Diabetes is now reaching epidemic proportions, and the associated complications of this disease can be life threatening and disabling. Over recent years, both clinical and basic researchers have increased our understanding of the mechanisms involved in the progression of diabetes and the relative roles played by both environmental and genetic factors. For example, it is well known that a lifestyle of inactivity and excessive food intake plays an important part in diabetes risk.

The purpose of this volume is to provide up-to-date explanations of commonly used laboratory protocols used in diabetes research. Specifically, the chapters will cover the commonly described in vivo and in vitro model systems, ultimately leading to an overall view of how cellular dysfunction and degeneration lead to susceptibility and diabetes disease progression.

This book is unique in providing a simple explanation of a particular practical technique or model in a short succinct format, thus allowing research scientists and clinicians quick and easy practical information to address a particular question. There are key practical notes at the end of each chapter, as well as numerous helpful tables and figures.

Claire Stocker
Buckingham, UK
Contents

Preface ........................................................................................................................ v
Contributors .............................................................................................................. ix

1. Selecting the “Right” Mouse Model for Metabolic Syndrome and Type 2 Diabetes Research ................................................................. 1
   Edward H. Leiter

2. Nutritional Models of Type 2 Diabetes Mellitus ................................................... 19
   Beverly Sara Mühlhauser

3. The Isolation and Purification of Rodent Pancreatic Islets of Langerhans .......... 37
   Jacqueline F. O’Dowd

4. The Measurement of Insulin Secretion from Isolated Rodent Islets of Langerhans ............................................................................................. 43
   Anna L. Nolan and Jacqueline F. O’Dowd

5. The Incubation and Monitoring of Cell Viability in Primary Rat Islets of Langerhans and Pancreatic β-Cell Lines ............................................. 53
   Noel G. Morgan, Eleftheria Diakogiannaki, and Mark A. Russell

6. In Vitro Culture of Isolated Islets of Langerhans: Analysis of Function .......... 65
   Anna L. Nolan

7. Single-Cell RT-PCR Identification of Genes Expressed by Human Islet Endocrine Cells ..................................................................... 73
   Dany Muller, Peter M. Jones, and Shanta J. Persaud

8. Laser Capture Microdissection of Human Pancreatic β-Cells and RNA Preparation for Gene Expression Profiling ............................................. 87
   Lorella Marselli, Dennis C. Sgroi, Susan Bonner-Weir, and Gordon C. Weir

9. In Vitro Transdifferentiation of Human Hepatoma Cells into Pancreatic-Like Cells ........................................................................... 99
   Wan-Chun Li

10. The Measurement of GLUT4 Translocation in 3T3-L1 Adipocytes ................. 111
    Nicky Konstantopoulos and Juan Carlos Molero-Navajas

    Eduard Montanya and Noëlia Téllez

12. Morphology of Pancreatic Islets: A Time Course of Pre-diabetes in Zucker Fatty Rats ......................................................... 159
    Petra Augstein and Eckhard Salzsieder

13. Fluorescent Immunohistochemistry and In Situ Hybridization Analysis of Pancreas ........................................................................... 191
    Xiuli Wang, Shundi Ge, and Gay M. Crooks
15. Hyperinsulinemic–Euglycemic Clamp to Assess Insulin Sensitivity In Vivo................ Jason K. Kim 221
16. Gene Expression Analysis in Diabetes Research.................................................. Peter White and Klaus H. Kaestner 239
17. Gene Expression Mining in Type 2 Diabetes Research................................. Donald R. Dunbar 263

Index........................................................................................................................................ 273
Contributors

Petra Augstein • Institute of Diabetes “Gerhardt Katsch” Karlsburg e.V.,
Karlsburg, Germany

Susan Bonner-Weir • Section on Islet Transplantation and Cell Biology,
Research Division, Joslin Diabetes Center and the Department of Medicine,
Harvard Medical School, Boston, MA, USA

Gay M. Crooks • Division of Research Immunology/BMT, Childrens Hospital Los
Angeles, Los Angeles, CA, USA

Eleftheria Diakogiannaki • Institute of Biomedical and Clinical Science, Peninsula
Medical School, Plymouth, Devon, UK

Donald R. Dunbar • Centres for Cardiovascular Science and Inflammation Research,
Queen’s Medical Research Institute, University of Edinburgh, Edinburgh, UK

Shundi Ge • Division of Research Immunology/BMT, Childrens Hospital Los
Angeles, Los Angeles, CA, USA

Peter M. Jones • Beta Cell Development & Function Group, King’s College London,
London, UK

Klaus H. Kaestner • Department of Genetics and Institute for Diabetes, Obesity and
Metabolism, University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Jason K. Kim • Division of Endocrinology, Metabolism and Diabetes Director,
UMass Mouse Phenotyping Center University of Massachusetts Medical School,
381 Plantation Street, Suite 200 Worcester, MA, USA

Nicky Konstantopoulos • Metabolic Research Unit, Deakin University, Geelong,
VIC, Australia

Edward H. Leiter • The Jackson Laboratory, Bar Harbor, ME, USA

Wan-Chun Li • Section of Islet Transplantation and Cell Biology, Joslin Diabetes
Center, Boston, MA, USA

Lorella Marselli • Section on Islet Transplantation and Cell Biology, Research
Division, Joslin Diabetes Center and the Department of Medicine, Harvard
Medical School, Boston, MA, USA

Juan Carlos Molero-Navajas • Metabolic Research Unit, Deakin University,
Geelong, VIC, Australia

Eduard Montanya • Endocrine Unit, University Hospital of Bellvitge, Barcelona,
Spain

Department of Clinical Sciences, University of Barcelona, Barcelona, Spain

Biomedical Research Institute of Bellvitge (IDIBELL), L’Hospitalet de Llobregat,
Barcelona, Spain

Noel G. Morgan • Institute of Biomedical and Clinical Science, Peninsula Medical
School, Plymouth, Devon, UK
BEVERLY SARA MÜHLHAUSLER • Early Origins of Adult Health Research Group, Sansom Research Institute, University of South Australia, Adelaide, SA, Australia

DANY MULLER • Beta Cell Development & Function Group, King’s College London, London, UK

ANNA L. NOLAN • Elixic Pharmaceuticals, Cambridge, MA, USA

JACQUELINE F. O’DOWD • Clore Laboratory, University of Buckingham, Buckingham, Buckinghamshire, UK

SHANTA J. PERSAUD • Beta Cell Development & Function Group, King’s College London, London, UK

MARK A. RUSSELL • Institute of Biomedical and Clinical Science, Peninsula Medical School, Plymouth, Devon, UK

ECKHARD SALZSIEDER • Institute of Diabetes “Gerhardt Katsch” Karlsburg e.V., Karlsburg, Germany

DENNIS C. SGROI • Molecular Pathology Unit, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

NOÉLIA TÉLLEZ • Biomedical Research Institute of Bellvitge (IDIBELL), L’Hospital de Llobregat, Barcelona, Spain

XIULI WANG • Division of Research Immunology/BMT, Childrens Hospital Los Angeles, Los Angeles, CA, USA, Division of Cancer Immunotherapeutics and Tumor Immunology, City of Hope National Medical Center, Duarte, CA, USA

EDWARD T. WARGENT • Clore Laboratory, University of Buckingham, Buckingham, Buckinghamshire, UK

GORDON C. WEIR • Section on Islet Transplantation and Cell Biology, Research Division, Joslin Diabetes Center and the Department of Medicine, Harvard Medical School, Boston, MA, USA

PETER WHITE • Director, Biomedical Genomics Core, Research Assistant Professor of Pediatrics, The Research Institute at Nationwide Children’s Hospital and The Ohio State University