TABLE OF CONTENTS

Bioinformatics in Aquaculture : Principles and Methods

About the Editor

List of Contributors

Preface

Part I Bioinformatics Analysis of Genomic Sequences 1

- 1 Introduction to Linux and Command Line Tools for Bioinformatics 3 Shikai Liu and Zhanjiang Liu
- 2 Determining Sequence Identities: BLAST, Phylogenetic Analysis, and Syntenic Analyses 30 Sen Gao, Zihao Yuan, Ning Li, Jiaren Zhang and Zhanjiang Liu
- 3 Next-Generation Sequencing Technologies and the Assembly of Short Reads into Reference Genome Sequences 43
 Ning Li, Xiaozhu Wang and Zhanjiang Liu
- 4 Genome Annotation: Determination of the Coding Potential of the Genome 74 Ruijia Wang, Lisui Bao, Shikai Liu and Zhanjiang Liu
- 5 Analysis of Repetitive Elements in the Genome 86 *Lisui Bao and Zhanjiang Liu*
- 6 Analysis of Duplicated Genes and Multi-Gene Families 98 Ruijia Wang and Zhanjiang Liu
- 7 Dealing with Complex Polyploidy Genomes: Considerations for Assembly and Annotation of the Common Carp Genome 110

 Peng Xu, Jiongtang Li and Xiaowen Sun

Part II Bioinformatics Analysis of Transcriptomic Sequences 123

8 Assembly of RNA-Seq Short Reads into Transcriptome Sequences 125 *Jun Yao, Chen Jiang, Chao Li, Qifan Zeng and Zhanjiang Liu*

9 Analysis of Differentially Expressed Genes and Co-expressed Genes Using RNA-Seq Datasets 135

Chao Li, Qifan Zeng, Chen Jiang, Jun Yao and Zhanjiang Liu

10 Gene Ontology, Enrichment Analysis, and Pathway Analysis 150 *Tao Zhou, Jun Yao and Zhanjiang Liu*

11 Genetic Analysis Using RNA-Seq: Bulk Segregant RNA-Seq 169 Jun Yao, RuijiaWang and Zhanjiang Liu

12 Analysis of Long Non-coding RNAs 179 Ruijia Wang, Lisui Bao, Shikai Liu and Zhanjiang Liu

13 Analysis of MicroRNAs and Their Target Genes 200 Shikai Liu and Zhanjiang Liu

14 Analysis of Allele-Specific Expression 228 *Yun Li, Ailu Chen and Zhanjiang Liu*

15 Bioinformatics Analysis of Epigenetics 247 Yanghua He and Jiuzhou Song

Part III Bioinformatics Mining and Genetic Analysis of DNA Markers 275

16 Bioinformatics Mining of Microsatellite Markers from Genomic and Transcriptomic Sequences 277

Shaolin Wang, Yanliang Jiang and Zhanjiang Liu

17 SNP Identification from Next-Generation Sequencing Datasets 288 Qifan Zeng, Luyang Sun, Qiang Fu, Shikai Liu and Zhanjiang Liu

18 SNP Array Development, Genotyping, Data Analysis, and Applications 308 Shikai Liu, Qifan Zeng, Xiaozhu Wang and Zhanjiang Liu

19 Genotyping by Sequencing and Data Analysis: RAD and 2b-RAD Sequencing 338 Shi Wang, Jia Lv, Jinzhuang Dou, Qianyun Lu, Lingling Zhang and Zhenmin Bao

20 Bioinformatics Considerations and Approaches for High-Density Linkage Mapping in Aquaculture 356

Yun Li, Shikai Liu, Ruijia Wang, Zhenkui Qin and Zhanjiang Liu

21 Genomic Selection in Aquaculture Breeding Programs 380 *Mehar S. Khatkar*

22 Quantitative Trait Locus Mapping in Aquaculture Species: Principles and Practice 392

Alejandro P. Gutierrez and Ross D. Houston

23 Genome-wide Association Studies of Performance Traits 415 Xin Geng, Degui Zhi and Zhanjiang Liu

24 Gene Set Analysis of SNP Data from Genome-wide Association Studies 434 Shikai Liu, Peng Zeng and Zhanjiang Liu

Part IV Comparative Genome Analysis 461

25 Comparative Genomics Using CoGe, Hook, Line, and Sinker 463 Blake Joyce, Asher Baltzell, Matt Bomhoff and Eric Lyons

26 NCBI Resources Useful for Informatics Issues in Aquaculture 491 Zihao Yuan, Yujia Yang, Shikai Liu and Zhanjiang Liu

27 Resources and Bioinformatics Tools in Ensembl 508 Yulin Jin, Suxu Tan, Jun Yao and Zhanjiang Liu

28 iAnimal: Cyberinfrastructure to Support Data-driven Science 527 Blake Joyce, Asher Baltzell, Fiona McCarthy, Matt Bomhoff and Eric Lyons

Conclusion 544

Acknowledgments 545

References 545

Index 547.