

Contents

<i>List of contributors</i>	xv
<i>Plates</i>	xxiii
<i>Preface</i>	xxvii
1 Introduction	1
Michael Syvanen and Clarence I. Kado	
1.1 Origins of the modern eukaryotic cell	4
References	7
Part One Mechanisms of Transfer into Bacteria and Eukaryotes	9
2 Looking sideways at the evolution of replicons	11
Jack A. Heinemann	
Summary	11
2.1 Introduction	12
2.2 Love of beasts	14
2.3 Love of the dead	16
2.4 Conclusion	22
Acknowledgments	23
References	23
3 Plasmid specificity and interaction: the similarities and differences between the transfer regions of two compatible plasmids, F and R100-1	25
William A. Klimke, Richard Fekete, Jan Manchak, Karen Anthony and Laura S. Frost	
Summary	25
3.1 Introduction	26
3.2 Results	28
3.3 Discussion	36
References	37

4	Lateral broad host range gene transfer in nature: how and how much?	40
	<i>Abigail A. Salyers, Andrew J. Cooper and Nadja B. Shoemaker</i>	
	Summary	40
4.1	How do broad host range lateral gene transfers occur?	40
4.2	Moving beyond the plasmid paradigm	42
4.3	Cooperation, not competition: interactions between plasmids and conjugative transposons	46
4.4	Regulation of transfer function by tetracycline	46
4.5	How much? Evidence for widespread gene transfer in nature	47
	Acknowledgments	50
	References	50
5	The role of gene cassettes and integrons in the horizontal transfer of genes in Gram-negative bacteria	53
	<i>Ruth M. Hall</i>	
	Summary	53
5.1	Introduction	54
5.2	Mobile gene cassettes	56
5.3	Integrans	58
5.4	Cassette integration and excision	59
5.5	Class 1 integrans are transposons or defective transposon derivatives	59
5.6	The 3'-conserved segment and evolution of Class 1 integrans	60
	Acknowledgments	61
	References	61
6	Evolution of the selfish Ti plasmid of <i>Agrobacterium</i> <i>tumefaciens</i> promoting horizontal gene transfer	63
	<i>Clarence I. Kado</i>	
	Summary	63
6.1	Introduction	64
6.2	Organization of the promiscuous DNA transfer system	66
6.3	A promiscuous conjugative pilus encoded by Ti plasmid genes	67
6.4	Horizontal gene transfer by <i>Agrobacterium</i>	68
6.5	Conclusions and implications	71
	Acknowledgments	71
	References	72

7	<i>Arabidopsis</i> ecotypes resistant to crown gall tumorigenesis Jaesung Nam and Stanton B. Gelvin	75
	Summary	75
	7.1 Introduction	77
	7.2 Results	88
	7.3 Discussion	90
	Acknowledgments	90
	References	
8	Evidence for the ancient transfer of Ri-plasmid T-DNA genes between bacteria and plants Corinne Fründt, Alain D. Meyer, Takanari Ichikawa and Frederick Meins, Jr	94
	Summary	94
	8.1 Introduction	95
	8.2 Expression and function of Ri-plasmid T-DNA genes in plants	95
	8.3 Evidence for plant homologs of <i>rol</i> genes	97
	8.4 Expression of <i>c-rol</i> genes	97
	8.5 Evidence for the ancient transfer of <i>rol</i> genes between plants and bacteria	100
	8.6 Concluding remarks	101
	Acknowledgments	103
	References	103
9	Gene transfer from bacteria to mammalian cells Patrice Courvalin, Sylvie Goussard and Catherine Grillot-Courvalin	107
	Summary	107
	9.1 Introduction	107
	9.2 Materials and methods	108
	9.3 Results and discussion	109
	Acknowledgments	116
	References	116
10	Horizontal gene transfer in the host-parasite system <i>Absidia glauca</i> - <i>Parasitella parasitica</i> J. Wöstemeyer, A. Wöstemeyer, A. Burmester and K. Czempinski	118
	Summary	118
	10.1 Introduction	119
	10.2 Results and discussion	119
	References	126

Part Two	Bacterial Gene Transfer in Nature	129
11	Selective DNA uptake and DNA restriction as barriers to horizontal gene exchange by natural genetic transformation in <i>Pseudomonas stutzeri</i> JM300 <i>Michael G. Lorenz, Birte Meyer, Marcus Wittstock, Stefan Graupner and Wilfried Wackernagel</i>	131
	Summary	131
	11.1 Introduction	132
	11.2 Results and discussion	133
	11.3 Conclusions	140
	Acknowledgments	142
	References	142
12	Transformation in aquatic environments <i>Martin Day</i>	144
	Summary	144
	12.1 Introduction	144
	12.2 Gene transfer process	145
	12.3 Transformation	146
	12.4 Microcosm studies	154
	12.5 The <i>in situ</i> assay	154
	12.6 Planning <i>in situ</i> studies	159
	12.7 Frequency	160
	12.8 Conclusions	161
	Acknowledgments	162
	References	162
13	Natural genetic transformation of bacteria in soil <i>Wilfried Wackernagel, Johannes Sikorski, Stephanie Blum, Michael G. Lorenz and Stefan Graupner</i>	168
	Summary	168
	13.1 Introduction	169
	13.2 Results and discussion	170
	Acknowledgments	175
	References	176
14	The importance of pseudolysogeny to <i>in situ</i> bacteriophage-host interactions <i>Robert V. Miller and Steven Ripp</i>	179
	Summary	179
	14.1 Introduction	180
	14.2 Results and discussion	181
	14.3 Conclusions	189
	Acknowledgments	190
	References	190

15	Archeological footprints of horizontal gene transfer: mosaic cell surface proteins in <i>Streptococcus pyogenes</i> and <i>S. pneumoniae</i>	192
	<i>Susan K. Hollingshead, Debra Bessen and David Briles</i>	
	Summary	192
	15.1 Introduction	193
	15.2 Results and discussion	196
	References	205
16	Role of horizontal transfer in bacterial evolution	208
	<i>Jeffrey Lawrence and John Roth</i>	
	Summary	208
	16.1 Introduction	209
	16.2 Results and discussions	210
	References	223
17	Evolutionary evidence for recombination among bacteria in Nature: <i>Escherichia coli</i>	226
	<i>Roger Milkman, Diane Cryderman, Melissa McKane, Kerri McWeeny and Elisabeth A. Raleigh</i>	
	Summary	226
	17.1 Introduction	226
	17.2 Results and discussion	227
	Acknowledgments	237
	References	237
18	The lysogenic conversion genes of coliphage P2 have unusually high AT content	241
	<i>Richard Calendar, Sidney Yu, Heejoon Myung, Virginia Barreiro, Richard Odegrip, Karin Carlson, Laura Davenport, Gisela Mosig, Gail E. Christie and Elisabeth Haggård-Ljungquist</i>	
	Summary	241
	18.1 Introduction	242
	18.2 Results and discussion	242
	Acknowledgments	250
	References	250
Part Three	Eukaryotic Mobile Elements	253
19	Evidence for horizontal transfer of the <i>P</i> transposable element between <i>Drosophila</i> species	255
	<i>Jonathan B. Clark and Margaret G. Kidwell</i>	
	Summary	255
	19.1 Introduction	255
	19.2 Results and discussion	258
	References	266

20	The <i>mariner</i> transposons of animals: horizontally jumping genes	268
	<i>Hugh M. Robertson, Felipe N. Soto-Adames, Kimberly K.O. Walden, Rita M.P. Avancini and David J. Lampe</i>	
	Summary	268
20.1	Introduction	269
20.2	Methods	270
20.3	Results	273
20.4	Discussion	278
	Acknowledgments	283
	References	283
21	Horizontal and vertical transmission of <i>hobo</i> -related sequences between <i>Drosophila melanogaster</i> and <i>Drosophila simulans</i>	285
	<i>Gail M. Simmons, Dahlia Plummer, Alex Simon, Ian A. Boussy, Julie Frantsve and Masanobu Itoh</i>	
	Summary	285
21.1	Introduction	286
21.2	Materials and methods	288
21.3	Results and discussions	289
	Acknowledgments	293
	References	293
22	The splicing of transposable elements: evolution of a nuclear defense against genomic invaders?	295
	<i>Michael D. Purugganan</i>	
	Summary	295
22.1	Introduction	295
22.2	The splicing of transposable elements	298
22.3	The evolution of transposable element splicing: mechanisms and consequences	301
	Acknowledgments	305
	References	305
Part Four Evidence for Ancient Transfer		309
23	The case for gene transfers between very distantly related organisms	311
	<i>Russell F. Doolittle</i>	
	Summary	311
23.1	Introduction	000
23.2	Some reconsiderations	314
23.3	A summary comment	318
	References	319

24	Fungal denitrification, a respiratory system possibly acquired by horizontal gene transfer from prokaryotes <i>Naoki Takaya, Michiyoshi Kobayashi and Hirofumi Shoun</i>	321
	Summary	321
	24.1 Introduction	321
	24.2 Results and discussion	322
	References	326
25	Cytochrome-c from <i>Stellaria longipes</i> and <i>Arabidopsis thaliana</i> was likely transferred from fungi since the radiation of terrestrial plants <i>Michael Syvanen</i>	328
	Summary	328
	25.1 Introduction	328
	25.2 Convergent evolution	330
	25.3 Orthology versus pathology	332
	25.4 Conclusion	335
	References	336
26	Phylogenetic relationship of volvocine algae to plants and animals <i>Rüdiger Schmitt, Klaus Stark, Stefan Fabry and David L. Kirk</i>	338
	Summary	338
	26.1 Introduction	339
	26.2 Results and discussions	340
	Acknowledgments	347
	References	347
27	Horizontal gene transfer and fusing lines of descent: the Archaeobacteria – a chimera? <i>Lorraine Olendzenski, Elena Hilario and J. Peter Gogarten</i>	349
	Summary	349
	27.1 Introduction	350
	27.2 Comparison of molecular markers can reveal episodes of horizontal gene transfer	350
	27.3 Transfer from Archaea to Eubacteria: the example of H ⁺ -pumping ATPases	352
	27.4 The Archaea: a chimeric lineage?	354
	Acknowledgments	359
	References	359

28	Endosymbiosis and the origins of chloroplast-cytosol isoenzymes: a revision of the gene transfer corollary <i>William F. Martin</i>	363
	Summary	363
	28.1 Introduction	364
	28.2 Results and discussion	366
	28.3 Conclusions	374
	Acknowledgments	376
	References	376
29	Dating the age of the last common ancestor of all living organisms with a protein clock <i>Ronald M. Adkins and Wen-Hsiung Li</i>	380
	Summary	380
	29.1 Introduction	380
	29.2 Materials and methods	382
	29.3 Results	383
	29.4 Discussion	387
	Acknowledgments	389
	References	389
30	The prokaryotic origin of eukaryotes <i>James A. Lake and Maria C. Rivera</i>	392
	Summary	392
	30.1 Introduction	392
	30.2 Difficulties with the traditional prokaryotic-eukaryotic classification	394
	30.3 Prokaryotic diversity	394
	30.4 Origin of the eukaryotes	396
	30.5 Elongation factor genes	397
	30.6 Organization of ribosomal operons	403
	30.7 Conclusions	404
	References	406
Part Five	Macroevolutionary Trends: Does Horizontal Gene Transfer Resolve Homoplasy?	409
31	Character parallelism and reticulation in the origin of angiosperms <i>Valentin A. Krassilov</i>	411
	Summary	411
	31.1 Introduction	411
	31.2 Seed plant phylogeny	412
	31.3 Proangiosperms as a morphological pool	414

31.4	Angiosperm diversity	415
31.5	Collective breakthrough	417
31.6	Insect role	418
31.7	Ecological crises as a gene transfer situation	421
31.8	Concluding remarks	422
	References	422
32	Graptolite parallel evolution and lateral gene transfer	425
	<i>William B.N. Berry and Hyman Hartman</i>	
	Summary	425
32.1	Introduction	425
32.2	Graptolites	426
32.3	Conditions at a near extinction among graptolites	427
32.4	Re-radiation after near extinction	429
32.5	Gene exchanges	432
32.6	Viroids	432
32.7	Discussion	433
	References	434
33	Larval transfer in evolution	436
	<i>Donald I. Williamson</i>	
	Summary	436
33.1	Introduction	436
33.2	Larvae	437
33.3	Metamorphosis	442
33.4	Hybridization	446
33.5	Classification	449
	References	452
34	Analysis of animal and plant cytochrome-c sequences by probability of character compatibility	454
	<i>Christopher A. Meacham and Hyman Hartman</i>	
	Summary	454
34.1	Introduction	454
34.2	Compatibility analysis	456
34.3	Results	457
34.4	Discussion	460
	References	461
	<i>Index</i>	463