## Contents

Pref	ace ET	9		No Teleporte vi Anna	
				11/24/	r
PAR	PTER 10 Studying Adaptation: serives on 1 T				
INT	TRODUCTION	15		> MADE	
TEE	Production Manufacturing Controller, Global Addition 1971   September 1971	AHD		A. A. L.	
CHA	PTER 1				
AC	Case for Evolutionary Thinking:			A Salar Maria Control	
	lerstanding HIV	15			
1.1	The Natural History of the HIV		CHA	PTER 3	
YES,	Epidemic Epidemic	16	Evo	lution by Natural Selection	87
1.2	Why Does HIV Therapy Using Just	AHD		TO SMANIANTA	ME
	One Drug Ultimately Fail?	23	3.1	Artificial Selection: Domestic Animals	00
1.3	Are Human Populations Evolving as a		3.2	and Plants Evolution by Natural Selection	88 91
	Result of the HIV Pandemic?	29	3.3	The Evolution of Flower Color in an	91
1.4	Where Did HIV Come From?	32	3.3		02
1.5	Why Is HIV Lethal?	37	2.4	Experimental Snapdragon Population	93
	Computing Consequences 1.1 When did		3.4	The Evolution of Beak Shape in	05
	HIV move from chimpanzees to humans?	38		Galápagos Finches	95
	Summary 45 • Questions 45			Computing Consequences 3.1 Estimating	00
	Exploring the Literature 46 • Citations 4	7	2.5	heritabilities despite complications	98
			3.5	The Nature of Natural Selection	104
			3.6	The Evolution of Evolutionary Biology	
CIIA	DEED Top form by Dated States relition of the Limited		3.7	Intelligent Design Creationism	111
	PTER 2 Proof and Brita monotovil, by 1917			Summary 118 • Questions 119	
The	Pattern of Evolution	51		Exploring the Literature 120 • Citations	120
2.1	Evidence of Microevolution: Change			either the prior ordinarior an architecture bapping to	
	through Time	53	CHA	PTER 4 censing Agency Led, Sallron Flouse, 6-10 K	
2.2	Evidence of Speciation: New Lineages from Old	58	Esti	mating Evolutionary Trees	123
2.3	Evidence of Macroevolution:	olymen.	4.1	How to Read an Evolutionary Tree	124
	New Forms from Old	63	4.2	The Logic of Inferring Evolutionary	
2.4	Evidence of Common Ancestry:	00		Trees	128
W.Rish	All Life-Forms Are Related	69	4.3	Molecular Phylogeny Inference and	
2.5	The Age of Earth	76		the Origin of Whales	137
	Computing Consequences 2.1 A closer look			Computing Consequences 4.1 Calculating	
	at radiometric dating	79		the likelihood of an evolutionary tree	143
	Summary 80 • Questions 81			Computing Consequences 4.2 Neighbor	- 10
	Exploring the Literature 82 • Citations 8.	3		joining: A distance matrix method	144
	1 - 5	The Man			

4.4	Using Phylogenies to Answer			Computing Consequences 6.4 Statistical	
	Questions	151		analysis of allele and genotype frequencies	
	Summary 155 • Questions 155			using the $\chi^2$ (chi-square) test	212
	Exploring the Literature 157 • Citations	157		Computing Consequences 6.5 Predicting	
				the frequency of the CCR5- $\Delta$ 32 allele	
				in future generations	215
			6.3	Patterns of Selection: Testing	527
PAR	T 2		0.5	Predictions of Population Genetics	
ME	CHANISMS OF			Theory	215
	OLUTIONARY CHANGE	161			
LV	OLUTIONARI CHANGE	101		Computing Consequences 6.6 An algebraic	
				treatment of selection on recessive and	A
CHA	PTER 5			dominant alleles	218
				Computing Consequences 6.7 Stable	
Var	iation Among Individuals	161		equilibria with heterozygote superiority and	
coc	Exploring the the there's and the children	465		unstable equilibria with heterozygote inferiority	222
5.1	Three Kinds of Variation	162	6.4	Mutation and Linkage noisellibrium	230
	Computing Consequences 5.1 Epigenetic			Computing Consequences 6.8	
	inheritance and evolution	168		A mathematical treatment of mutation as	
5.2	Where New Alleles Come From	171		an evolutionary mechanism	232
5.3	Where New Genes Come From	175		Computing Consequences 6.9 Allele	
	Computing Consequences 5.2 Measuring			frequencies under mutation-selection balance	234
	genetic variation in natural populations	176		Computing Consequences 6.10 Estimating	
5.4	Chromosome Mutations	180		mutation rates for recessive alleles	236
5.5	Rates and Fitness Effects of Mutations	183	( E		250
0.0	Summary 188 • Questions 189	475	6.5	An Engineering Test of Population	000
		100		Genetics Theory	238
	Exploring the Literature 190 • Citations	190		Computing Consequences 6.11 Predicting	
				the frequency of Medea across generations	240
СНА	PTER 6			Summary 241 • Questions 241	
				Exploring the Literature 243 • Citations	245
	idelian Genetics in Populations I	AUF			
Sele	ection and Mutation	193	400	Parenting	
	lying Adaptation: Evolutionary		CHA	PTER 7 industrions actions in the principle of the princi	
6.1	Mendelian Genetics in Populations:	Ana	Mer	ndelian Genetics in Populations II	I:83
	Hardy-Weinberg Equilibrium	194		ration, Drift, and	
	Computing Consequences 6.1 Combining	1.01		TO SECURE TO SECURE AND ASSESSMENT OF THE PROPERTY OF THE PROP	247
	probabilities	199	Noi	random Mating	247
	Computing Consequences 6.2 The Hardy-		7.1	Migration	248
	Weinberg equilibrium principle with more		FHA	Computing Consequences 7.1 An algebraic	OV8
	than two alleles	203			
6.2	Selection	205		treatment of migration as an evolutionary	
305	Computing Consequences 6.3 A general	10.4		process	250
	treatment of selection	208		Computing Consequences 7.2 Selection	0.0
	irealment of selection	200		and migration in Lake Erie water snakes	252
		200	7.2	Genetic Drift	254
				Computing Consequences 7.3 The	
				probability that a given allele will be the	
				one that drifts to fixation	262
	A CONTRACTOR OF THE STATE OF TH	S. C.		Computing Consequences 7.4 Effective	615
		OLY OLY		population size	265
4 4	The state of the s			Computing Consequences 7.5 The rate of	200
				the control of the base of the control of the contr	270
				evolutionary substitution under genetic drift	2/0

7.3	Genetic Drift and Molecular				
	Evolution	274			
7.4	Nonrandom Mating	289			
	Computing Consequences 7.6 Genotype		17		
	frequencies in an inbred population	293			
7.5	Conservation Genetics of the Florida				
	Panther anisati monosles lo amenta	297			
	Summary 299 • Questions 299				
	Exploring the Literature 301 • Citation	s 302			
	Computing Consequences 6.6 An algebraic				
CHA	treatment of selection on recessive and 8 PATA				
	Market and American and the contract of the co				
Evo	olution at Multiple Loci:				
Lin	kage and Sex	305		Computing Consequences 9.3 The selection	ı
01				gradient and the selection differential	363
8.1	Evolution at Two Loci: Linkage		9.5	Predicting the Evolutionary Response	
	Equilibrium and Linkage			to Selection assumus and guinuguro	364
	Disequilibrium	306	9.6	Modes of Selection and the	
	Computing Consequences 8.1	200		Maintenance of Genetic Variation	370
	The coefficient of linkage disequilibrium	309	9.7	The Bell-Curve Fallacy and Other	
	Computing Consequences 8.2 Hardy-			Misinterpretations of Heritability	374
	Weinberg analysis for two loci	310		Summary 379 • Questions 379	
	Computing Consequences 8.3 Sexual			Exploring the Literature 381 • Citations	381
	reproduction reduces linkage disequilibrium	315		Rates and pulses remeds of mitalions	
8.2	Practical Reasons to Study Linkage	3.0			
	Disequilibrium	321			
	Computing Consequences 8.4 Estimating		PART	3he Evolution of Beak Shape in	
	the age of the GBA-84GG mutation	323	AD	APTATION	383
8.3	The Adaptive Significance of Sex	328	-	Congruing Consequence 3.9 Delinary	303
	Computing Consequences 8.5			idelian Genetics in Populations I	
	A demographic model of the maintenance of	224	CHA	PTER 10	
	males in the nematode Caenorhabditis elegan	S 331	Stud	lying Adaptation: Evolutionary	
	Summary 338 • Questions 339	241	Ana	lysis of Form and Function	383
	Exploring the Literature 340 • Citations			Hardy-Weinberg Equilibrium remmes	
	Pattern of Evolution mobner		10.1	All Hypotheses Must Be Tested:	
CHA	DTED Q		199	Oxpeckers Reconsidered	384
	PTER 9 ce of Microevolution: Change trous 181M		10.2	Experiments when a summand	387
Evo	lution at Multiple Loci:			Computing Consequences 10.1	
Qua	entitative Genetics	343	Eggir	A primer on statistical testing	391
		58	10.3	Observational Studies nobosla2	392
9.1	The Nature of Quantitative Traits	344	10.4	The Comparative Method	396
9.2	Identifying Loci That Contribute to	0.3		Computing Consequences 10.2 Calculating	14 19 19
	Quantitative Traits	348	40 =	phylogenetically independent contrasts	398
	Computing Consequences 9.1 Genetic	09	10.5	Phenotypic Plasticity	401
0.0	mapping and LOD scores	352	10.6	Trade-Offs and Constraints	403
9.3	Measuring Heritable Variation	357	10.7	Selection Operates on Different	
	Computing Consequences 9.2 Additive		4.0	Levels	411
	genetic variation versus dominance genetic		10.8	Strategies for Asking Interesting	
0.4	variation	359		Questions	415
9.4	Measuring Differences in Survival			Summary 416 • Questions 416	
	and Reproductive Success	362		Exploring the Literature 418 • Citations	419

CHAI	Computing Consequences 18.1 11 Party			Computing Consequences 13.1 Late-acting	
Sexu	al Selection	421		deleterious mutations are weakly selected	515
				Computing Consequences 13.2 Alleles conferring early benefits and late costs can	
11.1	Sexual Dimorphism and Sex	422		be adaptive	518
11.2	Sexual Selection on Males:	431	13.3	How Many Offspring Should an	310
11 2	Competition Sexual Selection on Males:	431	10.0	Individual Produce in a Given Year?	527
11.3	Female Choice	437	13.4	How Big Should Each Offspring Be?	531
	Computing Consequences 11.1 Runaway	437	13.5	Conflicts of Interest between Life	
	sexual selection	444		Histories	536
11.4	Sexual Selection on Females	452	13.6	Life Histories in a Broader	
11.5	Sexual Selection in Plants	455		Evolutionary Context	539
11.6	Sexual Dimorphism in Humans	458		Summary 544 • Questions 544	
PAL	Summary 462 • Questions 462	Deve		Exploring the Literature 546 • Citations	546
	Exploring the Literature 464 • Citation	s 465		opulations fround	
			CHA	PTER 14 greatly at 9319	
CHAI	PTER 12 Tab the table of the press of the			lution and Human Health	E40
The	Evolution of Social Behavior	469	Evo	ution and Human Health	343
		garans.	14.1		
12.1	Four Kinds of Social Behavior	470		Host's Immune Response	551
12.2	Kin Selection and Costly Behavior	473	14.2	Evolving Pathogens: Antibiotic	
	Computing Consequences 12.1 Calculating	g		Resistance Wanaa bna nollaxibiadyH	559
	relatedness as the probability of identity	175	14.3	Evolving Pathogens: Virulence	562
100	by descent	475	14.4	Tissues as Evolving Populations	6.5
12.3	Multilevel Selection and Cooperation	485		of Cells Money Consumus	567
	Computing Consequences 12.2 Different	487	14.5	Selection Thinking Applied to Humans	570
12.4	perspectives on the same evolutionary process  Cooperation and Conflict	491	14.6	Adaptation and Medical Physiology:	
12.4 12.5	Cooperation and Conflict The Evolution of Eusociality	497		Fever	578
12.5	Summary 500 • Questions 501	20.2	14.7	Adaptation and Human Behavior:	F04
	Exploring the Literature 502 • Citation	\$ 503		Parenting Community 14.4 Line Items	581
	ally protected efforts with part of Cathorina (1980)	e, we b		Computing Consequences 14.1 Is cultural evolution Darwinian?	583
CHAI	PTER 13			Summary 589 • Questions 589	7.1
				Exploring the Literature 591 • Citations	591
	ng and Other Life-History				
Cha	racters in genome size among other law less	505		What Was the Last Conflict Affice Store	
13.1	Basic Issues in Life-History Analysis	507	CHA	of All Extant Organisms and 16 Parq	
13.2	Why Do Organisms Age and Die?	509	Gen	ome Evolution and the	
PEN	VIS	SSOLE)	Molecular Basis of Adaptation		595
		while-	15.1	Diversity among Genomes	596
		Shari	15.2	Mobile Genetic Elements	600
		*****	15.3	The Evolution of Mutation Rates	605
	A A V		15.4	Gene Duplication and Gene Families	608
			15.5	The Locus of Adaptation in Natural	
				Populations Populations Populations	615
		A Second		Summary 620 • Questions 620	
				Exploring the Literature 621 • Citations	622
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					

18.2 Evolution in the Fossil Record

PAR	Evolutionary Context	274 289 293 8.81 297 4.81 3081	18.3 18.4 18.5 18.6	Computing Consequences 18.1  Evolutionary trends  Taxonomic and Morphological  Diversity over Time  Mass and Background Extinctions  Macroevolution  Fossil and Molecular Divergence  Timing  Summary 744 • Questions 745  Exploring the Literature 746 • Citations	720 721 723 733 741 746
	E HISTORY OF LIFE	623		Sexual Dimorphism in Humans	11.6
111	E INSTORT OF ERE	023	Deve	elopment and Evolution	749
	PTER 16 Chanisms of Speciation	623	19.1	The Divorce and Reconciliation of Development and Evolution Hox Genes and the Birth of Evo-Devo	
			19.3 19.4	Post Hox: Evo-Devo 2.0	758
16.1 16.2	Species Concepts  Mechanisms of Isolation	624 630	19.4	Hox Redux: Homology or Homoplasy The Future of Evo-Devo	778
16.3	Mechanisms of Divergence	637	473	Summary 779 • Questions 780	12.2
16.4	Hybridization and Gene Flow	057		Exploring the Literature 780 • Citations	
562	between Species	643		relatedness as the probability of identity	
16.5	What Drives Diversification?	651	475	by descent	
	Summary 654 • Questions 655			Multilevel Selection and Cool 02 NaT	
	Exploring the Literature 656 • Citations	657	Hun	nan Evolution	783
			20.1	Relationships among Humans	
CHA	Adaptation and Human Behav 71 RATE	14.7		and Extant Apes and to mobility and and	784
The	Origins of Life and		20.2	The Recent Ancestry of Humans	794
	cambrian Evolution	659	20.3	Origin of the Species Homo sapiens	804
583	evolution Danvinian?			<b>Computing Consequences 20.1</b> Using allel frequencies and linkage disequilibrium to date	ie
17.1 17.2	What Was the First Living Thing?	661		the modern human expansion from Africa	811
17.2	Where Did the First Living Thing Come From?	669	20.4	The Evolution of Distinctive Human	Agin
17.3	What Was the Last Common Ancestor			Traits ments 21950st	816
	of All Extant Organisms and What Is			Summary 821 • Questions 821	40.4
	the Shape of the Tree of Life?	677		Exploring the Literature 823 • Citations	824
17.4	How Did LUCA's Descendants Evolve	Loly	Gloss		829
	into Today's Organisms?	692	Illinote	nation Cradita	026
	Summary 697 • Questions 698 Exploring the Literature 700 • Citations	700	must	ration Credits	836
	Campunity Cappaniana a Langue	700	Index		844
	The Evolution of Mutation Rates Gene Duplication and Gene Louden				
CHAI	PTER 18	15%			
Evol	ution and the Fossil Record	705			
18.1	The Nature of the Fossil Record	706			

710