.2. In vitro dynamic model.	63
2.4. In vitro colon fermentation models.	66
2.5. Other in vitro models	66
2.6. Conclusion	67
2.7. References	68
Chapter 3. Yogurts and Fermented Milks	79
Marie-Hélène FAMELART, Sylvie TURGEON, Valérie GAGNAIRE, Gwénaél JAN, Eric GUEDON, Audrey GILBERT, Anne THIERRY, Jean-Philippe DROUIN-CHARTIER	
3.1. What are yogurts and fermented milks?	79
3.2. Yogurt and fermented milk production	81
3.2.1. Dairy blend formulation (milk composition and standardization)	81
3.2.2. Homogenization and heat treatment.	82
3.2.3. The fermentation microbiota and its role in techno-functional and organoleptic properties	84
3.3. Microstructure–texture–functionality relationships.	91
3.3.1. Microstructure of firm yogurts.	91
3.3.2. Microstructure of stirred yogurts	93
3.3.3. Techniques for observing yogurt structure	94
3.3.4. Links between microstructure and physical or sensory properties	97
3.3.5. Syneresis.	98
3.4. Nutrition and health	99
3.4.1. Consumption trends.	99
3.4.2. Yogurt and health – epidemiological perspectives.	99
3.4.3. Yogurt and health – clinical perspectives.	102
3.4.4. Yogurt and health – general outlook	107
3.5. General conclusion: yogurts for the future	109
3.6. References	111

Chapter 4. Enzymatic Gelation of Milk, Curd Draining and Cheese Yields	129
Julien BAULAND, Sébastien ROUSTEL, Marc FAIVELEY, Marie-Hélène FAMELART and Thomas CROGUENNEC	
4.1. Introduction	129
4.2. Casein micelle: structure, stability and equilibrium with the soluble phase of milk	130
4.2.1. Casein micelle structure and stability	130
4.2.2. Mineral equilibrium with the soluble phase of milk	133
4.3. Enzymatic coagulation of milk: formation and aging of a colloidal gel.	137
4.3.1. Hydrolysis of κ -casein and aggregation of para-micelles	137
4.3.2. Gel structure and rheological properties in the linear domain.	139
4.3.3. Mechanisms of gel aging	140
4.3.4. Effect of variations of physico-chemical conditions and milk composition on the structure and the rheological properties of the enzymatic gel.	143
4.3.5. Rheological properties at large strains	147
4.4. Physics of cheese curd and mechanisms of fat and protein losses during continental cheese manufacture	148
4.4.1. Macrosynthesis of the curd.	148
4.4.2. Fat and protein losses during cutting and stirring	154
4.5. Conclusion	163
4.6. References	164
Chapter 5. Do Technological Operations Have an Impact on the Nutritional Properties of Dairy Products?	173
Frédéric GAUCHERON and Constance BOYER	
5.1. Introduction	173
5.2. Uses, benefits and consequences of heat treatments and homogenization	174
5.2.1. Heat treatments	174
5.2.2. Homogenization.	177
5.3. Purification of dairy constituents to obtain high value-added fractions.	179
5.3.1. Dairy proteins	179
5.3.2. Bioactive peptides	179
5.3.3. Polar lipids.	180
5.4. Biotechnology for dairy products: using enzymes and micro-organisms of interest	181
5.4.1. Lactose removal.	181
5.4.2. Use of micro-organisms	181

5.5. Dairy products for tomorrow? What technologies? What research?	183
5.5.1. Dairy products for tomorrow?	183
5.5.2. What new milks and technologies need to be adapted? What kind of research?	184
5.6. References	188
Chapter 6. Fouling in the Dairy Industry.	193
Weiji LIU and Guillaume DELAPLACE	
6.1. Introduction	193
6.2. Thermal processing of milk and related issues	194
6.3. Composition of milk and fouling deposits.	196
6.4. Thermal denaturation of whey proteins	198
6.4.1. β -lactoglobulin (BLG)	198
6.4.2. Thermal denaturation mechanisms of BLG.	199
6.4.3. Thermal denaturation kinetic models of BLG	207
6.4.4. Caseins and their chaperone-like functions.	212
6.5. Mineral precipitations	220
6.5.1. Calcium phosphate precipitation.	220
6.5.2. Effect of calcium on BLG denaturation and fouling	222
6.6. Overall fouling mechanisms and influencing factors	225
6.7. Fouling models.	229
6.7.1. Fouling characteristics: definition and evolution.	229
6.7.2. One-dimensional fouling models	232
6.7.3. Two/three-dimensional CFD fouling models.	236
6.7.4. Other fouling models	237
6.8. Cleaning of dairy fouling	240
6.9. Conclusions	241
6.10. References	242
List of Authors	261
Index.	265