

SUPPORTIVE/SUPPLEMENTARY MATERIAL

Supplemental Table 1. Fish and other Non-Mammalian Vertebrate Species with/without the Capacity to Make Vitamin C

Species	Family	Order	Common name	Vitamin C production	Organ	References
<i>Petromyzon marinus</i>	Petromyzontidae	Petromyzontiformes	Sea lamprey	Yes	Kidney	[1]
<i>Lampetra japonica</i>	Petromyzontidae	Petromyzontiformes	Japanese lamprey	Yes	Kidney	[2]
<i>Triakis scyllium</i>	Triakidae	Carcharhiniformes	Banded houndshark	Yes	Kidney	[2, 3]
<i>Mustelus manazo</i>	Triakidae	Carcharhiniformes	Starspotted smooth-hound shark	Yes	Kidney	[2, 3]
<i>Mustelus griseus</i>	Triakidae	Carcharhiniformes	Japanese gray smooth hound shark	Yes	Kidney	[3]
<i>Raja kenojei</i>	Rajidae	Rajiformes	Ocellate spot skate	Yes	Kidney	[2, 3]
<i>Dasyatis akajei</i>	Dasyatidae	Myliobatiformes	Red stingray	Yes	Kidney	[2, 3]
<i>Potamotrygon sp C.</i>	Potamotrygonidae	Myliobatiformes	Freshwater stingray	Yes	Kidney	[4]
<i>Acipenser baeri</i>	Acipenseridae	Acipenseriformes	Siberian sturgeon	Yes	Kidney	[3]
<i>Acipenser gueldenstaedtii</i>	Acipenseridae	Acipenseriformes	Russian sturgeon	Yes	Kidney	[3]
<i>Acipenser naccarii</i>	Acipenseridae	Acipenseriformes	Adriatic sturgeon	Yes	Kidney	[3]
<i>Acipenser transmontanus</i>	Acipenseridae	Acipenseriformes	White sturgeon	Yes	Kidney	[3, 5, 9]
<i>Acipenser ruthenus</i>	Acipenseridae	Acipenseriformes	Sterlet	Yes	Kidney	[3, 6]
<i>Scyliorhinus torazame</i>	Scyliorhinidae	Carcharhiniformes	Cloudy catshark	Yes	Kidney	[3]
<i>Squalus acanthias</i>	Squalidae	Squaliformes	Picked dogfish	Yes	Kidney	[3, 6]
<i>Polyodon spathula</i>	Polyodontidae	Acipenseriformes	Paddlefish	Yes	Kidney	[5]
<i>Protopterus aethiopicus</i>	Ceratodontidae	Ceratodontiformes	African lungfish	Yes	Kidney	[2]
<i>Neoceratodus forsteri</i>	Ceratodontidae	Ceratodontiformes	Australian lungfish	Yes	Kidney	[7]
<i>Lepidosiren paradoxo</i>	Lepidosirenidae	Lepidosireniformes	South African lungfish	Yes	Kidney	[4]
<i>Polypterus senegalus</i>	Polypteridae	Polypteriformes	<i>Polypterus</i>	Yes	Kidney	[8]
<i>Amia calva</i>	Amiidae	Amiiformes	Bowfin	Yes	Kidney	[8]
<i>Lepisosteus osseus</i>	Lepisosteidae	Lepisosteiformes	Longnose gar	Yes	Kidney	[8]
<i>Carassius auratus</i>	Cyprinidae	Cypriniformes	Goldfish	No	n.a.	[8]
<i>Cyprinus carpio</i>	Cyprinidae	Cypriniformes	Common carp	No	n.a.	[8]
<i>Oncorhynchus mykiss</i>	Salmonidae	Salmoniformes	Rainbow trout	No	n.a.	[9]
<i>Ictalurus punctatus</i>	Ictaluridae	Siluriformes	Catfish	No	n.a.	[9]
<i>Oryzias latipes</i>	Adrianichthyidae	Beloniformes	Medaka	No	n.a.	[10]

(Table S1). Contd.....

Species	Family	Order	Common name	Vitamin C production	Organ	References
<i>Osteoglossum bicirrhosum</i>	Osteoglossidae	Osteoglossiformes	Arowana	No	n.a.	[4]
<i>Pelona sp.</i>	Clupeidae	Clupeiformes	Sardine	No	n.a.	[4]
<i>Arapaima gigas</i>	Osteoglossidae	Osteoglossiformes	Arapaima	No	n.a.	[4]
<i>Pygocentrus nattereri</i>	Characidae	Characiformes	Piranha caju	No	n.a.	[4]
<i>Serrasalmus elongatus</i>	Characidae	Characiformes	Piranha mucura	No	n.a.	[4]
<i>Schizodon fasciatus</i>	Characidae	Characiformes	Aracu comum	No	n.a.	[4]
<i>Colossoma macropomum</i>	Characidae	Characiformes	Tambaqui	No	n.a.	[4]
<i>Hypostomus sp.</i>	Loricariidae	Siluriformes	Acari-pedra	No	n.a.	[4]
<i>Steatogenys elegans</i>	Hypopomidae	Gymnotiformes	Sarapo	No	n.a.	[4]
<i>Electrophorus electricus</i>	Gymnotidae	Gymnotiformes	Electric eel	No	n.a.	[4]
<i>Cichla sp.</i>	Cichlidae	Perciformes	Peacock bass	No	n.a.	[4]
<i>Clupea harengus</i>	Clupeidae	Clupeiformes	Atlantic herring	No	n.a.	[6]
<i>Anguilla anguilla</i>	Anguillidae	Anguilliformes	European eel	No	n.a.	[6]
<i>Salmo salar</i>	Salmonidae	Salmoniformes	Atlantic salmon	No	n.a.	[6]
<i>Gadus morhua</i>	Gadidae	Gadiformes	Atlantic cod	No	n.a.	[6]
<i>Scomber scombrus</i>	Scombridae	Perciformes	Atlantic mackerel	No	n.a.	[6]
<i>Hippoglossus hippoglossus</i>	Pleuronectidae	Pleuronectiformes	Atlantic halibut	No	n.a.	[6]
<i>Scophthalmus maximus</i>	Scophthalmidae	Pleuronectiformes	Atlantic turbot	No	n.a.	[6]
<i>Rutilus rutilus</i>	Cyprinidae	Cypriniformes	Common roach	No	n.a.	[11]
<i>Coregonus lavaretus</i>	Salmonidae	Salmoniformes	Common whitefish	No	n.a.	[11]
<i>Salvelinus alpinus</i>	Salmonidae	Salmoniformes	Arctic char	No	n.a.	[11]
<i>Rana tigrina</i>	Ranidae	Anura	Indus valley bullfrog	Yes	Kidney	[12]
<i>Testudo elegans</i>	Testudinidae	Testudines	Tortoise	Yes	Kidney	[12]
<i>Lissemys punctata</i>	Trionychidae	Testudines	Indian flap-shelled turtle	Yes	Kidney	[12]
<i>Bufo melanostictus</i>	Bufonidae	Anura	Asian common toad	Yes	Kidney	[12, 13]
<i>Mabuya carinata</i>	Scincidae	Squamata	Keeled Indian Mabuya	Yes	Kidney	[12]
<i>Natrix piscator</i>	Colubridae	Squamata	Snake	Yes	Kidney	[12]
<i>Hemidactylus flaviviridis</i>	Gekkonidae	Squamata	Yellow-bellied House Gecko	Yes	Kidney	[12]
<i>Calotes versicolor</i>	Agamidae	Squamata	Oriental garden lizard	Yes	Kidney	[12, 13]
<i>Varanus monitor</i>	Varanidae	Squamata	Common Indian Monitor	Yes	Kidney	[12, 13]

[1] Moreau, R.; Dabrowski, K. Body pool and synthesis of ascorbic in adult sea lamprey (*Petromyzon marinus*): An agnathan fish with gulonolactone oxidase activity. *Proc. Natl. Acad. Sci. U.S.A.*, **1998**, 95, 10279-10282.

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(Table S1). Contd.....

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- [11] Dabrowski, K. Ascorbate concentration in fish ontogeny. *J. Fish Biol.*, **1992**, *40*, 273-279.
- [12] Chatterjee, I.B. Evolution and the biosynthesis of ascorbic acid. *Science*, **1973**, *182*, 1271-1272.
- [13] Roy, R.N.; Guha, B.C. Species difference in regard to the biosynthesis of ascorbic acid. *Nature*, **1958**, *182*, 319-318.

Supplemental Table 2. Mammalian Species with/without the Capacity to Make Vitamin C

Species	Family	Order	Common name	Vitamin C production	Organ	References
<i>Tachyglossus aculeatus</i>	Tachyglossidae	Monotremata	Australian echidna	Yes	Kidney	[1]
<i>Ornithorhynchus anatinus</i>	Ornithorhynchidae	Monotremata	Platypus	Yes	Kidney	[1]
<i>Didelphis virginiana</i>	Didelphidae	Didelphimorphia	North American opossum	Yes	Liver	[1]
<i>Dasyuroides byrnei</i>	Dasyuridae	Dasyuromorphia	Kowari	Yes	Liver	[1]
<i>Antechinus stuartii</i>	Dasyuridae	Dasyuromorphia	Brown antechinus	Yes	Liver	[1]
<i>Dasyurus maculatus</i>	Dasyuridae	Dasyuromorphia	Spotted-tailed quoll	Yes	Liver	[1]
<i>Perameles nasuta</i>	Peramelidae	Peramelemorphia	Long-nosed bandicoot	Yes	Liver & kidney	[1]
<i>Isodon macrourus</i>	Peramelidae	Peramelemorphia	Northern brown bandicoot	Yes	Liver & kidney	[1]
<i>Pseudocheirus peregrinus</i>	Pseudocheiridae	Diprotodontia	Common ring-tailed possum	Yes	Liver	[1]
<i>Schoinobates volans</i>	Petauridae	Diprotodontia	Greater Gliding Possum	Yes	Liver	[1]
<i>Cercartetus nanus</i>	Burramyidae	Diprotodontia	Dormouse Possum	Yes	Liver	[1]
<i>Vombatus ursinus</i>	Vombatidae	Diprotodontia	Common wombat	Yes	Liver	[1]
<i>Trichosurus vulpecula</i>	Phalangeridae	Diprotodontia	Common brush-tailed possum	Yes	Liver	[1]
<i>Macropus rufogriseus</i>	Macropodidae	Diprotodontia	Red-necked wallaby	Yes	Liver	[1]
<i>Macropus eugenii</i>	Macropodidae	Diprotodontia	Tammar wallaby	Yes	Liver	[1]
<i>Macropus giganteus</i>	Macropodidae	Diprotodontia	eastern gray kangaroo	Yes	Liver	[1]
<i>Macropus robustus</i>	Macropodidae	Diprotodontia	Wallaroo	Yes	Liver	[1]
<i>Thylogale thetis</i>	Macropodidae	Diprotodontia	Red-necked pademelon	Yes	Liver	[1]
<i>Wallabia bicolor</i>	Macropodidae	Diprotodontia	Swamp wallaby	Yes	Liver	[1]

(Table S2). Contd.....

Species	Family	Order	Common name	Vitamin C production	Organ	References
<i>Myoprocta acouchy</i>	Dasyproctidae	Rodentia	Acouchi	Yes	Liver	[2]
<i>Dasyprocta aguti</i>	Dasyproctidae	Rodentia	Brazilian agouti	Yes	Liver	[2]
<i>Cavia porcellus</i>	Caviidae	Rodentia	Guinea pig	No	n.a.	[3, 4, 5, 6, 7]
<i>Canis familiaris</i>	Canidae	Carnivora	Dog	Yes	Liver	[3, 6, 8]
<i>Felis catus</i>	Felidae	Carnivora	Cat	Yes	Liver	[3, 6]
<i>Sus scrofa</i>	Suidae	Artiodactyla	Pig	Yes	Liver	[8]
<i>Bos primigenius</i>	Bovidae	Artiodactyla	Cow	Yes	Liver	[3, 6]
<i>Capra hircus</i>	Bovidae	Artiodactyla	Goat	Yes	Liver	[9]
<i>Ovis aries</i>	Bovidae	Artiodactyla	Sheep	Yes	Liver	[3, 6]
<i>Oryctolagus cuniculus</i>	Leporidae	Lagomorpha	Rabbit	Yes	Liver	[3]
<i>Sciurus carolinensis</i>	Sciuridae	Rodentia	Grey squirrel	Yes	Liver	[3, 6, 8]
<i>Mus musculus</i>	Muridae	Rodentia	Mouse	Yes	Liver	[3, 5, 6, 8]
<i>Rattus norvegicus</i>	Muridae	Rodentia	Rat	Yes	Liver	[3, 4, 5, 6, 8]
?	Muridae	Rodentia	Gerbil	Yes	Liver	[6, 9]
<i>Homo sapiens</i>	Hominidae	Primates	Human	No	n.a.	[3, 4, 6]
<i>Macaca mulatta</i>	Cercopithecidae	Primates	Macaque	No	n.a.	[3, 6]
<i>Chlorocebus aethiops</i>	Cercopithecidae	Primates	African green monkey	No	n.a.	[4]
<i>Tarsius bancanus</i>	Tarsiidae	Primates	Horsfield's tarsier	Yes	Liver & kidney*	[5]
<i>Microcebus murinus</i>	Cheirogaleidae	Primates	Gray mouse lemur	Yes	Liver & kidney*	[5]
<i>Cheirogaleus medius</i>	Cheirogaleidae	Primates	Lesser dwarf lemur	Yes	Liver & kidney*	[5]
<i>Propithecus verreauxi</i>	Indriidae	Primates	White sifaka	Yes	Liver & kidney*	[5]
<i>Galago senegalensis moholi</i>	Galagidae	Primates	South African galago	Yes	Liver & kidney*	[5]
<i>Galago garnetti</i>	Galagidae	Primates	Small-eared galago	Yes	Liver & kidney*	[5]
<i>Galago crassicaudatus</i>	Galagidae	Primates	Thick-tailed bush baby	Yes	Liver & kidney*	[5]
<i>Loris tardigradus</i>	Lorisidae	Primates	Slender loris	Yes	Liver & kidney*	[5]
<i>Perodicticus potto</i>	Lorisidae	Primates	Potto	Yes	Liver & kidney*	[5]
<i>Hapalemur griseus</i>	Lemuridae	Primates	Bamboo lemur	Yes	Liver & kidney*	[5]
<i>Varecia variegata</i>	Lemuridae	Primates	Ruffed lemur	Yes	Liver & kidney	[5]
<i>Lemur fulvus albigrons</i>	Lemuridae	Primates	Lemur	Yes	Liver & kidney	[5]
<i>Lemur fulvus collaris</i>	Lemuridae	Primates	Lemur	Yes	Liver & kidney	[5]
<i>Lemur fulvus rufus</i>	Lemuridae	Primates	Lemur	Yes	Liver & kidney	[5]
<i>Lemur macaco</i>	Lemuridae	Primates	Lemur	Yes	Liver & kidney	[5]

Note. Stars (*) denote species for which GLO activity in the liver is still uncertain because the detection method used could not detect zero GLO activity.

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(Table S2). Contd.....

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Supplemental Table 3. Bat Species with/without the Capacity to Make Vitamin C

Species	Family	Order	Vitamin C production	References
<i>Myotis ricketti</i>	Vespertilionidae	Chiroptera	No	[1]
<i>Rousettus leschenaultii</i>	Pteropodidae	Chiroptera	Yes, in the liver	[1]
<i>Rhinolophus ferrumequinum</i>	Rhinolophidae	Chiroptera	No	[1]
<i>Hipposideros armiger</i>	Hipposideridae	Chiroptera	Yes, in the liver	[1]
<i>Cynopterus sphinx</i>	Pteropodidae	Chiroptera	No	[1]
<i>Scotophilus kuhlii</i>	Vespertilionidae	Chiroptera	No	[1]
<i>Noctilio leporinus</i>	Noctilionidae	Chiroptera	No	[2]
<i>Pteronotus davyi</i> <i>Pteronotus parnelli</i> <i>Pteronotus suapurensis</i>	Mormoopidae	Chiroptera	No	[2]
<i>Mormoops megalophylla</i>	Mormoopidae	Chiroptera	No	[2]
<i>Micronycteris megalotis</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Mimon cozumelae</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Glossophaga soricina</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Carollia brevicauda</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Sturnira lilium</i> <i>Sturnira ludovici</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Uroderma bilobatum</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Chiroderma villosum</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Artibeus jamaicensis</i> <i>Artibeus lituratus</i> <i>Artibeus phaeotis</i> <i>Artibeus toltecus</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Desmodus rotundus</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Diphylla ecaudata</i>	Phyllostomatinae	Chiroptera	No	[2]
<i>Natalus stramineus</i>	Natalidae	Chiroptera	No	[2]
<i>Myotis keaysi</i> <i>Myotis leibii</i> <i>Myotis lucifugus</i> <i>Myotis velifer</i> <i>Myotis riparius</i>	Vespertilionidae	Chiroptera	No	[2]

(Table S3). Contd.....

Species	Family	Order	Vitamin C production	References
<i>Eptesicus furalis</i> <i>Eptesicus fuscus</i>	Vespertilionidae	Chiroptera	No	[2]
<i>Lasiurus ega</i> <i>Lasiurus intermedius</i>	Vespertilionidae	Chiroptera	No	[2]
<i>Plecotus townsendii</i>	Vespertilionidae	Chiroptera	No	[2]
<i>Molossus ater</i> <i>Molossus sinaloae</i>	Molossidae	Chiroptera	No	[2]
<i>Promops centralis</i>	Molossidae	Chiroptera	No	[2]
<i>Eumops glaucinus</i>	Molossidae	Chiroptera	No	[2]
<i>Pteropus medius</i>	Pteropodidae	Chiroptera	No	[3, 4]
<i>Vesperugo abramus</i>	Vespertilionidae	Chiroptera	No	[4]

[1] Cui, J.; Pan, Y.H.; Zhang, Y.; Jones, G.; Zhang, S. Progressive pseudogenization: vitamin C synthesis and its loss in bats. *Mol. Biol. Evol.*, **2011**, 28, 1025-1031.

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Supplemental Table 4. Bird Species with/without the Capacity to Make Vitamin C

Species	Family	Order	Vitamin C production	Organ	References
<i>Anser indicus</i>	Anatidae	Anseriformes	Yes	Kidney	[1, 2]
<i>Gallus gallus</i>	Phasianidae	Galliformes	Yes	Kidney	[1, 2, 3]
<i>Brachypterus benghalensis</i>	Picidae	Piciformes	Yes	Liver	[1, 2]
<i>Halcyon smyrnensis</i>	Halcyonidae	Coraciiformes	Yes	Kidney	[1, 2, 3]
<i>Eudynamis scolopaceus</i>	Cuculidae	Cuculiformes	Yes	Kidney	[1, 2]
<i>Psittacula eupatria</i>	Psittacidae	Psittaciformes	Yes	Kidney	[1, 2]
<i>Otus bakkamoena</i>	Strigidae	Strigiformes	Yes	Kidney	[1, 2, 3]
<i>Fulica atra</i>	Rallidae	Gruiformes	Yes	Kidney	[1, 2, 3]
<i>Columba livia</i>	Columbidae	Columbiformes	Yes	Kidney	[1, 2, 3]
<i>Falco jugger</i>	Falconidae	Falconiformes	Yes	Kidney	[1, 2]
<i>Bubulcus ibis</i>	Ardeidae	Ciconiiformes	Yes	Kidney	[1, 2]
<i>Aegithina tiphia</i>	Aegithinidae	Passeriformes	No	n.a.	[1, 2]
<i>Lanius Schach tricolor</i> <i>Lanius vittatus</i> <i>Lanius excubitor</i>	Laniidae	Passeriformes	No	n.a.	[1, 2]
<i>Dendocitta vagabunda</i>	Corvidae	Passeriformes	Yes	Liver	[1, 2]
<i>Corvus splendens</i>	Corvidae	Passeriformes	Yes	Liver & kidney	[1, 2, 3]
<i>Oriolus xanthornus</i>	Oriolidae	Passeriformes	No	n.a.	[1, 2]
<i>Pericrocotus flammeus</i>	Campephagidae	Passeriformes	No	n.a.	[1, 2]
<i>Gracula religiosa</i>	Sturnidae	Passeriformes	Yes	Liver	[1, 2, 3]

(Table S4). Contd.....

Species	Family	Order	Vitamin C production	Organ	References
<i>Acridotheres tristis</i>	Sturnidae	Passeriformes	Yes	Liver & kidney	[1, 2, 3]
<i>Sturnopastor contra</i>	Sturnidae	Passeriformes	Yes	Liver	[1, 2]
<i>Aethiopsar fuscus</i>	Sturnidae	Passeriformes	Yes	Liver	[1, 2]
<i>Monticola cinaclorhynchus</i>	Muscicapidae	Passeriformes	Yes	Liver	[1, 2]
<i>Copsychus saularis</i>	Muscicapidae	Passeriformes	Yes	Liver	[1, 2, 3]
<i>Terpsiphone paradisi</i>	Monarchidae	Passeriformes	No	n.a.	[1, 2]
<i>Hirundo rustica</i>	Hirundinidae	Passeriformes	No	n.a.	[1, 2]
<i>Pycnonotus luteolus</i> <i>Pycnonotus jocosus</i> <i>Pycnonotus leucogenys</i>	Pycnonotidae	Passeriformes	No	n.a.	[1, 2]
<i>Pycnonotus cafer</i>	Pycnonotidae	Passeriformes	No	n.a.	[1, 2, 3]
<i>Turdoides somervillei</i>	Timaliidae	Passeriformes	Yes	Liver	[1, 2]
<i>Acrocephalus slentoreus</i>	Acrocephalidae	Passeriformes	No	n.a.	[1, 2]
<i>Passer domesticus</i>	Passeridae	Passeriformes	Yes	Liver	[1, 2]
<i>Lonchura malacca</i>	Estrildidae	Passeriformes	Yes	Liver	[1, 2, 3]
<i>Aethopyga siparaja</i>	Nectariniidae	Passeriformes	No	n.a.	[1, 2]
<i>Dicaeum erythrorhynchos</i>	Dicaeidae	Passeriformes	No	n.a.	[1, 2]
<i>Rhipidura albogularis</i>	Corvidae	Passeriformes	No	n.a.	[1, 2]
<i>Aythya ferina</i>	Anatidae	Anseriformes	Yes	Kidney	[2, 3]
<i>Francolinus pondicerianus</i>	Phasianidae	Galliformes	Yes	Kidney	[2, 3]
<i>Acridotheres ginginianus</i>	Sturnidae	Passeriformes	Yes	Liver	[1, 2, 3]
<i>Crypsirina vagabunda</i>	Corvidae	Passeriformes	Yes	Liver	[3]

Note: n.a., not applicable.

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[3] Roy, R.N.; Guha, B.C. Species difference in regard to the biosynthesis of ascorbic acid. *Nature*, **1958**, *182*, 319-318.