



# INTERCELLULAR SIGNALING IN DEVELOPMENT AND DISEASE

EDITED BY  
EDWARD A. DENNIS AND RALPH A. BRADSHAW



## Contents

### Section A – Overview 1

1. Signaling in Development and Disease 3  
*Edward A. Dennis, Ralph A. Bradshaw*

### Section B – Cell-Cell Signaling 9

2. Overview of Cell–Cell and Cell–Matrix Interactions 11  
*E. Brad Thompson and Ralph A. Bradshaw*
3. Integrin Signaling: Cell Migration, Proliferation, and Survival 13  
*J. Thomas Parsons, Jill K. Slack-Davis, Robert W. Tilghman, Marcin Iwanicki and Karen H. Martin*
4. The Focal Adhesion: A Network of Molecular Interactions 23  
*Jianxin A. Yu, Nicholas O. Deakin and Christopher E. Turner*
5. Cadherin Regulation of Adhesive Interactions 29  
*Barbara Ranscht*
6. *In vivo* Functions of Heterotrimeric G Proteins 43  
*Stefan Offermanns*
7. G-Protein Signaling in Chemotaxis 51  
*Jonathan Franca-Koh, Stacey Sedore Willard and Peter N. Devreotes*
8. Interactive Signaling Pathways in the Vasculature 59  
*Lucy Liaw, Igor Prudovsky, Volkhard Lindner, Calvin Vary and Robert E. Friesel*
9. Signaling Pathways Involved in Cardiogenesis 67  
*Deepak Srivastava and Chulan Kwon*

10. Calcium Signaling in Cardiac Muscle 77  
*K.M. Dibb, A.W. Trafford and D.A. Eisner*
11. Calcium Signaling in Smooth Muscle 81  
*Susan Wray*
12. Trophic Effects of Gut Hormones in the Gastrointestinal Tract 99  
*Kanika A. Bowen and B. Mark Evers*
13. Cell–Cell and Cell–Matrix Interactions in Bone 109  
*Lynda F. Bonewald*
14. Cell–Cell Signaling in the Testis and Ovary 125  
*Michael K. Skinner, Eric E. Nilsson and Ramji K. Bhandari*
15. Kidney 141  
*William J. Arendshorst and Elsa Bello-Reuss*
16. Cytokines and Cytokine Receptors Regulating Cell Survival, Proliferation, and Differentiation in Hematopoiesis 167  
*Fiona J. Pixley and E. Richard Stanley*
17. CD45 177  
*Michelle L. Hermiston, Vikas Gupta and Arthur Weiss*
18. Signal Transduction in T Lymphocytes 183  
*Rolf König*
19. Signal Transduction via the B Cell Antigen Receptor: A Crucial Regulator of B Cell Biology 193  
*Louis B. Justement*
20. Signaling Pathways Regulating Growth and Differentiation of Adult Stem Cells 203  
*Larry Denner, Margaret Howe and Randall J. Urban*

- Section C – Signaling In Development 213**
21. **Wnt Signaling in Development 215**  
*Stefan Rudloff, Daniel Messerschmidt and Rolf Kemler*
  22. **Interactions between Wnt/β-Catenin/ Fgf and Chemokine Signaling in Lateral Line Morphogenesis 221**  
*Tatjana Piotrowski*
  23. **Integration of BMP, RTK, and Wnt Signaling Through Smad1 Phosphorylations 227**  
*Luis C. Fuentealba, Edward Eivers, Hojoon X. Lee and E. M. De Robertis*
  24. **Hedgehog Signaling in Development and Disease 233**  
*Frederic de Sauvage*
  25. **Regulation of Vertebrate Left-Right Axis Development by Calcium 239**  
*Adam D. Langenbacher and Jau-Nian Chen*
  26. **LIN-12/Notch Signaling: Induction, Lateral Specification, and Interaction with the EGF/Ras Pathway 245**  
*Sophie Jarriault*
  27. **Proteolytic Activation of Notch Signaling: Roles for Ligand Endocytosis and Mechanotransduction 251**  
*James T. Nichols and Gerry Weinmaster*
  28. **Vascular Endothelial Growth Factors and Receptors: Signaling in Vascular Development 259**  
*Anna Dimberg, Charlotte Rolny, Laurens A. van Meeteren and Lena Claesson-Welsh*
  29. **BMPs in Development 271**  
*Kelsey N. Retting and Karen M. Lyons*
  30. **Signaling from Fibroblast Growth Factor Receptors in Development and Disease 279**  
*Kristine A. Drafahl, Christopher W. McAndrew and Daniel J. Donoghue*
  31. **Regulation of Synaptic Fusion by Heterotrimeric G Proteins 289**  
*Simon Alford, Edaeni Hamid, Trillium Blackmer and Tatyana Gerachshenko*
  32. **The Role of Receptor Protein Tyrosine Phosphatases in Axonal Pathfinding 297**  
*Andrew W. Stoker*
  33. **Neurotrophin Signaling in Development 303**  
*Katrin Deinhardt and Moses V. Chao*
  34. **Attractive and Repulsive Signaling in Nerve Growth Cone Navigation 309**  
*Guo-li Ming and Mu-ming Poo*
  35. **Semaphorins and their Receptors in Vertebrates and Invertebrates 315**  
*Eric F. Schmidt, Hideaki Togashi and Stephen M. Strittmatter*
  36. **Signaling Pathways that Regulate Cell Fate in the Embryonic Spinal Cord 321**  
*Matthew T. Pankratz and Samuel L. Pfaff*
- Section D – Signaling In Disease 329**
37. **Ras and Cancer 331**  
*Frank McCormick*
  38. **Targeting Ras for Anticancer Drug Discovery 335**  
*Jen Jen Yeh, James P. Madigan, Paul M. Campbell, Patrick J. Roberts, Lanika DeGraffenreid and Channing J. Der*
  39. **The Roles of Ras Family Small GTPases in Breast Cancer 357**  
*Ariella B. Hanker and Channing J. Der*
  40. **Signaling Pathways in the Normal and Neoplastic Breast 367**  
*Tushar B. Deb, Danica Ramljak, Robert B. Dickson, Michael D. Johnson and Robert Clarke*
  41. **Aberrant Signaling Pathways in Pancreatic Cancer: Opportunities for Targeted Therapeutics 375**  
*Alixanna Norris and Murray Korc*

42. Regulatory Signaling in Pancreatic Organogenesis: Implications for Aberrant Signaling in Pancreatic Cancer 391  
*Catherine Carrière and Murray Korc*
43. Angiogenesis Signaling Pathways as Targets in Cancer Therapy 401  
*Chery A. Whipple and Murray Korc*
44. Clinical Applications of Kinase Inhibitors in Solid Tumors 413  
*William Pao and Nicolas Girard*
45. Adipokine Signaling: Implications for Obesity 431  
*Rexford S. Ahima and Gladys M. Varela*
46. CXC Chemokine Signaling in Interstitial Lung Diseases 441  
*Borna Mehrad and Robert M. Strieter*
47. ER and Oxidative Stress: Implications in Disease 447  
*Jyoti D. Malhotra and Randal J. Kaufman*
48. Protein Serine/Threonine Phosphatase Inhibitors and Human Disease 457  
*Shirish Shenolikar and Matthew H. Brush*
49. Signal Transduction in Rheumatoid Arthritis and Systemic Lupus Erythematosus 463  
*Thomas Dörner and Peter E. Lipsky*
50. Translational Concepts in Vasculitis 477  
*Daniel A. Albert and David B. Talmadge*
51. Translational Implications of Proteomics 489  
*Sam Hanash*
52. Translational Implications of MicroRNAs in Clinical Diagnostics and Therapeutics 495  
*Lorenzo F. Sempere and Sakari Kauppinen*
- Index 513