

Table S1

Supplementary Table S1 List of salamander taxa used in this study

Family	Species	Accession No. Mt genome	BDNF	POMC	Rag1	Rag2	Lungs	Life cycle in Plethodontidae
Ambystomatidae	<i>Ambystoma barbouri</i>	NC_014568	KJ610094	KJ610458			+	
	<i>Ambystoma bishopi</i>	NC_027501					+	
	<i>Ambystoma laterale</i>	NC_006330					+	
	<i>Ambystoma mexicanum</i>	NC_005797			AY323752	KC165605	+	
	<i>Dicamptodon aterrimus</i>	GQ368657			KC165591	KC165611	+	
Amphiumidae	<i>Amphiuma means</i>	GQ368656		AY141896	AY650127	KC165604	+	
	<i>Andrias japonicus</i>	NC_007446			AY583346		+	
Cryptobranchidae	<i>Cryptobranchius alleganiensis</i>	GQ368662			AY650141		+	
	<i>Batrachuperus yenyuanensis</i>	NC_012430	HM037740	HM037765	HM037715	KC165607	+	
Hynobiidae	<i>Hynobius arisanensis</i>	NC_009335					+	
	<i>Hynobius guabangshanensis</i>	NC_013762	HM037743	HM037768	HM037718	KJ715336	+	
	<i>Hynobius kimurae</i>	NC_026032			KJ715369	KJ715332	+	
	<i>Hynobius maoershanensis</i>	NC_023789	HM037745	HM037770	HM037720		+	
	<i>Hynobius nebulosus</i>	NC_020650	HM037746	HM037771	AY650144		+	
	<i>Hynobius nigrescens</i>	NC_026033			KJ715356	KJ715337	+	
	<i>Hynobius yangi</i>	NC_013825					+	
	<i>Liua shihi</i>	NC_008078	HM037751	HM037776	HM037726	KJ715344	+	
	<i>Liua tsinpaensis</i>	NC_008081	HM037752	HM037777	HM037727	KJ715345	+	
	<i>Onychodactylus zhangyapingi</i>	NC_026853					-	
	<i>Onychodactylus zhaermii</i>	NC_026854					-	
	<i>Pachyhynobius shangchengensis</i>	NC_008080	HM037754	HM037779	HM037729	KJ715349	+	
	<i>Paradactylodon gorganensis</i>	NC_008091	HM037755	HM037780	HM037730		+	
	<i>Paradactylodon mustersi</i>	NC_008090	HM037756	HM037781	HM037731	KJ715350	+	
	<i>Pseudohynobius flavomaculatus</i>	NC_020635	HM037758	HM037783	HM037733	KJ715346	+	
	<i>Pseudohynobius jinbo</i>	NC_026698					+	
	<i>Pseudohynobius shuichengensis</i>	NC_021001		HM037784	HM037734	KJ715347	+	
	<i>Ranodon sibiricus</i>	NC_004021	HM037760	HM037785	HM037735	KC165618	+	
	<i>Salamandrella keyserlingii</i>	NC_008082	KJ855091	KJ855092	AY650145	MF567484	+	
	Plethodontidae	<i>Aneides flavipunctatus</i>	NC_006327	MF946481	MF946506			-
<i>Aneides hardii</i>		NC_006338	MF946486		EU275780	KC165603	-	DD
<i>Batrachoseps attenuatus</i>		NC_006340	JF449372	KP900129	KM202870	KF911907	-	DD
<i>Batrachoseps nigriventris</i>		NC_028184			KM202742	KM202918	-	DD
<i>Batrachoseps wrighti</i>		NC_006333	JF449369		KM202864	KM203042	-	DD
<i>Bolitoglossa</i> sp.		NC_006346					-	DD
<i>Desmognathus fuscus</i>		NC_006339	EU275858	EU275812	EU275781	KF911911	-	MM
<i>Desmognathus wrighti</i>		NC_006337		KR732363	AY691699	KF911913	-	DD
<i>Ensatina eschscholtzii</i>		NC_006328	EU275862	EU275816	AY650119	KF911914	-	DD
<i>Eurycea bislineata</i>		NC_006329	EU275861	JQ920726	AY691706	KC165612	-	MM
<i>Gyrinophilus palleucus</i>		NC_028297			KY073116		-	MM
<i>Hemidactylium scutatum</i>		NC_006342	EU275898	EU275852	AY691711	KF911917	-	MM
<i>Hydromantes brunus</i>		NC_006345	EU275871	EU275825	HM797619		-	DD
<i>Oedipina poelzi</i>		NC_006326					-	DD
<i>Phaeognathus hubrichti</i>		NC_006344	EU275860	EU275814	AY691700		-	DD
<i>Plethodon elongatus</i>		NC_006335	EU275882	EU275836	AY650120		-	DD
<i>Pseudotriton ruber</i>		NC_006332	EU275900	EU275854	AY650123	KF911925	-	MM
<i>Stereochilus marginatus</i>		NC_006325	EU275859	JQ920723	AY691713	KF911926	-	MM
<i>Thorius</i> sp.		NC_006336					-	DD
Proteidae		<i>Necturus beyeri</i>	NC_023341		JX144998	JX145010	KC165613	+
	<i>Proteus anguinus</i>	NC_023342		KC295576	AY650138	KC165615	+	
Rhyacotritonidae	<i>Rhyacotriton variegatus</i>	NC_006331	EU275869	EU275823	AY691693	KC165619	+	
Salamandridae	<i>Chioglossa lusitanica</i>	EU880308			AY583347		+	
	<i>Echinotriton andersoni</i>	NC_017870		HM462065			+	
	<i>Lyciasalamandra atifi</i>	NC_002756					+	
	<i>Notophthalmus perstriatus</i>	NC_028278					+	
	<i>Pachytriton feii</i>	NC_029345			KU375037	JX907980	+	
	<i>Paramesotriton chinensis</i>	NC_035008					+	
	<i>Salamandrina terdigitata</i>	EU880332			HQ915067		+	
	<i>Triturus macedonicus</i>	NC_015794					+	
	<i>Triturus pygmaeus</i>	NC_015796					+	
	<i>Tylotriton kweichowensis</i>	NC_029231	KY800640	KC733384			+	
Sirenidae	<i>Pseudobranchius axanthus</i>	GQ368660		JX145003	JX145015	KC165616	+	
	<i>Siren intermedia</i>	GQ368661		JX145005	AY583353	KC165620	+	

Table S2

Supplementary Table S2 Best-fit partition scheme and substitution models

Partition	Gene + Codon position	Substitution model	
		IQTREE	MrBayes
1	atp6_1, atp8_1, nd1_1, nd3_1, nd4_1, nd4l_1	GTR+F+R5	GTR+F+I+G4
2	atp6_2, atp8_2, nd1_2, nd2_2, nd3_2, nd4_2, nd4l_2, nd5_2	TVM+F+R5	GTR+F+I+G4
3	co1_1, co3_2, cyb_1, cyb_2	TIM2+F+R5	GTR+F+I+G4
4	co1_2, co2_1	SYM+R4	SYM+I+G4
5	co2_2, co3_1	TPM2u+F+R2	F81+F+I+G4
6	nd2_1, nd5_1	GTR+F+R4	GTR+F+I+G4
7	nd6_1	TIM2+F+I+G4	GTR+F+I+G4
8	nd6_2	HKY+F+R3	HKY+F+I+G4

Numbers following G or R represent the number of categories.

Table S3

Supplementary Table 3 Results of site model analysis

Gene	Null model (n.p.)	Alt. model (n.p.)	LRT	ω (M0)
ATP6	M0 (121)	M3 (126)		0.03724
	InL -18000.496357	-15630.310836	0.000	
	M1a (123)	M2a (125)		
	InL -16178.537504	-16178.53751	-	
	M7 (123)	M8 (125)		
	InL -15601.93418	-15601.93602	-	
ATP8	M8a (124)	M8 (125)		
	InL -15601.309362	-15601.93602	-	
	M0 (121)	M3 (126)		0.13866
	InL -1767.285964	-1612.522287	0.000	
	M1a (123)	M2a (125)		
	InL -1639.457606	-1638.80797	0.522	
COX1	M7 (123)	M8 (125)		
	InL -1608.611551	-1606.365845	0.106	
	M8a (124)	M8 (125)		
	InL -1606.63545	-1606.365845	0.463	
	M0 (121)	M3 (126)		0.00855
	InL -39900.319837	-31436.760677	0.000	
COX2	M1a (123)	M2a (125)		
	InL -31973.925214	-31973.925214	1.000	
	M7 (123)	M8 (125)		
	InL -31424.381615	-31424.386685	-	
	M8a (124)	M8 (125)		
	InL -31421.370034	-31424.386685	-	
COX3	M0 (121)	M3 (126)		0.02328
	InL -16827.851769	-13929.963922	0.000	
	M1a (123)	M2a (125)		
	InL -14215.074489	-14215.074489	1.000	
	M7 (123)	M8 (125)		
	InL -13924.766613	-13924.768873	-	
CYTB	M8a (124)	M8 (125)		
	InL -13923.483977	-13924.768873	-	
	M0 (121)	M3 (126)		0.02976
	InL -18429.076548	-15419.218485	0.000	
	M1a (123)	M2a (125)		
	InL -15948.945676	-15948.945676	1.000	
CYTB	M7 (123)	M8 (125)		
	InL -15394.600829	-15394.602917	-	
	M8a (124)	M8 (125)		
	InL -15393.444469	-15394.602917	-	
	M0 (121)	M3 (126)		0.03365
	InL -34165.175775	-29006.708198	0.000	
CYTB	M1a (123)	M2a (125)		
	InL -30125.289556	-30125.289556	1.000	
	M7 (123)	M8 (125)		
	InL -28981.353549	-28981.357319	-	
M8a (124)	M8 (125)			

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ND1	InL	-28980.765282	-28981.357319	-	0.02645
	M0 (121)		M3 (126)		
	InL	-26480.902137	-22321.408577	0.000	
	M1a (123)		M2a (125)		
	InL	-23103.125516	-23103.125551	-	
ND2	M7 (123)		M8 (125)		0.05317
	InL	-22308.465961	-22308.468951	-	
	M8a (124)		M8 (125)		
	InL	-22307.594155	-22308.468951	-	
	M0 (121)		M3 (126)		
ND3	InL	-29851.10539	-26922.567855	0.000	0.04871
	M1a (123)		M2a (125)		
	InL	-27692.028658	-27692.028658	1.000	
	M7 (123)		M8 (125)		
	InL	-26895.343391	-26895.346431	-	
ND4	M8a (124)		M8 (125)		0.0416
	InL	-26894.934545	-26895.346431	-	
	M0 (121)		M3 (126)		
	InL	-10034.050928	-8580.749766	0.000	
	M1a (123)		M2a (125)		
ND41	InL	-8951.551042	-8951.551042	1.000	0.03979
	M7 (123)		M8 (125)		
	InL	-8578.494095	-8578.495125	-	
	M8a (124)		M8 (125)		
	InL	-8578.043563	-8578.495125	-	
ND5	M0 (121)		M3 (126)		0.04813
	InL	-39574.003357	-34673.370898	0.000	
	M1a (123)		M2a (125)		
	InL	-35843.649173	-35843.649173	1.000	
	M7 (123)		M8 (125)		
ND5	InL	-34622.498124	-34622.502231	-	0.04813
	M8a (124)		M8 (125)		
	InL	-34621.459507	-34622.502231	-	
	M0 (121)		M3 (126)		
	InL	-7907.917641	-6900.888554	0.000	
ND5	M1a (123)		M2a (125)		0.04813
	InL	-7149.575349	-7149.575349	1.000	
	M7 (123)		M8 (125)		
	InL	-6897.612831	-6897.613671	-	
	M8a (124)		M8 (125)		
ND5	InL	-6897.535354	-6897.613671	-	0.04813
	M0 (121)		M3 (126)		
	InL	-51719.607871	-45408.281543	0.000	
	M1a (123)		M2a (125)		
	InL	-47218.308293	-47218.308293	1.000	
ND5	M7 (123)		M8 (125)		0.04813
	InL	-45343.881613	-45343.886424	-	
	M8a (124)		M8 (125)		
ND5	InL	-45342.385343	-45343.886424	-	

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ND6	M0 (121)	M3 (126)		0.05089
InL	-12177.525846	-10809.786492	0.000	
	M1a (123)	M2a (125)		
InL	-11159.398501	-11159.398501	1.000	
	M7 (123)	M8 (125)		
InL	-10784.246169	-10784.247429	-	
	M8a (124)	M8 (125)		
InL	-10783.79465	-10784.247429	-	

n.p. is the estimated number of parameters. Dash represents InL of alternative model is lower than that of null model, and unable to perform LRT.

Table S4

Supplementary Table 4 Results of branch model analyses without internal branches.

Comparison	Gene	Branch model			
		-2 $\Delta\ln L$ (d.f. = 1)	p-value	ω_1	ω_2
Plethodontidae vs. lunged salamanders	<i>atp6</i>	-10.0672	0.002	0.048	0.033
	<i>atp8</i>	-0.0467	0.829	0.132	0.139
	<i>cox1</i>	-28.4104	0.000	0.012	0.007
	<i>cox2</i>	-36.7897	0.000	0.038	0.018
	<i>cox3</i>	-2.1061	0.147	0.034	0.028
	<i>cytb</i>	-4.6570	0.031	0.036	0.030
	<i>nad1</i>	-7.6948	0.006	0.030	0.023
	<i>nad2</i>	-31.2956	0.000	0.067	0.041
	<i>nad3</i>	-1.3742	0.241	0.058	0.049
	<i>nad4</i>	-12.8570	0.000	0.050	0.038
	<i>nad4L</i>	-0.0004	0.983	0.040	0.040
	<i>nad5</i>	-19.2041	0.000	0.053	0.040
	<i>nad6</i>	-15.5252	0.000	0.074	0.042
	<i>Onychodactylus</i> vs. lunged salamanders	<i>atp6</i>	-0.0221	0.882	0.035
<i>atp8</i>		-0.1093	0.741	0.105	0.137
<i>cox1</i>		-1.2962	0.255	0.003	0.009
<i>cox2</i>		-0.0349	0.852	0.016	0.024
<i>cox3</i>		-0.0006	0.980	0.029	0.030
<i>cytb</i>		-0.1953	0.659	0.027	0.032
<i>nad1</i>		-0.0785	0.779	0.021	0.026
<i>nad2</i>		-0.1300	0.718	0.045	0.049
<i>nad3</i>		-0.5475	0.459	0.069	0.051
<i>nad4</i>		-1.4853	0.223	0.052	0.042
<i>nad4L</i>		-0.0208	0.885	0.036	0.040
<i>nad5</i>		-1.8241	0.177	0.053	0.044
<i>nad6</i>		-0.6594	0.417	0.059	0.053

Values with bold showed $P < 0.05$. ω_1 and ω_2 indicate ω values in test and reference lineages, respectively.