## Contents

| Preface  | υ    |  |  |
|--|------|--|--|
| Acknowledgments  | vii  |  |  |
| List of Figures  | xi   |  |  |
| List of Tables   | xvii |  |  |
| Introduction   | xix  |  |  |
| PART I   |      |  |  |
| THE PROTOPLASMIC UNIT  | 1    |  |  |
| 1. The Protoplasmic Unit                                     | 5    |  |  |
| PART II  |      |  |  |
| EXTRANEOUS COATS   | 33   |  |  |
| 2. General Characteristics of Extraneous Coats and           |      |  |  |
| Methods of Investigation                                     | 35   |  |  |
| 3. Extraneous Coats of Plant Cells                           | 50   |  |  |
| 4. Extraneous Coats of Animal Cells                          | 63   |  |  |
| 5. Role of Intercellular Cement in Cell Organization         | 75   |  |  |
| PART III   |      |  |  |
| THE PROTOPLASMIC SURFACE FILM                                |      |  |  |
| 6. The Protoplasmic Surface Film as a Barrier                | 91   |  |  |
| 7. New Formation of the Protoplasmic Surface Film            | 100  |  |  |
| 8. Physical Properties of the Protoplasmic Surface Film      | 105  |  |  |
| 9. Nature of the Protoplasmic Surface Film: An Hypothesis    | 114  |  |  |
| PART IV  |      |  |  |
| THE ACTION OF SALTS ON PROTOPLASM                            | 119  |  |  |
| 10. Critique of Immersion Studies of the Effects of Salts on |      |  |  |
| Protoplasm   | 121  |  |  |
| 11. Effects of Salts Microinjected into Protoplasm           | 131  |  |  |
|  | ix   |  |  |

| x | CONTENTS |
|---|----------|
|   |          |

| PART | rν  |     |
|------|---|-----|
| HYDI | ROGEN-ION CONCENTRATION OF CELL COMPONENTS            | 141 |
|      | 12. Critique of Various Methods of Determining        |     |
|      | Intracellular pH                                      | 143 |
|      | 13. Measurements of pH by Microinjecting Indicators   | 152 |
|      | 14. Evaluation of Intraprotoplasmic pH Determinations | 166 |
| PART | r vi  |     |
| PENI | ETRATION OF DYES INTO CELLS AND VITAL STAINING        | 175 |
|      | 15. Penetration of Dyes by Diffusion                  | 177 |
|      | 16. Penetration of Dyes by Metabolic Activity         | 190 |
| PART | r vii   |     |
| THE  | ASTER, THE SPINDLE, AND CELL DIVISION                 | 197 |
|      | 17. The Aster   | 199 |
|      | 18. The Spindle                                       | 222 |
|      | 19. Cell Division in Echinoderm Eggs                  | 228 |
|      | 20. Cell Division in Cells other than Echinoderm Eggs | 253 |
| PART | r viii  |     |
| MICE | ROMANIPULATION  | 259 |
|      | 21. The Micromanipulative Method                      | 261 |
| APPE | ENDICES   |     |
|      | A. The Technique of Micromanipulation                 | 281 |
|      | B. Technique of Determining Intracellular pH by the   |     |
|      | Microinjection Method                                 | 295 |
| BIBL | JOGRAPHY  | 299 |
| INDE | ex  | 331 |

•