

Supplementary Figure 1. This is the phylogenetic tree from Figure 1 with all source NCBI RefSeq accession numbers listed at the branch termini. Translations of these numbers are available in Supplementary Table 1.

Supplementary Figure 2. This “figure” consists of two gif movies that correspond to the still pictures in Figure 4.

Supplementary Table 1. The following table is a list of all accession numbers and taxonomic information (order, family, genus species, and common name) for the source genomes used in this study.

NC_002746 :Peramelemorphia :Peramelidae :Isoodon macrourus :NA
NC_003322 :Diprotodontia :Vombatidae :Vombatus ursinus :coarse-haired wombat
NC_003039 :Diprotodontia :Phalangeridae :Trichosurus vulpecula :common brush-tailed possum
NC_001610 :Didelphimorphia :Didelphidae :Didelphis virginiana :Virginia opossum
NC_003321 :Monotremata :Tachyglossidae :Tachyglossus aculeatus :short-beaked echidna
NC_000891 :Monotremata :Ornithorhynchidae :Ornithorhynchus anatinus :duck-billed platypus
NC_002763 :Primates :Cebidae :Cebus albifrons :brown pale-fronted capuchin
NC_004031 :Dermoptera :Cynocephalidae :Cynocephalus variegatus :NA
NC_006671 :Primates :Cercopithecidae :Trachypithecus obscurus :dusky leaf-monkey
NC_006670 :Primates :Cercopithecidae :Colobus guereza :eastern black-and -white colobus
NC_001992 :Primates :Cercopithecidae :Papio hamadryas :baboon
NC_006669 :Primates :Cercopithecidae :Cercopithecus aethiops :African green monkeys
NC_002764 :Primates :Cercopithecidae :Macaca sylvanus :Barbary macaque
NC_002083 :Primates :Hominidae :Pongo pygmaeus_abelii :NA
NC_001646 :Primates :Hominidae :Pongo pygmaeus :orang-utan
NC_002082 :Primates :Hylobatidae :Hylobates lar :white-handed gibbon
NC_001645 :Primates :Hominidae :Gorilla gorilla :NA
NC_001807 :Primates :Hominidae :Homo sapiens :man
NC_001644 :Primates :Hominidae :Pan paniscus :bonobo
NC_001643 :Primates :Hominidae :Pan troglodytes :NA
NC_002503 :Cetacea :Physeteridae :Physeter catodon :NA
NC_001601 :Cetacea :Balaenopteridae :Balaenoptera musculus :NA
NC_001321 :Cetacea :Balaenopteridae :Balaenoptera physalus :common rorqual
NC_004027 :Pholidota :Manidae :Manis tetradactyla :NA
NC_002631 :Insectivora :Tenrecidae :Echinops telfairi :lesser hedgehog tenrec
NC_004026 :Macroscelidea :Macroscelididae :Macroscelides proboscideus :NA
NC_002078 :Tubulidentata :Orycteropodidae :Orycteropus afer :NA
NC_003314 :Sirenia :Dugongidae :Dugong dugon :NA
NC_001821 :Xenarthra :Dasypodidae :Dasypus novemcinctus :NA
NC_003040 :Insectivora :Soricidae :Soriculus fumidus :NA
NC_003041 :Rodentia :Muridae :Volemys kikuchii :NA
NC_001665 :Rodentia :Muridae :Rattus norvegicus :brown rat
NC_001569 :Rodentia :Muridae :Mus musculus :mouse
NC_002521 :Scandentia :Tupaiaidae :Tupaia belangeri :NA

NC_004032 :Xenarthra :Myrmecophagidae :Tamandua tetradactyla :NA
NC_002626 :Chiroptera :Vespertilionidae :Chalinolobus tuberculatus :NA
NC_002504 :Artiodactyla :Camelidae :Lama pacos :NA
NC_000889 :Artiodactyla :Hippopotamidae :Hippopotamus amphibius :NA
NC_001941 :Artiodactyla :Bovidae :Ovis aries :domestic sheep
NC_004577 :Artiodactyla :Cervidae :Muntiacus crinifrons :NA
NC_004563 :Artiodactyla :Cervidae :Muntiacus muntjak :Indian muntjac
NC_004069 :Artiodactyla :Cervidae :Muntiacus reevesi :Reeves's muntjac
NC_001567 :Artiodactyla :Bovidae :Bos taurus :bovine
NC_003426 :Carnivora :Ursidae :Ursus americanus :NA
NC_003428 :Carnivora :Ursidae :Ursus maritimus :white bear
NC_003427 :Carnivora :Ursidae :Ursus arctos :grizzly bear
NC_002619 :Chiroptera :Pteropodidae :Pteropus scapulatus :NA
NC_002612 :Chiroptera :Pteropodidae :Pteropus dasymallus :NA
NC_001808 :Perissodactyla :Rhinocerotidae :Ceratotherium simum :square-lipped rhinoceros
NC_001779 :Perissodactyla :Rhinocerotidae :Rhinoceros unicornis :Indian rhinoceros
NC_001788 :Perissodactyla :Equidae :Equus asinus :African ass
NC_001640 :Perissodactyla :Equidae :Equus caballus :domestic horse
NC_002009 :Chiroptera :Phyllostomidae :Artibeus jamaicensis :NA
NC_002391 :Insectivora :Talpidae :Talpa europaea :NA
NC_001700 :Carnivora :Felidae :Felis catus :cats
NC_001602 :Carnivora :Phocidae :Halichoerus grypus :grey seal
NC_001325 :Carnivora :Phocidae :Phoca vitulina :NA
NC_004029 :Carnivora :Odobenidae :Odobenus rosmarus rosmarus :NA
NC_004030 :Carnivora :Otariidae :Eumetopias jubatus :northern sea lion
NC_004023 :Carnivora :Otariidae :Arctocephalus forsteri :NA
NC_002008 :Carnivora :Canidae :Canis familiaris :bitches
NC_000845 :Artiodactyla :Suidae :Sus scrofa :pigs
NC_002793 :Squamata :Iguanidae :Iguana iguana :NA
NC_000888 :Squamata :Scincidae :Eumeces egregius :NA
NC_002780 :Testudines :Trionychidae :Dogania subplana :NA
NC_002073 :Testudines :Emydidae :Chrysemys picta :NA
NC_000886 :Testudines :Cheloniidae :Chelonia mydas :NA
NC_002781 :Tinamiformes :Tinamidae :Tinamus major :NA
NC_002069 :Passeriformes :Corvidae :Corvus frugilegus :NA
NC_000880 :Passeriformes :Estrildidae :Vidua chalybeata :NA
NC_003128 :Ciconiiformes :Accipitridae :Buteo buteo :NA
NC_000879 :Passeriformes :Eurylaimidae :Smithornis sharpei :NA
NC_001323 :Galliformes :Phasianidae :Gallus gallus :chickens
NC_004575 :Galliformes :Phasianidae :Coturnix chinensis :Chinese painted quail
NC_003408 :Galliformes :Phasianidae :Coturnix japonica :NA
NC_000878 :Ciconiiformes :Falconidae :Falco peregrinus :NA
NC_004539 :Anseriformes :Anatidae :Anser albifrons :NA
NC_000877 :Anseriformes :Anatidae :Aythya americana :NA
NC_006668 :Piciformes :Picidae :Picoides pubescens :NA
NC_003713 :Charadriiformes :Haematopodidae :Haematopus ater :NA
NC_003712 :Ciconiiformes :Scolopacidae :Arenaria interpres :NA
NC_004538 :Ciconiiformes :Spheniscidae :Eudyptula minor :NA
NC_002197 :Ciconiiformes :Ciconiidae :Ciconia ciconia :NA
NC_002196 :Ciconiiformes :Ciconiidae :Ciconia boyciana :oriental stork
NC_002784 :Casuariiformes :Dromaiidae :Dromaius novaehollandiae :NA
NC_002778 :Struthioniformes :Casuariidae :Casuarius casuarius :Australian cassowary
NC_002785 :Struthioniformes :Struthionidae :Struthio camelus :NA
NC_002672 :Dinornithiformes :Dinornithidae :Dinornis giganteus :NA
NC_002779 :Dinornithiformes :Emeidae :Anomalopteryx didiformis :little bush moa
NC_002673 :Dinornithiformes :Emeidae :Emeus crassus :NA

NC_002782 :Struthioniformes :Apterygidae :Apteryx haastii :NA
 NC_002783 :Struthioniformes :Rheidae :Pterocnemia pennata :lesser rhea
 NC_000846 :Struthioniformes :Rheidae :Rhea americana :common rhea
 NC_004382 :Lophiiformes :Chaunacidae :Chaunax tosaensis :sea toad
 NC_004381 :Lophiiformes :Chaunacidae :Chaunax abei :sea toad
 NC_004378 :Gadiformes :Melanonidae :Melanonus zugmayeri :NA
 NC_004374 :Ophidiiformes :Ophidiidae :Bassozetus zenkevitchi :cusk-eel
 NC_004021 :Caudata :Hynobiidae :Ranodon sibiricus :NA
 NC_002756 :Caudata :Salamandridae :Mertensiella luschni :NA
 NC_004402 :Scorpaeniformes :Dactylopteridae :Dactyloptena tiltoni :flying gurnard
 NC_003194 :Scorpaeniformes :Dactylopteridae :Dactyloptena peterseni :NA
 NC_003196 :Perciformes :Sparidae :Pagrus major :red tail
 NC_003096 :Osteoglossiformes :Pantodontidae :Pantodon buchholzi :NA
 NC_003095 :Osteoglossiformes :Osteoglossidae :Osteoglossum bicirrhosum :arawana
 NC_004418 :Polypteriformes :Polypteridae :Polypterus senegalus senegalus :NA
 NC_001778 :Polypteriformes :Polypteridae :Polypterus ornatipinnis :NA
 NC_004702 :Gonorynchiformes :Gonorynchidae :Gonorynchus greyi :NA
 NC_001573 :Anura :Pipidae :Xenopus laevis :clawed frog
 NC_003177 :Tetraodontiformes :Monacanthidae :Stephanolepis cirrhifer :NA
 NC_004388 :Cyprinodontiformes :Poeciliidae :Gambusia affinis :NA
 NC_004385 :Atheriniformes :Melanotaeniidae :Melanotaenia lacustris :Lake Kutubu rainbowfish
 NC_003173 :Zeiformes :Zeidae :Zenopsis nebulosus :NA
 NC_002647 :Stomiiformes :Gonostomatidae :Diplophos taenia :NA
 NC_003165 :Lampridiformes :Lamprididae :Lampris guttatus :Jerusalem haddock
 NC_004396 :Zeiformes :Parazenidae :Parazen pacificus :NA
 NC_003167 :Lampridiformes :Trachipteridae :Zu cristatus :NA
 NC_003166 :Lampridiformes :Trachipteridae :Trachipterus trachipterus :NA
 NC_003190 :Zeiformes :Zeidae :Zeus faber :NA
 NC_004399 :Zeiformes :Oreosomatidae :Neocyttus rhomboidalis :NA
 NC_004398 :Zeiformes :Oreosomatidae :Alloctytus niger :NA
 NC_004379 :Gadiformes :Lotidae :Lota lota :NA
 NC_004449 :Gadiformes :Gadidae :Theragra chalcogramma :walleye pollock
 NC_002081 :Gadiformes :Gadidae :Gadus morhua :NA
 NC_003160 :Aulopiformes :Chlorophthalmidae :Chlorophthalmus agassizi :NA
 NC_004600 :Osmeriformes :Opisthoproctidae :Opisthoproctus soleatus :NA
 NC_003193 :Synbranchiformes :Mastacembelidae :Mastacembelus favus :NA
 NC_004742 :Amiiformes :Amiidae :Amia calva :NA
 NC_003136 :Chimaeriformes :Chimaeridae :Chimaera monstrosa :NA
 NC_000893 :Rajiformes :Rajidae :Raja radiata :NA
 NC_003137 :Heterodontiformes :Heterodontidae :Heterodontus francisci :NA
 NC_002012 :Squaliformes :Squalidae :Squalus acanthias :NA
 NC_001950 :Carcharhiniformes :Scyliorhinidae :Scyliorhinus canicula :smaller spotted dogfish
 NC_000890 :Carcharhiniformes :Triakidae :Mustelus manazo :NA
 NC_003185 :Stephanoberyciformes :Cetomimidae :Danacetichthys galathenus :NA
 NC_004389 :Stephanoberyciformes :Cetomimidae :Cetostoma regani :NA
 NC_004372 :Percopsiformes :Aphredoderidae :Aphredoderus sayanus :NA
 NC_003168 :Percopsiformes :Percopsidae :Percopsis transmontana :NA
 NC_004744 :Semionotiformes :Lepisosteidae :Lepisosteus oculatus :NA
 NC_004700 :Characiformes :Characidae :Chalceus macrolepidotus :NA
 NC_004699 :Characiformes :Alestidae :Phenacogrammus interruptus :NA
 NC_004701 :Gymnotiformes :Eigenmanniidae :Eigenmannia sp. :NA
 NC_004698 :Siluriformes :Callichthyidae :Corydoras rabauti :rust corydoras
 NC_004697 :Siluriformes :Bagridae :Pseudobagrus tokiensis :NA
 NC_003489 :Siluriformes :Ictaluridae :Ictalurus punctatus :NA
 NC_003189 :Beryciformes :Holocentridae :Myripristis berndti :NA
 NC_003179 :Ateleopodiformes :Ateleopodidae :Ijimaia dofleini :jellynose fish

NC_003178 :Ateleopodiformes :Ateleopodidae :Ateleopus japonicus :jellynose fish
 NC_004387 :Beloniformes :Adrianichthyidae :Oryzias latipes :Japanese rice fish
 NC_004386 :Atheriniformes :Atherinidae :Hypoatherina tsurugae :NA
 NC_003184 :Beloniformes :Exocoetidae :Exocoetus volitans :NA
 NC_003183 :Beloniformes :Scomberesocidae :Cololabis saira :NA
 NC_004413 :Perciformes :Gobiesocidae :Arcos sp. KU-149 :clingfish
 NC_003182 :Mugiliformes :Mugilidae :Mugil cephalus :Formosan gray mullet
 NC_003170 :Mugiliformes :Mugilidae :Crenimugil crenilabis :black-axil mullet
 NC_004412 :Perciformes :Blenniidae :Salarias fasciatus :NA
 NC_004417 :Anguilliformes :Muraenidae :Gymnothorax kidako :NA
 NC_003162 :Aulopiformes :Synodontidae :Saurida undosquamis :NA
 NC_003161 :Aulopiformes :Synodontidae :Harpadon microchir :NA
 NC_004380 :Lophiiformes :Lophiidae :Lophius americanus :American goosfish
 NC_004416 :Tetraodontiformes :Balistidae :Sufflamen fraenatus :NA
 NC_004408 :Perciformes :Lutjanidae :Pterocaesio tile :NA
 NC_004407 :Perciformes :Emmelichthyidae :Emmelichthys struhsakeri :rover
 NC_004384 :Lophiiformes :Melanocetidae :Melanocetus murrayi :NA
 NC_004383 :Lophiiformes :Caulophryidae :Caulophryne pelagica :fanfin
 NC_003171 :Stephanoberyciformes :Melamphidae :Scopelogadus mizolepis :bigscale
 NC_003172 :Stephanoberyciformes :Melamphidae :Poromitra oscitans :NA
 NC_004393 :Beryciformes :Berycidae :Beryx decadactylus :NA
 NC_003188 :Beryciformes :Berycidae :Beryx splendens :NA
 NC_004376 :Ophidiiformes :Bythitidae :Diplacanthopoma brachysoma :viviparous brotula
 NC_004375 :Ophidiiformes :Bythitidae :Cataetys rubrirostris :NA
 NC_003186 :Stephanoberyciformes :Rondeletiidae :Rondeletia loricata :NA
 NC_004395 :Beryciformes :Holocentridae :Sargocentron rubrum :NA
 NC_004394 :Beryciformes :Holocentridae :Ostichthys japonicus :NA
 NC_003180 :Myctophiformes :Neoscopelidae :Neoscopelus microchir :lanternfish
 NC_003164 :Myctophiformes :Myctophidae :Diaphus splendidus :NA
 NC_002813 :Perciformes :Carangidae :Trachurus japonicus :Japanese jack mackerel
 NC_004406 :Perciformes :Carangidae :Caranx melampygus :NA
 NC_004405 :Perciformes :Carangidae :Carangoides armatus :NA
 NC_002386 :Pleuronectiformes :Paralichthyidae :Paralichthys olivaceus :Japanese flounder
 NC_003181 :Polymixiiformes :Polymixiidae :Polymixia lowei :NA
 NC_002648 :Polymixiiformes :Polymixiidae :Polymixia japonica :NA
 NC_004299 :Tetraodontiformes :Tetraodontidae :Takifugu rubripes :torafugu
 NC_003191 :Zeiformes :Caproidae :Antigonia capros :NA
 NC_002674 :Aulopiformes :Aulopidae :Aulopus japonicus :Japanese thread-sail fish
 NC_004415 :Perciformes :Eleotridae :Eleotris acanthopoma :sleepy goby
 NC_004414 :Perciformes :Rhyacichthyidae :Rhyacichthys aspro :NA
 NC_004530 :Perciformes :Scombridae :Euthynnus alletteratus :NA
 NC_004593 :Esociformes :Esocidae :Esox lucius :NA
 NC_004592 :Esociformes :Umbridae :Dallia pectoralis :NA
 NC_004694 :Cypriniformes :Cyprinidae :Sarcocheilichthys variegatus microoculus :NA
 NC_004696 :Cypriniformes :Balitoridae :Lefua echigonia :Japanese eight-barbel loach
 NC_001727 :Cypriniformes :Balitoridae :Crossostoma lacustre :NA
 NC_004695 :Cypriniformes :Cobitidae :Cobitis striata :NA
 NC_002079 :Cypriniformes :Cyprinidae :Carassius auratus :NA
 NC_001606 :Cypriniformes :Cyprinidae :Cyprinus carpio :carp
 NC_004693 :Gonorynchiformes :Chanidae :Chanos chanos :NA
 NC_004419 :Acipenseriformes :Polyodontidae :Polyodon spathula :North American paddlefish
 NC_004743 :Acipenseriformes :Acipenseridae :Acipenser transmontanus :NA
 NC_004420 :Acipenseriformes :Acipenseridae :Scaphirhynchus cf. albus :NA
 NC_002707 :Anguilliformes :Anguillidae :Anguilla japonica :NA
 NC_003097 :Clupeiformes :Engraulidae :Engraulis japonicus :NA
 NC_002616 :Clupeiformes :Clupeidae :Sardinops melanostictus :NA

NC_004594 :Osmeriformes :Galaxiidae :Galaxias maculatus :Inanga
 NC_004598 :Osmeriformes :Retropinnidae :Retropinna retropinna :NA
 NC_004599 :Osmeriformes :Osmeridae :Salangichthys microdon :NA
 NC_002734 :Osmeriformes :Osmeridae :Plecoglossus altivelis :ayu
 NC_004597 :Osmeriformes :Platyroctidae :Platyroctes apus :NA
 NC_004590 :Osmeriformes :Alepocephalidae :Alepocephalus tenebrosus :NA
 NC_004595 :Osmeriformes :Argentinidae :Glossanodon semifasciatus :NA
 NC_004596 :Osmeriformes :Microstomatidae :Nansenia ardesiaca :NA
 NC_004591 :Osmeriformes :Microstomatidae :Bathylagus ochotensis :NA
 NC_002646 :Salmoniformes :Salmonidae :Coregonus lavaretus :NA
 NC_002980 :Salmoniformes :Salmonidae :Oncorhynchus tshawytscha :king salmon
 NC_001717 :Salmoniformes :Salmonidae :Oncorhynchus mykiss :NA
 NC_001960 :Salmoniformes :Salmonidae :Salmo salar :NA
 NC_000861 :Salmoniformes :Salmonidae :Salvelinus alpinus :NA
 NC_000860 :Salmoniformes :Salmonidae :Salvelinus fontinalis :NA
 NC_003163 :Myctophiformes :Myctophidae :Myctophum affine :NA
 NC_003176 :Pleuronectiformes :Pleuronectidae :Platichthys bicoloratus :NA
 NC_004391 :Beryciformes :Anoplogasteridae :Anoplogaster cornuta :NA
 NC_004392 :Beryciformes :Monocentridae :Monocentris japonicus :pineconefish
 NC_003187 :Beryciformes :Trachichthyidae :Hoplostethus japonicus :NA
 NC_004400 :Gasterosteiformes :Hypoptychidae :Hypoptychus dybowskii :NA
 NC_003174 :Gasterosteiformes :Gasterosteidae :Gasterosteus aculeatus :NA
 NC_004403 :Scorpaeniformes :Peristediidae :Satyrichthys amiscus :armored gurnard
 NC_003195 :Scorpaeniformes :Scorpaenidae :Helicolenus hilgendorfi :NA
 NC_004410 :Perciformes :Pholidae :Enedrias crassispina :gunnel
 NC_004409 :Perciformes :Zoarcidae :Lycodes toyamensis :eelpout
 NC_004404 :Scorpaeniformes :Cottidae :Cottus reinii :NA
 NC_002812 :Perciformes :Trichodontidae :Arctoscopus japonicus :NA
 NC_002639 :Myxiniformes :Myxiniinae :Myxine glutinosa :OutgroupHyperotreti
 (NA means common name is not available)