

GEPHE SUMMARY

<p>RNASE4 (<a +rnase4+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+RNASE4+"#gephebase-summary-title)</p> <p>Published</p>	<p>Gephebase Gene</p> <p>Entry Status</p>	<p>GP00001505</p> <p>Prigent</p>	<p>GepheID</p> <p>Main curator</p>
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PHENOTYPIC CHANGE

<p>Physiology (<a +physiology+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait+Category=">https://www.gephebase.org/search-criteria?/and+Trait+Category="+Physiology+"#gephebase-summary-title)</p> <p>High-altitude adaptation (enhanced angiogenesis) (<a +high-altitude+adaptation+(enhanced+angiogenesis)+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+High-altitude+adaptation+(enhanced+angiogenesis)+"#gephebase-summary-title)</p> <p>Snub-nosed monkey of lowland regions (<i>R. avunculus</i>)</p> <p>Snub-nosed monkey of high-altitude habitats (<i>R. strykeri</i> & <i>R. bieti</i>)</p> <p>Taxon A</p> <p>Interspecific (<a +interspecific+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status="+Interspecific+"#gephebase-summary-title)</p>	<p>Trait Category</p> <p>Trait</p> <p>Trait State in Taxon A</p> <p>Trait State in Taxon B</p> <p>Ancestral State</p> <p>Taxonomic Status</p>
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Taxon A	Taxon B #1
Latin Name	Latin Name
Rhinopithecus avunculus (<a +rhinopithecus+avunculus+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Rhinopithecus+avunculus+"#gephebase-summary-title)	Rhinopithecus strykeri (<a +rhinopithecus+strykeri+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Rhinopithecus+strykeri+"#gephebase-summary-title)
Common Name	Common Name
Tonkin snub-nosed monkey	Burmese snub-nosed monkey
Synonyms	Synonyms
Pygathrix avunculus; Tonkin snub-nosed monkey; Dollman's snub-nosed monkey; Rhinopithecus avunculus (Dollman, 1912)	Burmese snub-nosed monkey; Myanmar snub-nosed monkey; Rhinopithecus strykeri Geissmann et al., 2010
Rank	Rank
species	species
Lineage	Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Cercopithecidae; Colobinae; Rhinopithecus	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Cercopithecidae; Colobinae; Rhinopithecus
Parent	Parent
Rhinopithecus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=542827)	Rhinopithecus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=542827)
NCBI Taxonomy ID	NCBI Taxonomy ID
66062 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=66062)	1194336 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1194336)
is Taxon A an Infrasppecies?	is Taxon B an Infrasppecies?
No	No

Taxon B #1	Taxon B #2
Latin Name	Latin Name
Rhinopithecus strykeri (<a +rhinopithecus+strykeri+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Rhinopithecus+strykeri+"#gephebase-summary-title)	Rhinopithecus bieti (<a +rhinopithecus+bieti+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Rhinopithecus+bieti+"#gephebase-summary-title)
Common Name	Common Name
Burmese snub-nosed monkey	black snub-nosed monkey
Synonyms	Synonyms
Burmese snub-nosed monkey; Myanmar snub-nosed monkey; Rhinopithecus strykeri Geissmann et al., 2010	Pygathrix bieti; black snub-nosed monkey
Rank	Rank
species	species
Lineage	Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Cercopithecidae; Colobinae; Rhinopithecus	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Cercopithecidae; Colobinae; Rhinopithecus
Parent	Parent
Rhinopithecus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=542827)	Rhinopithecus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1194336)
NCBI Taxonomy ID	NCBI Taxonomy ID
1194336 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1194336)	66062 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=66062)
is Taxon B an Infrasppecies?	is Taxon A an Infrasppecies?
No	No

Taxon B #2	Taxon B #1
Latin Name	Latin Name
Rhinopithecus bieti (<a +rhinopithecus+bieti+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Rhinopithecus+bieti+"#gephebase-summary-title)	Rhinopithecus strykeri (<a +rhinopithecus+strykeri+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Rhinopithecus+strykeri+"#gephebase-summary-title)
Common Name	Common Name
black snub-nosed monkey	Burmese snub-nosed monkey
Synonyms	Synonyms
Pygathrix bieti; black snub-nosed monkey	Burmese snub-nosed monkey; Myanmar snub-nosed monkey; Rhinopithecus strykeri Geissmann et al., 2010
Rank	Rank
species	species
Lineage	Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Cercopithecidae; Colobinae; Rhinopithecus	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Cercopithecidae; Colobinae; Rhinopithecus
Parent	Parent
Rhinopithecus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=66062)	Rhinopithecus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=542827)
NCBI Taxonomy ID	NCBI Taxonomy ID
66062 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=66062)	1194336 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1194336)
is Taxon B an Infrasppecies?	is Taxon A an Infrasppecies?
No	No

(<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=542827>)

NCBI Taxonomy ID

61621

(<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=61621>)

is Taxon B an Intraspecies?

No

GENOTYPIC CHANGE

RNASE4
 Generic Gene Name P34096 (<http://www.uniprot.org/uniprot/P34096>) UniProtKB Homo sapiens
 Synonyms GenebankID or UniProtKB
 RAB1; RNS4 XM_017868534.1 (https://www.ncbi.nlm.nih.gov/nucleotide/XM_017868534.1)
 String
 9606.ENSPO0000381081
 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000381081)

Sequence Similarities
Belongs to the pancreatic ribonuclease family.

GO - Molecular Function
 GO:0003676 : nucleic acid binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0003676>)
 GO:0004522 : ribonuclease A activity (<https://www.ebi.ac.uk/QuickGO/term/GO:0004522>)
 GO:0004540 : ribonuclease activity (<https://www.ebi.ac.uk/QuickGO/term/GO:0004540>)
 GO - Biological Process
 GO:0006379 : mRNA cleavage (<https://www.ebi.ac.uk/QuickGO/term/GO:0006379>)
 GO - Cellular Component
 GO:0005576 : extracellular region (<https://www.ebi.ac.uk/QuickGO/term/GO:0005576>)

Mutation #1

No (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=~No^#gephebase-summary-title>)

Presumptive Null

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular Type=~Coding^#gephebase-summary-title>)

Molecular Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration Type=~SNP^#gephebase-summary-title>)

Aberration Type

Nonsynonymous

SNP Coding Change

p.Asn89Lys & p.Thr128Ile

Molecular Details of the Mutation

Association Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=~Association Mapping^#gephebase-summary-title>)

Experimental Evidence

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Asn	Lys	89

Genomic analysis of snub-nosed monkeys (*Rhinopithecus*) identifies genes and processes related to high-altitude adaptation. (2016) (<https://pubmed.ncbi.nlm.nih.gov/27399969>)

Main Reference

Yu L; Wang GD; Ruan J; Chen YB; Yang CP; Cao X; Wu H; Liu YH; Du ZL; Wang XP; Yang J; Cheng SC; Zhong L; Wang L; Wang X; Hu JY; Fang L; Bai B; Wang KL; Yuan N; Wu SF; Li BG; Zhang JG; Yang YQ; Zhang CL; Long YC; Li HS; Yang JY; Irwin DM; Ryder OA; Li Y; Wu CI; Zhang YP

Authors

The snub-nosed monkey genus *Rhinopithecus* includes five closely related species distributed across altitudinal gradients from 800 to 4,500 m. *Rhinopithecus bieti*, *Rhinopithecus roxellana*, and *Rhinopithecus strykeri* inhabit high-altitude habitats, whereas *Rhinopithecus brelichi* and *Rhinopithecus avunculus* inhabit lowland regions. We report the de novo whole-genome sequence of *R. bieti* and genomic sequences for the four other species. Eight shared substitutions were found in six genes related to lung function, DNA repair, and angiogenesis in the high-altitude snub-nosed monkeys. Functional assays showed that the high-altitude variant of CDT1 (Ala537Val) renders cells more resistant to UV irradiation, and the high-altitude variants of RNASE4 (Asn89Lys and Thr128Ile) confer enhanced ability to induce endothelial tube formation in vitro. Genomic scans in the *R. bieti* and *R. roxellana* populations identified signatures of selection between and within populations at genes involved in functions relevant to high-altitude adaptation. These results provide valuable insights into the adaptation to high altitude in the snub-nosed monkeys.

Abstract

Additional References

Mutation #2

No (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=~No^#gephebase-summary-title>)

Presumptive Null

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular Type=~Coding^#gephebase-summary-title>)

Molecular Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration Type=~SNP^#gephebase-summary-title>)

Aberration Type

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

p.Asn89Lys & p.Thr128Ile

Experimental Evidence

Association Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=~Association+Mapping~#gephebase-summary-title>)

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Thr	Ile	128

Main Reference

Genomic analysis of snub-nosed monkeys (*Rhinopithecus*) identifies genes and processes related to high-altitude adaptation. (2016) (<https://pubmed.ncbi.nlm.nih.gov/27399969>)

Authors

Yu L; Wang GD; Ruan J; Chen YB; Yang CP; Cao X; Wu H; Liu YH; Du ZL; Wang XP; Yang J; Cheng SC; Zhong L; Wang L; Wang X; Hu JY; Fang L; Bai B; Wang KL; Yuan N; Wu SF; Li BG; Zhang JG; Yang YQ; Zhang CL; Long YC; Li HS; Yang JY; Irwin DM; Ryder OA; Li Y; Wu CI; Zhang YP

Abstract

The snub-nosed monkey genus *Rhinopithecus* includes five closely related species distributed across altitudinal gradients from 800 to 4,500 m. *Rhinopithecus bieti*, *Rhinopithecus roxellana*, and *Rhinopithecus strykeri* inhabit high-altitude habitats, whereas *Rhinopithecus brelichi* and *Rhinopithecus avunculus* inhabit lowland regions. We report the de novo whole-genome sequence of *R. bieti* and genomic sequences for the four other species. Eight shared substitutions were found in six genes related to lung function, DNA repair, and angiogenesis in the high-altitude snub-nosed monkeys. Functional assays showed that the high-altitude variant of CDT1 (Ala537Val) renders cells more resistant to UV irradiation, and the high-altitude variants of RNASE4 (Asn89Lys and Thr128Ile) confer enhanced ability to induce endothelial tube formation in vitro. Genomic scans in the *R. bieti* and *R. roxellana* populations identified signatures of selection between and within populations at genes involved in functions relevant to high-altitude adaptation. These results provide valuable insights into the adaptation to high altitude in the snub-nosed monkeys.

Additional References

RELATED GEPHE

No matches found.

Related Genes

No matches found.

Related Haplotypes

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect Common substitution observed in high-altitude snub-nosed monkeys. identified as evolving under positive selection along the lineage containing *R. bieti* and *R. strykeri* and the lineage leading to *R. roxellana*. RNASE4 has been reported to induce angiogenesis. Variant RNASE4 (Asn89Lys and Thr128Ile; 1 ?g/ml concentration) showed higher activity in inducing tube formation in human umbilical vein endothelial cell (HUVVEC) cultures in Matrigel than reference RNASE4.