Contents

| Lis | t of Tables | ci |
|-----|---|----------|
| Lis | t of Figures | X |
| Voi | es on the Contributors | xi |
| Gei | neral Introduction | 3 |
| | RT I TOOLS AND RESEARCH MATERIALS: E INDUSTRIALIST AS PRODUCER | |
| nt | roduction | 18 |
| 1 | An Old Hand in a New System H. Otto Sibum | 23 |
| | Introduction | 23 |
| | Brewers Changing Tact | 25 |
| | Joule's Working Laboratory | 32 |
| | Writing a Body of Text A Conflict of Values | 35 |
| | Changing Gravity of Gestures | 36 41 |
| 2 | Plasticine and Valves: Industry, Instrumentation | |
| | and the Emergence of Nuclear Physics Jeff Hughes | 58 |
| | Introduction Exploring the Atom: the Technologies of Artificial | 58 |
| | Disintegration A Portrait of the Physicist as a Young Ham: Radio | 63 |
| | Technoculture at the Cavendish Laboratory 'Simplicity, Economy and Reliability': Valves, Circuits | 66 |
| | and the Transformation of Radioactivity Research Instrumentation and the Making of a Discipline: | 71 |
| | Valves, Technique and the Rise of Nuclear Physics Conclusion: Industry, Technique and the 'Purity' | 79 |
| | of Science | 86 |

| 3 | Instrument Hierarchies: Laboratories, Industry | |
|------|---|-----|
| | and Divisions of Labour | 102 |
| | Terry Shinn | |
| | Introduction | 102 |
| | The Research Technology Community | 103 |
| | Instrument Disinvolvement | 109 |
| | Mixed Hierarchies | 114 |
| | Remarks | 119 |
| 4 | Theory from Practice: Portraying the Constitution | |
| | of Synthetic Dyestuffs in the 1860s | 122 |
| | Anthony S. Travis | |
| | Introduction | 122 |
| | Hofmann, the Dye Industry and Type Formulae | 123 |
| | Heinrich Caro, Manchester and Rosolic Acid | 127 |
| | The Dislocation of the Network | 135 |
| | Epilogue: the Benzene Theory and the Constitutions of | |
| | Rosaniline and Rosolic Acid | 137 |
| | Conclusion | 138 |
| 5 | Can it Ever be Pure Science? Pharmaceuticals, | |
| | the Pharmaceutical Industry and Biomedical | |
| | Research in the Twentieth Century | 143 |
| | Jordan Goodman | |
| | Introduction | 143 |
| | Vignette I | 150 |
| | Vignette II | 153 |
| | Vignette III | 155 |
| | Conclusion | 160 |
| PAI | RT II STANDARDIZING TOOLS, OPERATORS | |
| AN | D PRACTICES: THE INDUSTRIALIST AS | |
| RE | GULATOR | |
| ĺntr | roduction | 168 |
| 6 | Instruments, Scientists, Industrialists and the | |
| - | Specificity of 'Influence': The Case of RCA and | |
| | Biological Electron Microscopy | 173 |
| | Nicolas Rasmussen | 1.0 |

| | Contents | vii |
|---|--|-----|
| | Introduction | 173 |
| | RCA Enters the Electron Microscope Business | 175 |
| | RCA and Biological Electron Microscopy in the Early | |
| | War Years | 178 |
| | The Rockefeller Foundation and Wartime Biological | |
| | Electron Microscopy at MIT and Stanford | 187 |
| | RCA and Postwar Biological Electron Microscopy | 191 |
| | Conclusion: Industrialists in Biological Electron | |
| | Microscopy and the Question of Influence | 196 |
| 7 | Disciplining Cancer: Mice and the Practice of | |
| | Genetic Purity | 209 |
| | Ilana Löwy and Jean-Paul Gaudillière | |
| | Introduction | 210 |
| | Transplanted Tumours as a Model of Cancer | 211 |
| | Genetic Purity: the Co-production of Inbred Lines | |
| | and Spontaneous Cancers | 216 |
| | Genetic Purity as a 'Cottage Industry': Low-Cancer and | |
| | High-Cancer Lines at the Radium Institute, Paris. | 225 |
| | The Return of Transplanted Tumours: Screening for | |
| | Anti-cancer Drugs, 1945-66 | 227 |
| | Genetic Purity as an Impure Practice: Mass-Produced | |
| | Mice and Tumour Viruses | 232 |
| | Conclusion | 238 |
| 8 | Interlaboratory Life: Regulating Flow Cytometry | 250 |
| | Peter Keating and Alberto Cambrosio | |
| | Introduction | 250 |
| | Flow Cytometry | 252 |
| | Regulation and the Meaning of Data | 254 |
| | Flow Cytometry: Between Industry, the Clinic and Science | 256 |
| | Regulatory Practices | 259 |
| | Regulation in Motion | 262 |
| | Regulating Practices | 267 |
| | Regulating Operators | 268 |
| | Regulating Reagents | 271 |
| | Regulating the Instrument | 274 |
| | Regulating Blood | 276 |
| | Regulation as Research: from Subject to Regulation to | |
| | Regulatory Tool | 278 |
| | Conclusion | 281 |

PART III ORGANIZATION OF RESEARCH AND POLICY: THE INDUSTRIALIST AS MANAGER

| Introduction | | 298 |
|--------------|--|-----|
| 9 | Industrial R&D and Its Influence on the Organization and Management of the Production of Knowledge in the Public Sector Vivien Walsh | 301 |
| | Introduction Public Policy and the Promotion of Links Between | 301 |
| | Industry and Public Sector Research | 304 |
| | Biotechnology | 313 |
| | Steroids and Oral Contraceptives | 323 |
| | Conclusion | 334 |
| 10 | Shifting Boundaries between Industry and Science: | |
| | The Role of the WHO in Contraceptive R&D Nelly Oudshoorn | 345 |
| | Introduction | 345 |
| | The Decline of Industrial Contraceptive R&D | 346 |
| | Reallocating Contraceptive R&D from the North to | |
| | Reorienting Contraceptive R&D Towards Other | 349 |
| | Products and Users | 355 |
| | Conclusions | 361 |
| nde. | x | 369 |

List of Tables

| 9.1 | Performance of R&D resources spent by sector | 302 |
|-----|--|-----|
| 9.2 | | 302 |
| 9.3 | Number of public research and industrial participants in the | |
| | ESPRIT Programme, 1987–91 | 309 |
| 9.4 | Acquisitions of biotechnology companies by European firms | 319 |
| 9.5 | | 321 |

List of Figures

| 1.1 | Characteristic gesture of hydrometric measurement by an | |
|------|---|-----------|
| | early Victorian brewer to determine the specific gravity of | |
| | fluids. Engraving taken from George Dodd, Days at the | |
| | Factories; or the Manufacturing Industry of Great Britain | |
| | Described and Illustrated by Numerous Engravings of | |
| | Machines and Processes. London: Charles Knight & Co, | |
| | 1843; reprint New York: Augustus M. Kelley, 1967 | 29 |
| 1.2 | James Clerk Maxwell's sketch of an experiment to | |
| | determine the mechanical equivalent of heat. Cambridge | |
| | University Library, letter from Maxwell to Tait, | |
| | 23 December 1867, MSS Add 7655 Ib 9 | 39 |
| 1.3 | James Joule's sketch of an air (nitrogen) thermometer, | <i>J.</i> |
| | found in a letter from Joule to William Thomson, | |
| | 16 September 1879, Cambridge University Library, | |
| | MSS Add 7342 J 296 | 47 |
| 4.1 | Kekulé's four-valent carbon atom concept | 126 |
| 4.2 | Formulae for aniline red, aniline blue and aniline violet | 126 |
| 4.3 | Rosolic acid and its derivatives | 129 |
| 4.4 | Wanklyn comparison of the reduction of ethylene to ethane | 127 |
| | to the conversion of rosaniline into leucaniline | 131 |
| 4.5 | Hofmann's formula for rosaniline | 131 |
| 4.6 | Wanklyn's formula for the constitution of rosolic acid | 131 |
| 4.7 | Wanklyn's equation for the formation of a blue dye through | |
| | the action of aniline on rosolic acid. | 132 |
| 4.8 | Conversion of rosaniline to rosolic acid | 133 |
| 4.9 | Rosolic acid formulae according to Caro and Wanklyn | 133 |
| 4.10 | Baeyer's formulae for rosolic acid and rosaniline | 138 |
| 5.1 | Model to illustrate the relationship between pharmaceuticals, | 150 |
| | research, industry and the market as a positive-feedback | |
| | system | 149 |
| 6.1 | Vladimir Zworykin and James Hillier at the model B | 142 |
| | microscope, circa 1940 | 179 |
| 6.2 | James Hillier demonstrating the RCA EMU microscope, | 117 |
| | circa 1945 | 192 |
| 6.3 | RCA full-page advertisement on p. 1 of the December 1949 | . , 2 |
| | Scientific American | 194 |
| | | |

| | List of Figures | x i |
|-----|--|------------|
| 9.1 | Growth of newly established technology cooperation agreements in biotechnology, information technologies | |
| | and new materials | 311 |
| 9.2 | The network of cooperation in biotechnology | 312 |
| 9.3 | Types of biotechnology collaborations | 318 |