
CONTENTS

- xiii **FOREWORD** *Gordon Bell*
- xix **JIM GRAY ON eSCIENCE: A TRANSFORMED SCIENTIFIC METHOD**
Edited by Tony Hey, Stewart Tansley, and Kristin Tolle

1. EARTH AND ENVIRONMENT

- 3 **INTRODUCTION** *Dan Fay*
- 5 **GRAY'S LAWS: DATABASE-CENTRIC COMPUTING IN SCIENCE**
Alexander S. Szalay, José A. Blakeley
- 13 **THE EMERGING SCIENCE OF ENVIRONMENTAL APPLICATIONS**
Jeff Dozier, William B. Gail
- 21 **REDEFINING ECOLOGICAL SCIENCE USING DATA**
James R. Hunt, Dennis D. Baldocchi, Catharine van Ingen
- 27 **A 2020 VISION FOR OCEAN SCIENCE**
John R. Delaney, Roger S. Barga
- 39 **BRINGING THE NIGHT SKY CLOSER: DISCOVERIES IN THE DATA DELUGE**
Alyssa A. Goodman, Curtis G. Wong
- 45 **INSTRUMENTING THE EARTH: NEXT-GENERATION
SENSOR NETWORKS AND ENVIRONMENTAL SCIENCE**
*Michael Lehning, Nicholas Dawes, Mathias Bavay,
Marc Parlange, Suman Nath, Feng Zhao*

2. HEALTH AND WELLBEING

- 55 **INTRODUCTION** *Simon Mercer*
- 57 **THE HEALTHCARE SINGULARITY AND THE AGE OF SEMANTIC MEDICINE**
*Michael Gillam, Craig Feied, Eliza Moody, Jonathan Handler,
Catherine Plaisant, Ben Shneiderman, Mark Smith, John Dickason*
- 65 **HEALTHCARE DELIVERY IN DEVELOPING COUNTRIES:
CHALLENGES AND POTENTIAL SOLUTIONS**
Joel Robertson, Del DeHart, Kristin Tolle, David Heckerman
- 75 **DISCOVERING THE WIRING DIAGRAM OF THE BRAIN**
Jeff W. Lichtman, R. Clay Reid, Hanspeter Pfister, Michael F. Cohen
- 83 **TOWARD A COMPUTATIONAL MICROSCOPE FOR NEUROBIOLOGY**
Eric Horvitz, William Kristan
- 91 **A UNIFIED MODELING APPROACH TO DATA-INTENSIVE HEALTHCARE**
Iain Buchan, John Winn, Chris Bishop
- 99 **VISUALIZATION IN PROCESS ALGEBRA MODELS OF BIOLOGICAL SYSTEMS**
Luca Cardelli, Corrado Priami





3. SCIENTIFIC INFRASTRUCTURE

- 109 INTRODUCTION *Daron Green*
- 111 A NEW PATH FOR SCIENCE? *Mark R. Abbott*
- 117 BEYOND THE TSUNAMI: DEVELOPING THE INFRASTRUCTURE TO DEAL WITH LIFE SCIENCES DATA *Christopher Southan, Graham Cameron*
- 125 MULTICORE COMPUTING AND SCIENTIFIC DISCOVERY *James Larus, Dennis Gannon*
- 131 PARALLELISM AND THE CLOUD *Dennis Gannon, Dan Reed*
- 137 THE IMPACT OF WORKFLOW TOOLS ON DATA-CENTRIC RESEARCH *Carole Goble, David De Roure*
- 147 SEMANTIC eSCIENCE: ENCODING MEANING IN NEXT-GENERATION DIGITALLY ENHANCED SCIENCE *Peter Fox, James Hendler*
- 153 VISUALIZATION FOR DATA-INTENSIVE SCIENCE *Charles Hansen, Chris R. Johnson, Valerio Pascucci, Claudio T. Silva*
- 165 A PLATFORM FOR ALL THAT WE KNOW: CREATING A KNOWLEDGE-DRIVEN RESEARCH INFRASTRUCTURE *Savas Parastatidis*

4. SCHOLARLY COMMUNICATION

- 175 INTRODUCTION *Lee Dirks*
- 177 JIM GRAY'S FOURTH PARADIGM AND THE CONSTRUCTION OF THE SCIENTIFIC RECORD *Clifford Lynch*
- 185 TEXT IN A DATA-CENTRIC WORLD *Paul Ginsparg*
- 193 ALL ABOARD: TOWARD A MACHINE-FRIENDLY SCHOLARLY COMMUNICATION SYSTEM *Herbert Van de Sompel, Carl Lagoze*
- 201 THE FUTURE OF DATA POLICY *Anne Fitzgerald, Brian Fitzgerald, Kylie Pappalardo*
- 209 I HAVE SEEN THE PARADIGM SHIFT, AND IT IS US *John Wilbanks*
- 215 FROM WEB 2.0 TO THE GLOBAL DATABASE *Timo Hannay*
- 223 THE WAY FORWARD *Craig Mundie*
- 227 CONCLUSIONS *Tony Hey, Stewart Tansley, Kristin Tolle*
- 230 NEXT STEPS
- 231 ACKNOWLEDGMENTS
- 235 A FEW WORDS ABOUT JIM...
- 237 GLOSSARY
- 241 INDEX