
Cell Biology of Tooth Enamel Formation

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Cell Biology of Tooth Enamel Formation

Functional Electron Microscopic Monographs

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Contents

Preface	VII
Acknowledgments	IX
1. Introduction	1
1.1. Embryology of the Enamel Organ	1
1.2. Definitions and Terminology in Amelogenesis	4
1.3. Historical Review of Electron Microscopic Research of Tooth Enamel	6
1.4. Electron Microscopic Techniques for Research of Dental Hard Tissues	9
2. Amelogenesis	
2.1. Presecretory Stage	13
2.1.1. General Comments	13
2.1.2. Outer Layer of Enamel Organ	15
2.1.3. Inner Enamel Epithelium and Dental Papilla	17
2.1.4. Epithelial-Mesenchymal Interactions and Basement Membranes	20
2.1.5. Preameloblasts, Preodontoblasts, and Secretory Odontoblasts	23
2.1.6. Development of Intercellular Junctions in Preameloblasts	27
2.1.7. Calcium Localization and Ca-ATPase Development in Preameloblasts and Initial Enamel Formation	29
2.1.8. Calmodulin and Other Calcium-Binding Proteins in Preameloblasts and the Outer Layer of Enamel Organ	33
2.1.9. Complex Carbohydrates and Lipids in the Enamel Organ	35
2.2. Secretory Stage	37
2.2.1. General Comments	37
2.2.2. The Stratum Intermedium Layer	39
2.2.3. Stellate Reticulum and Outer Enamel Epithelium	42
2.2.4. Connective Tissues between the Outer Enamel Epithelium and Capillary Vessels	45
2.2.5. Secretory Ameloblasts – Whole View	45
2.2.6. Structure and Permeability of Junctional Complexes of the Secretory Ameloblast	50
2.2.7. Cytoskeleton in Secretory Ameloblasts	53
2.2.8. Enamel Protein Synthesis and Its Secretory Pathways	56
2.2.9. Effects of Tunicamycine on Structure of Secretory Ameloblasts and the Enamel Organ	60
2.2.10. Golgi-GERL-Lysosome System and Resorptive Function	62
2.2.11. Structure of the Tomes Process and Rod Enamel Formation	65

2.2.12. Localization of Calcium and Ca-ATPase in Secretory Ameloblasts	70
2.2.13. Intracellular Calcium Mediators in Secretory Ameloblasts	76
2.2.14. Regulation of Calcium Transport by Secretory Ameloblasts	80
2.2.15. Na-K-ATPase and H-K-ATPase Localization in Secretory Ameloblasts	84
2.3. Transition Stage	87
2.3.1. General Comments	87
2.3.2. Structural Changes in the Enamel Organ at the Transition Stage	88
2.3.3. Cytology of Transition Ameloblasts	92
2.4. Maturation Stage	95
2.4.1. General Comments	95
2.4.2. Three-Dimensional Architecture and Cytology of the Papillary Cell Layer	97
2.4.3. Microvascular Architecture of Enamel Organ	104
2.4.4. Maturation Ameloblasts: Structure and Cyclic Modulation	106
2.4.5. Junctional Complex of Maturation Ameloblasts	115
2.4.6. The Ruffled Border	119
2.4.7. Resorptive Function of Maturation Ameloblasts	121
2.4.8. Calmodulin in the Maturation-Zone Enamel Organ	124
2.4.9. Effects of Na-K-ATPase Inhibitor Ouabain Administration on Maturation Ameloblast Structure and Enamel Mineralization	128
2.4.10. Regulation of Enamel Maturation by Enamel Organ	132
3. Forming and Maturing Enamel Structure	138
3.1. Formation of Rod and Inter-Rod Enamel	138
3.2. Structure and Hydroxyapatite Crystals in Forming and Maturing Enamel	142
3.3. Microanalysis of Developing Enamel Matrix	146
3.4. Ultracytochemistry of Developing Enamel Matrix	150
3.5. Matrix: Mineral Relationship	154
4. Amelogenesis Disturbances	159
4.1. General Comments	159
4.2. Amelogenesis Disturbances Induced by Fluoride Administration	161
4.3. Amelogenesis Disturbance at the Secretory Stage Induced by Microtubule and Microfilament Inhibitors	164
4.4. Amelogenesis Disturbance at the Maturation Stage Induced by Microtubule Inhibitors	168
References	172
Subject Index	200

Preface

Morphological research has had an important role in elucidating the mechanisms of tooth enamel formation. Rapid advances in the sophistication of instrumentation and in the technology of processing dental hard tissues have provided us with a more profound knowledge and understanding of amelogenesis. Enamel is a unique mineralized tissue in its method of development, structure, and chemical nature. It is the only mineralized tissue of ectodermal origin in vertebrates. Mature enamel, containing very little organic matrix, is the mostly highly mineralized and hardest tissue in the body. Enamel is so stable that it can resist heavy occlusal forces and various noxious chemicals. Although sound enamel does not contain cellular elements and thus has no metabolic activity, its development and its internal three-dimensional architecture are under complete cellular control of the enamel organ. Unlike the ectomesenchymal mineralized tissues bone and dentine, enamel requires a long period of formation from matrix production to the end of maturation. During the process of enamel formation, the epithelial cells of the enamel organ undergo drastic morphological and functional modulations.

During the last decade, the authors of this monograph have attempted, by means of various histologic and electron microscopic techniques, to elucidate the cellular mechanisms involved in tooth enamel formation. Our interest has been particularly focused on *how* the biomineralization of enamel is regulated by the specialized epithelial cell layer, *the enamel organ*. Although the proceedings of several special symposia devoted to tooth enamel and its formation have been published recently, we believe it is worthwhile to review the process of enamel formation from a cellular point of view, and to compile in this monograph information that attempts to bridge the morphological and biochemical approaches. New immunocytochemical, cytochemical, and X-ray elemental analysis techniques have given us the means to understand the structural-functional relationship in a more dynamic way than heretofore possible. This monograph is written for postgraduate students and laboratory investigators, but may also be useful

for undergraduate students with a prior understanding of oral histology and embryology.

Some of the interpretations and conclusions that we have drawn from the data contained in this monograph and in our publications are at odds with the current hypotheses of other investigators. We are aware that not all of our ideas will stand the test of time, yet we are of the opinion that one purpose of this monograph is to stimulate future research on the enamel organ. We welcome the constructive criticism of our readers.

Tokyo, December 1989

Takahisa Sasaki

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