

NCBI Resources How To Sign in to NCBI

Nucleotide Nucleotide  Search

Advanced Help

GenBank

**Puntius chalakkudiensis mitochondrion, complete genome**

NCBI Reference Sequence: NC\_018566.1

[FASTA](#) [Graphics](#)

LOCUS NC\_018566 16989 bp DNA circular VRT 17-SEP-2012  
 DEFINITION Puntius chalakkudiensis mitochondrion, complete genome.  
 ACCESSION NC\_018566  
 VERSION NC\_018566.1  
 DBLINK Project: [174507](#)  
 BioProject: [PRJNA174507](#)

KEYWORDS RefSeq.

SOURCE mitochondrion Sahyadria chalakkudiensis (chalak barb)

ORGANISM [Sahyadria chalakkudiensis](#)

Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi;  
 Actinopterygii; Neopterygii; Teleostei; Ostariophysi;  
 Cypriniformes; Cyprinidae; Sahyadria.

REFERENCE 1 (bases 1 to 16989)

AUTHORS Joseph,T.C., Lalitha,K.V., Baby,A., Gopalakrishnan,A., Antony,T.P.,  
 Basheer,V.S., Sajeela,K.A. and Jena,J.K.

TITLE The complete mitochondrial genome of Puntius chalakkudiensis

JOURNAL Unpublished

REFERENCE 2 (bases 1 to 16989)

CONSRM NCBI Genome Project

TITLE Direct Submission

JOURNAL Submitted (06-SEP-2012) National Center for Biotechnology  
 Information, NIH, Bethesda, MD 20894, USA

REFERENCE 3 (bases 1 to 16989)

AUTHORS Joseph,T.C., Lalitha,K.V., Baby,A., Gopalakrishnan,A., Antony,T.P.,  
 Basheer,V.S., Sajeela,K.A. and Jena,J.K.

TITLE Direct Submission

JOURNAL Submitted (13-JUL-2012) Central Institute of Fisheries Technology &  
 National Bureau of Fish Genetic Resources, Cochin, Kerala, India

COMMENT REVIEWED [REFSEQ](#): This record has been curated by NCBI staff. The  
 reference sequence is identical to [JX311437](#).

##Assembly-Data-START##

Assembly Method :: Vector NTI Advance v. 11

Sequencing Technology :: Sanger dideoxy sequencing

##Assembly-Data-END##

COMPLETENESS: full length.

FEATURES Location/Qualifiers

source 1..16989  
 /organism="Sahyadria chalakkudiensis"  
 /organelle="mitochondrion"  
 /mol\_type="genomic DNA"  
 /db\_xref="taxon:723640"

[tRNA](#) 1..68  
 /product="tRNA-Phe"  
 /codon\_recognized="UUC"

[rRNA](#) 69..1022  
 /product="s-rRNA"  
 /note="12S ribosomal RNA"

[tRNA](#) 1023..1093  
 /product="tRNA-Val"  
 /codon\_recognized="GUA"

[rRNA](#) 1094..2783  
 /product="l-rRNA"  
 /note="16S ribosomal RNA"

[tRNA](#) 2784..2859

/product="tRNA-Leu"  
 /codon\_recognized="UUA"  
gene 2861..3835  
 /gene="ND1"  
 /db\_xref="GeneID:[13543378](#)"  
CDS 2861..3835  
 /gene="ND1"  
 /codon\_start=1  
 /transl\_table=2  
 /product="NADH dehydrogenase subunit 1"  
 /protein\_id="YP\_006666356.1"  
 /db\_xref="GeneID:[13543378](#)"  
 /translation="MMNTLIAYLINPLAYMVPVLLAVAFFTLIERKALGYMQFRKGPN  
 VVGPYGLLQPIADGVKLFIKEPVRPSTSSPLLFLAAPMLALTLAMVLWAPIPMPYSVM  
 DLNLGILFILALSSLMVYSILGSGWASNKYALIGALRAVAQTISYEVSGLLILLSVI  
 IFSGGYTLQTLNTTQESIWLLFPAPLSAMWYISTLAETNRTPFDLTEGESELVSGFN  
 VEYAGGPFALFFLAEYANILLMNALSTVFLFGASHMPNIPELTTINLMTKTALLSILF  
 LWVRASYPRFRYDQLMHLVWKNFLPLTLALMLWHAALPIALAGLPPQL"  
tRNA 3840..3911  
 /product="tRNA-Ile"  
 /codon\_recognized="AUC"  
tRNA complement (3910..3980)  
 /product="tRNA-Gln"  
 /codon\_recognized="CAA"  
tRNA 3982..4050  
 /product="tRNA-Met"  
 /codon\_recognized="AUG"  
gene 4051..5095  
 /gene="ND2"  
 /db\_xref="GeneID:[13543366](#)"  
CDS 4051..5095  
 /gene="ND2"  
 /note="TAA stop codon is completed by the addition of 3' A  
 residues to the mRNA"  
 /codon\_start=1  
 /transl\_except=(pos:5095,aa:TERM)  
 /transl\_table=2  
 /product="NADH dehydrogenase subunit 2"  
 /protein\_id="YP\_006666357.1"  
 /db\_xref="GeneID:[13543366](#)"  
 /translation="MSPYVFTTLLLSLGLGTTTLTFISSNWLLAWMGLEINTLAITPLL  
 AQHHHPRAVEATTKYFLTQATAAAMILFASTTNAWVTGEWDINNLSNPLASTIFMMAL  
 AMKIGLAPMHFWLPEVLQGLDLMTGLILSTWQKLAPLALIVQTAQTMSPDLLLTLGAL  
 STFAGGWGGLNQTQLRKILAYSSVTHMGWMIIVIQYAPQLTLIALGVYIVTTSATFLT  
 MKTLKSTKINTLTTVWPKNPPLTSMALTLLSLGGPLPLTGFI PKWLILQELTKQDMA  
 ITATIMALASLISLYFYLRRCYAMTLTIFPNMTNSPASWRTHTTQTSLPLALFIMATL  
 GLLPMTPTILMLFT"  
tRNA 5096..5166  
 /product="tRNA-Trp"  
 /codon\_recognized="UGA"  
tRNA complement (5169..5236)  
 /product="tRNA-Ala"  
 /codon\_recognized="GCA"  
tRNA complement (5238..5310)  
 /product="tRNA-Asn"  
 /codon\_recognized="AAC"  
tRNA complement (5346..5412)  
 /product="tRNA-Cys"  
 /codon\_recognized="UGC"  
tRNA complement (5412..5480)  
 /product="tRNA-Tyr"  
 /codon\_recognized="UAC"  
gene 5482..7032  
 /gene="COX1"  
 /db\_xref="GeneID:[13543367](#)"  
CDS 5482..7032

```

/gene="COX1"
/codon_start=1
/transl_table=2
/product="cytochrome c oxidase subunit I"
/protein_id="YP_006666358.1"
/db_xref="GeneID:13543367"
/translation="MTITRWWFFSTNHKDIGTLYLVFGAWAGMVGTALSLLRRAELSQP
GSLGDDQIYNVIVTAHAFVMIFFMVMPILIGGFNWLVLPLMIGAPDMAFPRMNNMSF
WLLPPSFLLLLTSSGVEAGAGTGWTVPYPLAGNLAHAGASVDLTI FSLHLGAGISSILG
AINFITTIINMKPPTTSQYQTPLFVWSVLVAVLLLLLSLPVLAAGITMLLTDRNLNTT
FFDPAGGGDPILYQHLFWFFGHPEVYILILPGFGIISHVVAYYSKGKPEFGYMGMVWA
MMAIGLLGFIVWAHMFVGMVDVTRAYFTSATMIIAIPVGVKVSFSLATLHGGSIKW
ETPMLWALGFIFLFTVGGTGIILSNSSLDIVLHDTYYVVAHFHYVLSMGAVFAIMAA
FVHWFPLFTGYTLHNAWTKIHFGVMFIGVNLTFPPQHFLGLAGMPRRYSYDPDAYALW
NTVSSVGLISLVAVIMFLFILWEAFTAKREVLVSELTNTNVEWLHGCPPPYHTYEYP
AFVQIQSN"
tRNA complement (7033..7103)
/product="tRNA-Ser"
/codon_recognized="UCA"
tRNA 7106..7176
/product="tRNA-Asp"
/codon_recognized="GAC"
gene 7191..7881
/gene="COX2"
/note="TAA stop codon is completed by the addition of 3' A
residues to the mRNA"
/db_xref="GeneID:13543368"
CDS 7191..7881
/gene="COX2"
/note="TAA stop codon is completed by the addition of 3' A
residues to the mRNA"
/codon_start=1
/transl_except=(pos:7881,aa:TERM)
/transl_table=2
/product="cytochrome c oxidase subunit II"
/protein_id="YP_006666359.1"
/db_xref="GeneID:13543368"
/translation="MAHPAQLGFQDAASPVMEELLHFHDHALMIVFLISTLVLYIITA
MVSTKLTNKYILDSQEIEIVWTILPAIILVLIALPSLRILYLMDEINDPHLTIKAMGH
QWYWSYEYTDYENLGFDSYMTPTQDLASGQFRLLTDHRMVIPVESPIRILVSAEDVL
HSWAVPSLGMKMDAVPGRLNQTTFIASRPGVFGQCSEICGANHSFMPPIVVESVPLEH
FENWSSLMLEDA"
tRNA 7882..7957
/product="tRNA-Lys"
/codon_recognized="AAA"
gene 7959..8123
/gene="ATP8"
/db_xref="GeneID:13543369"
CDS 7959..8123
/gene="ATP8"
/codon_start=1
/transl_table=2
/product="ATP synthase F0 subunit 8"
/protein_id="YP_006666360.1"
/db_xref="GeneID:13543369"
/translation="MPQLNPDPWFAILTFSWLIFLIIIPKTLNHIMPNELTPVSAEK
HKTESWDWPW"
gene 8117..8800
/gene="ATP6"
/db_xref="GeneID:13543370"
CDS 8117..8800
/gene="ATP6"
/codon_start=1
/transl_table=2
/product="ATP synthase F0 subunit 6"
/protein_id="YP_006666361.1"

```

/db\_xref="GeneID:[13543370](#)"  
 /translation="MMASFFDQFASPYFLGIPLIAIATMLPWALFPTPPSRWINNRLI  
 TIQGWFINRFTSQLMLPLNTGGHKWALLLTSLMIFLITINMLGLLPYTFTPTTQLSLN  
 MGFVAVPLWLATVIIGMRNQPTIALGHLLPEGTPIPLIPVLIITETISLFIPLALGVR  
 LTANLTAGHLLIQLIATAVAVFVLLPMMPTVAILTATVLFLLTLLEAVAVAMIQAYVFVLL  
 LSLYLQENV"  
[gene](#) 8800..9584  
 /gene="COX3"  
[CDS](#) 8800..9584  
 /gene="COX3"  
 /note="TAA stop codon is completed by the addition of 3' A  
 residues to the mRNA"  
 /codon\_start=1  
 /transl\_except=(pos:9583..9584,aa:TERM)  
 /transl\_table=2  
 /product="cytochrome c oxidase subunit III"  
 /protein\_id="[YP\\_006666362.1](#)"  
 /db\_xref="GeneID:[13543371](#)"  
 /translation="MAHQAHAYHMVDPSPWPLTGAIAALLTTSGLAIWFHFHSTTLMT  
 LGMILLLLTMYQWWRDIIREGTFQGHHTPPVQKGLRYGMILFITSEVFFFLGFFWAFY  
 HSSLAPTPELGGCWPPSGITPLDPFEVPLLNNTAVLLASGVTVTWAHHSIMEGERKQAI  
 QSLTTLTILLGLYFTALQAMEYYEAPFTIADGVYGSTFFVATGFHGLHVIIGSTFLAIC  
 LLRQIQYHFTSEHHFGFEAAAWYWHFVDVVWLFYVSIYWWGS"  
[tRNA](#) 9585..9657  
 /product="tRNA-Gly"  
 /codon\_recognized="GGA"  
[gene](#) 9658..10006  
 /gene="ND3"  
[CDS](#) 9658..10006  
 /gene="ND3"  
 /note="TAA stop codon is completed by the addition of 3' A  
 residues to the mRNA"  
 /codon\_start=1  
 /transl\_except=(pos:10006,aa:TERM)  
 /transl\_table=2  
 /product="NADH dehydrogenase subunit 3"  
 /protein\_id="[YP\\_006666363.1](#)"  
 /db\_xref="GeneID:[13543372](#)"  
 /translation="MNMFSTTLMTSTILSSALTMSFWLPQMNPNAEKMSPYECGFDP  
 LGSARLPFSLHFFLLAILFLLFDLEIALLLPLPWGNQLNNTSSFFWVTTILALLTLG  
 LMYEWTQGGLEWAE"  
[tRNA](#) 10007..10076  
 /product="tRNA-Arg"  
 /codon\_recognized="CGA"  
[gene](#) 10077..10373  
 /gene="ND4L"  
[CDS](#) 10077..10373  
 /gene="ND4L"  
 /codon\_start=1  
 /transl\_table=2  
 /product="NADH dehydrogenase subunit 4L"  
 /protein\_id="[YP\\_006666364.1](#)"  
 /db\_xref="GeneID:[13543373](#)"  
 /translation="MTPTHFSFSSAFILGLTGFLAFHRAHLISALLCLEGMMLSLFIAL  
 ALWALQFEATGFSTIPMMLLAFSACEASTGLALLVAATRTHGTDRLLQNFGLLQC"  
[gene](#) 10367..11747  
 /gene="ND4"  
[CDS](#) 10367..11747  
 /gene="ND4"  
 /note="TAA stop codon is completed by the addition of 3' A  
 residues to the mRNA"  
 /codon\_start=1

```

/transl_except=(pos:11747,aa:TERM)
/transl_table=2
/product="NADH dehydrogenase subunit 4"
/protein_id="YP_006666365.1"
/db_xref="GeneID:13543374"
/translation="MLKVLTPTIMLFPTIWLISPKWLWTATTTTHSLLIALLISLTWLKW
TSETGWAASNMYLATDPLSTPLLVLTCWLLPLMILASQNHINSEPINRQRSYITLLAS
LQTFLLIMAFGATEFIMFYVMFEATLIPTLIIITRWGNQTERLSAGVYFLFYTLAGSLP
LLVALLLLQHSSGTLMLLILQYSQPLQLNSWSHMIWWAGCLIAFLVKMPLYGVHLWLP
KAHVEAPVAGSMVLA AVLKLGGMRRMMIMLDPPSKELAYPFIILALWGIIMTGSIC
LRQTDLKS LIAYSSVSHMGLVAAGILIQTPWGFSGAIIILMIAHGLVSSALFCLANTM
YERTYSRTMILARGLQMMFPLTAFWWFIANLANLALPPLPNLMGELTIIITTLFNWSPW
TILLTGLGLTITAGYSLYMFLMLQRGPASNHIMNLQPYHSREHLLMTMHLPTILLIT
KPELMWGWYCY"
tRNA 11748..11816
/product="tRNA-His"
/codon_recognized="CAC"
tRNA 11817..11884
/product="tRNA-Ser"
/codon_recognized="AGC"
tRNA 11886..11958
/product="tRNA-Leu"
/codon_recognized="CUA"
gene 11961..13781
/gene="ND5"
/db_xref="GeneID:13543375"
CDS 11961..13781
/gene="ND5"
/codon_start=1
/transl_table=2
/product="NADH dehydrogenase subunit 5"
/protein_id="YP_006666366.1"
/db_xref="GeneID:13543375"
/translation="MALIMYASLLLTLIIILYPLLMTLNPIQQFNMAKTTKTAVSSAF
LISLLPLMIFLNLKTEGIIMNWQWMNTQTFDVNISFKFDHYSLIPTPIALYVTWSILE
FALWYMHSDPNINKFFKYLLTFLVAMIILVTANNMFQLFIGWEGV GIMSFLLIGWWHG
RADANTAALQAVIYNRVGDIGLIMTMAWLATNFNSWEIQQMFALSKNFDMMIPLMGLT
LAATGKSAQFGLHPWLPSAMEGPTPVSALLHSSTMVAVGVFLLIRLHPMMENNQTILT
ICLCLGALTSLFTATCALTQNDIKKVVAFSTSSQLGLMMVTIGLNMPQLAFLHICTHA
FFKAMFLFCSGSIIHSLNDEQDIRKMGLLNILPATSTFFTIGSLALTGTPFLAGFFS
KDAIEALNTSYLNAWALTTLIATSFTAAYSFRLVYFVTMGTPRFLPLSPINENNPL
VINPIKRLAWGSIIAGLIITQNFPPMKT PVMTPMIMKTAALTVTIIGLLTAMELANM
TNKQMKTTLVTKSYNFSNMLGFFPMVTHRLLPKLKLTLGQTAATQLDKTWELENTGPKN
LALMQMTMSKTTNDITQGMIKTYLTIFFLTLILVTLTLTLI"
gene complement(13778..14299)
/gene="ND6"
/db_xref="GeneID:13543376"
CDS complement(13778..14299)
/gene="ND6"
/codon_start=1
/transl_table=2
/product="NADH dehydrogenase subunit 6"
/protein_id="YP_006666367.1"
/db_xref="GeneID:13543376"
/translation="MAYHMFLLLVLTVIGLIAVASNPSPYFAALGLMVVAVGCGVIV
YHGGSFSLVLFLLIYLGGMVVVFAYSVALASEAFPEAWGSNPVSGYVVVIYFLVSLLV
WFCWGGWYEGSWVVVDGLKEFSVLRGDVSGVAIAYSLGGMLVACVWMLLLTLFVVLE
LTRGYGRGCIRAV"
tRNA complement(14300..14367)
/product="tRNA-Glu"
/codon_recognized="GAA"
gene 14374..15514
/gene="CYTB"
/db_xref="GeneID:13543377"
CDS 14374..15514
/gene="CYTB"

```

/note="TAA stop codon is completed by the addition of 3' A residues to the mRNA"

/codon\_start=1

/transl\_except=(pos:15514,aa:TERM)

/transl\_table=2

/product="cytochrome b"

/protein\_id="YP\_006666368.1"

/db\_xref="GeneID:13543377"

/translation="MASLRKTHPLIKIANEALVDLPTPSNISAWWNFGSLLGLCLITQ  
ILTGLFLAMHYTSDMSTAFSSVMHTCRDVNYGWLIRNIHANGASFFFICIIYAHIARGL  
YYGSYLYKKTWNIGVILLLLVMMTAFVGYVLPWGQMSFWGATVITNLLSAVPYVGNML  
VQWIWGGFSVDNATLTRFFAFHFLLPFIIAAVTILHLLFLHETGSNNPTGLNPDADKI  
PFHPYFTYKDLLGFMIMLMILMLLALFAPNLMGDPENFTPANPLITPTHIKPEWYFLF  
AYAILRSIPNKLGGVLLALLFSILVLMVPLLHTSKQRGITFRPITQFLFWALVADMI I  
LTWIGGMPVEHPLIIIGQIASALYFALFLVLFPLAGGLENKMLEWV"

15515..15585

/product="tRNA-Thr"

/codon\_recognized="ACA"

complement(15585..15655)

/product="tRNA-Pro"

/codon\_recognized="CCA"

15656..16582

tRNA

tRNA

D-loop

ORIGIN

```
1 gctagcgtag cttaaaataa agcatagcac tgaagatgct aagaaggacc ataaaaggcc
61 cgcattgcata aaggcatggt cccagcctta ttgtcagctt tagccaaact tacacatgca
121 agtttccgca acccagtgag tataccctca gccccctgct cggaggcgag gaataggat
181 caggcaaaa cattagccca agacatctag cataggccac accccaagg gaattcagca
241 gtgatagaca ttaagcaata agtgaaaact tgacttagtt aaacgctaat tgggccggta
301 aaactcgtgc cagccaccgc ggtagacga gaggccccag ttgacattac aacggcgtaa
361 agagtgggta ggggccaaa aataataaag ccaaatggcc ccttggccgt tatacgttc
421 taggcgcccg aagtcccaac acacgaaagt agctttaatt accaaccgga cccacgaaa
481 gctaagaaac aaactgggat tagatacccc actatgctta gccgtaaacc tagacatcca
541 gatacagcaa gatgtccgcc ggggtactac gagcaccagc ttaaaaccca aaggacctga
601 cggtgccctca gatccctcta gaggagcctg ttctagaatc gataaccccc gtttaacctc
661 accacttcta gcccgcctca gtctatatac cgccgctgta agcctacct gtgaaggat
721 aaaagttagc aaaatgggca caaccacata cgtcaggtca aggtgtagca catgaagtgg
781 aaagaaatgg gctgcatttt ctgcccacaga aactacgaa tctatacatg aaacagtatt
841 taaaggagga tttagcagta aagagggaac agagtgcccc cttgaaccgg gctctgagac
901 acgtacacac cgcccgtcac tctctccggt aaagcgcaca aaatatctaa taatttagca
961 tcaccaagga gaggcaagtc gtaacatggt aagtgtaccg gaaggtgcac ttggatcaaa
1021 cccgggatgt ggctgaatag ttaagcatct catttacgct gagaagacac ccatgcaaat
1081 tgggtcacc cgagctaaat agctagctta actatattt aacttaacca catagataaa
1141 acaaaacaaa cacacaacca taagtctaaa ccattttttc acctgagtat gggcgacaga
1201 aaaggttata ctaaagcaat agagaaagta ccgtgagggg aagctgaaag agaaatgaaa
1261 caaacatat aagcactaaa aagcaaagac taaccttgt accttttgca tcatgattta
1321 gccagtacgc ccaagcaaag agacctttag tttgaagccc cgaaactagg tgagctaccc
1381 cgagacagcc tattaagggc caactcatct ctgtggcaaa agagtgagaa gagctccggg
1441 tagaggatgat aaatctaccg gacctagtga tagctgggta cctaaaaaat gaataaaagt
1501 tcagcctcat ccacctcaag tcaaatataa taacaagac ttaatgagaa atacatgaga
1561 gttagttaaa ggggttacag ccctctaac caaggacaca acctttcagg tggataaaga
1621 tcacagtaca caaaatatac cgttctagtg ggcctaaaag cagccatcta aatagaaagc
1681 gtcaaagctc agacaaaaaa aaatttatta ttccgataac aaatcttaat cccctaaaat
1741 tattaggcca atccatgcc gcatgaaaga gattatgcta aaatgagtaa caagaaggcc
1801 cgcccttctc cccagcacia gtgtaagcca agtcggacca accttggca ataacgaac
1861 ccagccaaag agggaaatgt gaactacaaa taaaatcaag aaaaatccac aactaagcta
1921 tcgttatcct tactactagag tgccatcact aggggaaaga ctaaaagaga cgaaaggaac
1981 tcggcaaaaca caagcctcgc ctgtttacca aaacatcgc ctctgcaat aatataatgt
2041 ataggaggtc cagcctgccc agtgaccaca aatttaacgg ccgcagtatt ctgaccgtgc
2101 gaaggtagcg caatcacttg tcttttaaat aaagacctgt atgaacgggt aaacgagggc
2161 ttaactgtct cccatctcca gtcagtgaaa ttgatctatc cgtgcagaag cgggtataat
2221 aatacaagac gagaagacc tttggagctt aaggtacaaa acttaatcac gtaaagcaat
2281 tcaataaaaa acaacccttt aatctcgtga caaataagac cataccttcg gttggggcaa
2341 ccatggagga aaaaaagcc tccaagtggg ctgaggcaag ccaccttaa accaagagag
2401 acatctctaa gccacagaac atctgacct aaatgatccg atcaactaag atcgatcaac
2461 gaaccaagtt acccaagga taacagcgca atcccctcca agagcccata tcgacgaggg
2521 ggtttacgac ctcgatggtg gatcaggaca tccaatggc gcaaccgcta ttaagggttc
```

2581 gtttgttcaa cgattaaagt cctacgtgat ctgagttcag accggagtaa tccaggctag  
2641 tttctatctg taacgctact tttcctagta cgaaaggacc agaaaagagg ggcccatgct  
2701 taaagcacgc cccacccta atttatgaaa acaataaat aaacaaagga gggccaaaat  
2761 cccaacctgc caaataaagg cttactgggg tggcagagca tggtaaattg caaaagacct  
2821 aaacctttt aaccagaggt tcaaactctc tccccagttt atgataaaca ccctaactgc  
2881 ctacctaatt aacccctag cctatatagt accagtatta ctagcagtag ctttctttac  
2941 attaattgaa cgaaaagcac taggatatat acaatttcga aaaggaccaa acgtggtagg  
3001 gccctacgga ctattacaac caatcgccga cggagtaaaa ctcttcatta aagaaccagt  
3061 tcgcccctct acatcctctc cacttctatt tctagctgcc ccatacttg cactaacctt  
3121 agcaatagtt ctatgagccc ccattccaat accatactca gtgatagacc tcaacctagg  
3181 aattctattht attctagccc tatcaagcct catagtatac tcaatcttag ggtcaggctg  
3241 agcatcaaat tccaaatag cactaattgg ggccctacgg gccgtagccc aaacaatttc  
3301 ctacgaagta agcctgggac ttattctcct ctctgtaatc atttttctg ggggatatac  
3361 cctacaaaca ctcaacacca cccaagaaag catttgacta ttatttccag cctgaccctt  
3421 aagtgcaata tgatacatct caacattagc agaaacaaac cgaacacat tcgacctaac  
3481 agagggcgaa tcagagctag tatccggatt taatgtagaa tatgctgggag gaccatttgc  
3541 actattcttc tttagctgaat acgccaacat cctattaata aacgcactct ccaccgtatt  
3601 attcttagga gcctcacata tacciaacat cccagaatta acaacaatta atctaataac  
3661 taaaaccgca tctctatcta ttttattctt atgggtacga gcctcatacc cagcatccg  
3721 atatgaccaa ctaatacatc tagtatgaaa aaacttcctc ccattaacac tcgcccttat  
3781 attatgacac gccgcctgc caattgcatt ggcaggactc cccccacaat tataaccaag  
3841 gaactgtgcc cgagcgctaa aggtccactt tgatagagtg atttacaggg gttaaaatcc  
3901 cctcagctcc tagaaagaag ggaatcgaa ccatactcaa gagatcaaaa ctccagggtgc  
3961 ttcctctaca ccacttctca aggcagagtc agctaataaa gctattggac ccatactcca  
4021 aacatgatgg ttaaagtctt tctctcgtca atgagccat atgtattcac taccctacta  
4081 cttagtttag gactaggaac caccttaacc ttcacagct ctaactggct actagcttga  
4141 ataggtctag aatcaatac cctagccatt acccctttat tagcacaaca ccatcatccc  
4201 cgcgctgtag aagcaacaac aaaatatttt cttacacaag caactgcagc agcaataatc  
4261 ctatttgcaa gcacgacaaa tgcattgagtg acaggagaat gagacattaa taacttatca  
4321 aaccgctcgc ccagcacaat ctttataata gccttagcaa taaaaattgg actcgcccca  
4381 atacacttct gattaccaga agtcttcaa gggttagacc taataacagg acttatttta  
4441 tccacctgac aaaaactcgc cccgctagca ctaattgttc aaacagcaca aacaataagc  
4501 ccaacactat taacactact aggagcetta tctaccttcg caggagggtg aggaggactt  
4561 aaccaaacc aattacgaaa aatcctagcc tactcctcag ttacacatat aggtgaata  
4621 attattgtaa tccaatagc accacaatta actctaattg cactaggagt atacttght  
4681 acaacttctg caacattctc aaccataaaa acattaaaat caacaaaat taatacactc  
4741 acaactgtct gacaaaaaaa ccaacccta acatcaatag ctgccctcac attactctca  
4801 ctaggaggcc tgccgcccct cacaggattt attccaaaat gattaatttt acaagaacta  
4861 acaaaacaag atatggcaat taccgctaca attatagccc tagcttccct aattagctta  
4921 tacttctacc ttgcctatg ctacgcaata acactaaca tcttcccta catgaccaac  
4981 tcaccagcat catgacgaac ccacaccacc caaacctccc tacccttagc cctattttatt  
5041 atagccacc tgggtctact gccataaacc ccaaccatcc taatactttt cacctaggga  
5101 tttaggataa caccagctcg aaagtcttca aagctttaag tagaaatgaa aatcttctaa  
5161 tccctgataa gacctgcaag aaactaactc acatcctctg actgcaaatc agacacttta  
5221 attaagctaa agcctctcta gctgggaagg cctcgatcct acaaactctt agttaacagc  
5281 taaacgctca agccagttag ctaccaccta cttttccgc cgtctaaagc caaaaaggc  
5341 gggaaaagcc cgggcaaagt ataatctgc gtctccggac ttgcaatccg gtgtgaaacta  
5401 cactacaggg ctgataggga gaggactcaa acctctatta ctggggetac aaccatttgc  
5461 ctacatttgg ctactctacc tgtgacaatt acacgctgat tcttctctac taatcataaa  
5521 gacattggca ccctctatct agtatttggg gcctgagctg gaatagctcg aaccgcccata  
5581 agcctctca tccgagctga attaagttag ccaggatcac tcttgggtga cgaccaaat  
5641 tataatgtca tcgttactgc tcacgctttc gtaataattt tctttatagt tatacctatc  
5701 cttattgggg gatttgaaa ctgattggta ccactaataa ttggagcccc cgatatagca  
5761 tttccacgaa taaataacat aagcttctga ctactaccac catcatttct acttttatta  
5821 acctcctctg gcgttgaagc tggagcagga acggggtgaa cagtataccc tccacttgca  
5881 ggaaacctcg cccagccgg agcatccgtt gacctaaca ttttttact gcacttagca  
5941 ggtatctcat caatcctcgg agcaatcaac tttattacta ccattatcaa catgaaacco  
6001 ccaactactt cacaatatca aacacctctg tttgtttgat ctgtacttgt aaccgctgta  
6061 ttactactac tttcacttcc agttctagct gccggaatta caatacttct aacagatcga  
6121 aaccttaata ccacattctt tgaccgggca ggaggaggag acccgatcct atatcaacat  
6181 ctgttctgat tttttggta tccagaagtt tatattctta ttctccctgg atttgggatt  
6241 atttctcatg tcgtagccta ctactcaggt aaaaaagagc cattcggcta tataggaata  
6301 gtatgagcca taatggccat tggactacta ggattttattg tatgagctca tcatatgttt  
6361 accgtcggaa tagacgtaga tactcgtgca tactttacat ctgcaacaat aattattgca  
6421 attccaacgg gtgtaaaagt atttagctga ctagctacc tacacggagg atcaattaaa  
6481 tgagaaacac ccatgctatg ggcctaggt tttattttct tattcacagt agggggacta

6541 actggtatta tcttatccaa ctcatcacta gatattgttc tccacgacac ctactatgta  
6601 gtcgcacact tccactatgt actgtcaata ggtgccgtgt tcgctattat agcagccttc  
6661 gtacactgat tcccattatt taccggatat acacttcaca atgcttgaac aaaaattcac  
6721 ttcggagtaa tatttattgg tgtaacctc acattcttc cccaacactt cctaggccta  
6781 gcaggcatgc cagcagata ttctgactac ccagatgcat atgctttatg aaacacagta  
6841 tcatccgtag gatcactaat ttcttttagta gcggtaatta tgtttctggt tatcttatga  
6901 gaagctttca ccgccaacg agaagtatta tctgtagaac ttacaacaac aaacgtagaa  
6961 tgacttcacg gttgccacc cccttaccac acctacgaag aaccggcggt cgtacaaatt  
7021 caatcaaatt aacgagaaag ggaggaattg aacccccata tactgggttc aagccagcca  
7081 cataaccact ctgtcacttt cttcaagaca ttagtaaaat gcaaattaca tcacctgtc  
7141 aagatgaaac tgcaggttga actcctgcat gtcttagact attaagccta atggcacacc  
7201 cagcacaact aggattccaa gacgcagcat caccgtaat agaagaactc cttcactttc  
7261 acgaccatgc actaatgatc gtattttctca ttagcacctt agtattatat attattaccg  
7321 caatagtatc aactaaactt accaacaagt atattctaga ctctcaagaa attgaaattg  
7381 tatgaacat cttccagct atcatttttag tactaattgc cctaccctct ctacgcatct  
7441 tatactcat agacgaaatc aatgaccctc acctaacaat taaagcaata ggacatcaat  
7501 gatactgaag ttacgaatat acagactacg aaaacctcgg ctttgactcc tatataacac  
7561 caaccacaaga cctcgcctca gggcaattcc ggctgtaga aacagaccac cgaatagtta  
7621 tcccggtaga atctccaatt cgtatttttag tatccgctga agatgtactg cactcctgag  
7681 ctgtcccctc actaggaata aaaatagatg cagttccagg acgattaaat caaacactt  
7741 tcattgcctc tcgaccaggg gtgttttatg gacaatgctc cgaaatctgc ggagcaaate  
7801 acagttttat accaattgtc gttgaatcag tacccttaga gcacttcgaa aactgatcct  
7861 cattaatact agaagacgcc tcactaggaa gctaaatatt ggacaaagca ttggcctttt  
7921 aagccaaaga ttggtgactc ccgaccacc ctaatgaaat gccgcaacta aaccccgacc  
7981 catgatttgc aattttaaca ttttctgac taattttttt aatcattatt ccaactaaaa  
8041 ccctaaacca catcatacca aatgaactaa cccagtaag tgccgaaaaa cacaaaactg  
8101 aatcctgaga ctgaccatga tagcaagctt ctttgatcaa tttgcaagtc catacttctt  
8161 aggaattcca ttaattgcca ttgcaactat attaccatga gcactatttc ctaccctcc  
8221 gtctcgatga attaataacc gacttattac aatccaaggg tgatttatta accgatttac  
8281 aagtcaactt atactcccac taatacagg agggcacaaa tgagcactat tattaacctc  
8341 attaataatt tttttaatta caattaatat acttggccta ctaccatata cttttacacc  
8401 aacaacacaa ctatcactta atataggatt tgccgtacca ttatgacttg ctacagtaat  
8461 tattggaata cgaaaccaac caacaattgc tttaggacac cttctgccag aaggaacacc  
8521 aattccccta atcccagtac taattattat tgaacaatt agtctgttta ttcgaccatt  
8581 agccctagga gtccggctta ctgccaaact aaccgcaggt cacttattaa ttcaacttat  
8641 tggcacagcc gtatttgttc tttaccaat aatacctaca atggcaattt ttaactgccac  
8701 cgtactcttt ctgctcacac ttctagaagt tgcagtggca ataattcaag catatgtatt  
8761 tgtacttctt ctaagcctct acctacaaga aaacgtttta tggcccacca agcacatgcc  
8821 tatcacatag ttgacccaag cccatgacc ctaactggag ccatcgctgc tctattaaca  
8881 acatccggcc tagcaatctg atttcacttc cactcaaca cactaataac attaggaata  
8941 attcttctgc tcctaaccat atatcaatga tgacgagata ttattcgaga aggaaccttc  
9001 caaggccacc acacaccgcc agttcaaaaa ggattacgat atggaataat tctatttatc  
9061 acctctgagg tatttttttt cttaggattc ttctgagcct tctaccactc aagcctagct  
9121 ccaacaccag aactcggagg atgctgacca ccatcaggca tcacccccct ggacccttc  
9181 gaagtaccac ttctaaacac agctgtacta ctagcatcag gggttacagt aacatgagcc  
9241 caccacagca ttatggaagg agaacgaaaa caagctattc aatctctaac attaaccatc  
9301 ttattaggac tatattttac cgcacttcaa gctatagagt attacgaagc acctttcaca  
9361 attgcagatg gggtttatgg ctcaacattc tttgtagcca caggattcca cggattacat  
9421 gttattattg gatcaacctt cctagcaatc tgccactac gtcaaateca ataccatttt  
9481 acatcagaac accactttgg ctttgaagcc gctgcttgat actgacattt cgtcgacgta  
9541 gtagactat tcctctacgt ttccatctac tgatgaggct cataatcttt ctagtattaa  
9601 aagctagtac aggtgactc caatcactcg gtcttggtta aacccaagg aaagataatg  
9661 aatataattt ccaactctt aataacctca acaattctat catcagcctt aacaactata  
9721 tccttttgac tcccccaat aaacccaac gcagaaaaaa tatcaccata cgaatgtgga  
9781 tttgatcccc taggatctgc ccgattacca ttttctctc acttcttctt attagccatc  
9841 ctatttctac tatttgacct agaaattgcc ctattactcc cactaccctg aggaaaccaa  
9901 ctaaacaacc caaccagctc attcttttga gtaacaacca ttttagcctt attaacctt  
9961 gggttaatat acgaatgaac ccaaggcggg ctagaatgag cagaataggg agctagtcta  
10021 agataagact tctgatttgc gctcagaaaa ccgcggttta attccacgac tcccttataa  
10081 caccaccca ttttagcttt agttcagcat ttattctggg actaacagga ctagcatttc  
10141 accgagcca cctcatctcc gcgctactct gcttgggaagg aataatacta tcttatttta  
10201 ttgccctagc tttatgagcc ctacaatttg aagccacagg attttcaacg atcccaataa  
10261 tactcctagc cttctctgcc tgcgaaagcaa gcaccggctt agcattacta gtagccgcta  
10321 ctcgaccaca cggaactgac cgattacaaa acttccggcct tttacaatgt taaaagtact  
10381 caccacaaca atcatattat tccaacaat ctgactaatc tctcctaaat gattatgaac  
10441 agctacaacc acgcacagtt tattaattgc ctttattagc ttaacctgat taaaatgaac



10501 atctgaaacc ggatgagccg cctccaacat atatctagcc acagaccac tatcaacacc  
10561 cctattagta cttacatgct gacttcttcc actaataatt ctagccagtc aaaaccacat  
10621 taactcagaa ccaattaacc gacaacgctc atatattaca ctccttgctt cgctacaaac  
10681 ctttttaatt atagcatttg ggcaccagaa gttttattata ttttatgtta tatttgaagc  
10741 cacacttatt ccaacactta ttattattac acgatgaggg aaccaaactg aacggctcag  
10801 tgcaggagtc ttttttctat tttatacact agcaggatca ttaccacttc tagtagccct  
10861 gcttctactc caacactctt ctgggacact atcaatatta attcttcaat actcccaacc  
10921 actacaactt aattcctgaa gccacataat ctgatgagct ggctgcctaa ttgcattttct  
10981 agttaaataa ccactctacg gagtccacct gtgactacca aaagcacacg tagaagcccc  
11041 agtagcagga tccatagtag tagcagcagt cctactaaaa ctcggggggt acggaataat  
11101 gcgtataata attatacttg accccccctc aaaagaatta gcctaccat ttattatfff  
11161 agctttatga ggaattatca taacagggtc aatttgtcta cgacagacag acttaaaatc  
11221 cctaactgcc tactcatccg taagccacat aggattagta gcagcaggaa tcctaatacca  
11281 aacccccctg ggattttcag gagctattat cctaataatt gccacggat tagtatectc  
11341 agcactattc tgcctagcta atacaatata tgaacgaact tacagccgaa caataattct  
11401 tgcccagagga ctacaaataa tttttccact aaccgcattc tgatgattca tcgctaacct  
11461 agcaaacctc gcaactcccc cactaccta tctgatagga gaattaacaa ttattaccac  
11521 actattcaac tgaactcctt ggacaattttt attaacgggg ctaggtacac taattacagc  
11581 cggatattcc ctatatatat tctttatatt acaacgaggc ccagcatcaa atcatatcat  
11641 aaacctacaa ccatatcatt ctcgagaaca cctactaata accatgcatt tattaccaac  
11701 cattcttctg attacaaaac cggaaacttat gtgaggatga tgctattgta agtatagttt  
11761 aatcaaaata ttagattgtg attctaaaga taggggttaa acccccctta ctaccgagg  
11821 aagaacagat aaacgtaagc actgctaact cttacaccgg cggttaaaat ccccgattt  
11881 ctcaagcttt caaaggataa tagttcatcc gctagtctta ggaaccagaa actcttgggg  
11941 caagtccaag tgaaagctat atggccctaa ttatatatgc gtcgcttcta ctaccttaa  
12001 ttatcttaat ttatccteta cttataacac taaaccaat ccaacaattt aacatagcaa  
12061 aaacaactaa aactgccgtt agctccgcat tctttattag ctttctacc ctcatgatct  
12121 tcctgaacct aaaaacagaa ggcattatta taaactggca atgaataaat acccaacat  
12181 ttgacgtaaa cattagcttt aaattcgacc actattccct aatcttcacc ccaatcgcac  
12241 tatatgttac ttgatcaatt ctagaatttg cactatgata catacactcc gaccacaaca  
12301 ttaacaaatt cttcaaatc ttgctcacat ttctagtagc aataattatt ttagttacag  
12361 ctaacaacat attccaatta tttattggct gagaaggggt aggaattata tcatttctac  
12421 taatcgggtg atgacacgga cgagcagacg ccaacacagc cgccctcaa gctgtgatct  
12481 acaactcgagt aggagatatt ggactaatca taacctggc ctgactcgca acaaacttta  
12541 actctgaga aattcaacaa atatttgcac tttcaaaaaa ctttgatag ataattccac  
12601 taataggact aactctggca gcaacaggaa aatcagccca atttggcctc caccatgac  
12661 ttccttctgc tatagaaggc cccacaccag tctccgccct acttcattca agcactatgg  
12721 tcggtgctgg agtcttccta ctaattcgtc tacatccaat aatagaaaat aaccaaacga  
12781 tcctaacaat ctgcctttgc cttggtgctc taacctcatt atttacagcc acctgcgccc  
12841 taacccaaaa tgatattaag aaagtctgtag ctttctccac atctagtcag ctaggactaa  
12901 taatagtcac aatcggatta aatataccgc aactagcatt tcttcacatc tgtacacatg  
12961 ctttcttcaa ggccatactt ttcttatgct caggctcaat tattcacagc ctaaacgacg  
13021 aacaagacat ccgaaaaata ggaggcttac tcaatatttt accagctacc tcaacctttt  
13081 tcacaatcgg cagcctagcc ctacacaggaa cccctttcct agcaggattc ttctcaaaag  
13141 acgcatcat tgaagcttta aacacttcat acctaaacgc ctgagcccta accctaacat  
13201 tgattgccac atcatttacc gcggcataca gcttccgact tgtgtacttt gtaactatag  
13261 gaacccacg atttttacca ctatcaccaa ttaatgaaaa taatccacta gtaattaatc  
13321 ctatcaaacg acttgctga ggaagtatta ttgcaggact tattattaca caaaacttcc  
13381 caccaataaa aacaccagtt ataacaatac caataatcat aaaaacagca gccctcacag  
13441 taacaattat tggactacta acagccatag agtttagctaa cataacaaat aaacaaataa  
13501 aaactaccct agtaacaaa tttacaact tttcaaacat actaggattt ttccaatag  
13561 taacccacg actattacca aaactcaaac tcaccctagg ccaaacagc gccactcaac  
13621 tcgacaaaac atgattagaa aataccggac caaaaaacct agcactaata caaataacca  
13681 tatccaaaac tacaacgat attactcaag gaataattaa aacctaccta actatctttt  
13741 tcttaaccct aattctagtc accctcctaa cccttatcta aactgcacga atacaccac  
13801 gaccatatcc acgcgtaagc tccaacacta caaataaagt taaaagaagt attcaaacac  
13861 aagccactaa catccccca cctaacgaat acgcaatagc cacaccacta acatcaccac  
13921 gcaaaacaga aaactctttt aaccctgcaa caaccactca agaaccctca tatcagccac  
13981 cccaacaaaa ccacactagt aaactaacia aaagaaaata aattactaca tatcctgaaa  
14041 caggattact tccccagcc tcaggaaaag cctcagaagc caaggcaact gaataagcaa  
14101 aaactacaag catgccacct aaataaatta aaaataaaac caacgataaa aaagagcccc  
14161 cgtgatagac aataactcca cacccaacc ctgccacaac tattaaccct aaagcggcaa  
14221 aataaggact ggggttagaa gcaacagcaa ttaaccctaat aaccaagtt actaataata  
14281 agaatatatg ataagccata attcttgctt ggactttaac caagaccaat ggcttgaaga  
14341 gccaccgttg tattcaacta caaaaatcat ctaatggcaa gcctacgaaa aacacatccc  
14401 ctaatcaaaa tcgccaacga agcgctagtt gacctacaa caccatcaaa tatttccgca

14461	tgatgaaatt	ttggatccct	actgggatta	tgcttaatta	cccaaatctt	aaccggccta
14521	ttcctagcca	tacactatac	ctcagacata	tcaaccgcat	tttcatcagt	aatacatacc
14581	tgccgtgatg	taaattatgg	ttgactaatt	cgcaacatcc	acgccaacgg	agcatcattc
14641	ttctttatct	gcatctatgc	acatattgcc	cgaggcctat	actacgggtc	ttacctatac
14701	aaaaaacct	gaaacattgg	tgtaatttta	cttctattag	taataataac	agcctttggt
14761	ggatatgtcc	ttccatgagg	acaaatatcc	ttctgaggcg	ccacagttat	cacaaacctc
14821	ctatctgccg	taccttatgt	aggaaatata	ttagtacaat	gaatctgagg	cggattctca
14881	gtagacaacg	caacactaac	acgattcttc	gcattccact	tcttcctacc	atztatcatt
14941	gccgcagtaa	ccatcctaca	cctcttattt	ctacacgaaa	caggggtcaaa	caacccaacg
15001	ggactcaacc	cagatgcaga	caaaatccca	ttccatcctt	acttcaccta	caaagacctc
15061	cttggattta	taattatatt	aataatcttg	atattactag	cactatttgc	cccgaacctc
15121	ataggagacc	cagaaaactt	caccccagct	aaccattaat	ttacccaac	acatatcaaa
15181	ccagaatgat	actttctatt	tgcttacgcc	atcctgcat	caattccaaa	caaactcgga
15241	ggcgttctag	cactactttt	ctctatttta	gtattaatag	ttgttccact	actacataca
15301	tcaaaacaac	gaggaattac	gttccgccca	atcacccaat	tcttattttg	agcactagta
15361	gcagacataa	ttatcctaac	atgaattgga	ggtataccag	tagaacatcc	acttattatt
15421	attggacaaa	tcgcatccgc	cctatacttc	gcactatttc	tcgtcctttt	ccctctggct
15481	ggcggattag	aaaacaaaat	actagaatga	gtttgcccta	gtagcttaat	ttaaagcatt
15541	ggtctcgtaa	tccgaagatt	ggaagttaaa	ttcccccta	gagcccagaa	aagagagatt
15601	ttaactcccc	ccactagccc	ccaaagctag	cattctgaaa	ctaaactatt	ttctgaaata
15661	tcacttacac	tagtactagt	acatgtatta	tcacatata	gtactagtac	atataatgat
15721	tatcaccata	catgtactag	tacatatatg	tattatcacc	atacatgtac	tagtacatat
15781	atgtattatc	accatacatg	tactagtaca	tatatgtatt	atcaccatac	atgtactagt
15841	acatatatgt	attatcacca	tacgtgtact	agtacatata	tgtattatca	ccatacgtgt
15901	actagtacat	atatgtatta	tcaccatata	tgtactagta	catatatgta	ttatcaccat
15961	atatgtacta	gtacatatat	gtattatcac	cataccatta	tttaaaccat	aaagcaagta
16021	ctaaacatta	agaaagcaca	tgatgcatta	atacatatat	gtattatcac	catatcatta
16081	tttaaaccat	aaagcaagta	ctaaacatta	agaaagcaca	taatgcatta	atacatatat
16141	gtattatcac	catatcatta	tttaaaccat	aaagcaagta	ctaaatatta	aaaagtacat
16201	aagcataata	ttaagactag	aaatatattt	atthaagacg	agtaatttat	taacccccct
16261	aaaactcgac	ctccaatttt	tccttgaaaa	ctcagttaac	atthaactaa	aacatattaa
16321	tgtagtaaga	gaccaccaac	taatttatat	aaaggcatat	catgcatgat	agaatcaagg
16381	acaataattg	tgggggttgc	acaaagtgaa	ctattactgg	catctgggtc	ctatctcagg
16441	gacataaata	taaaattcca	cattatatta	attatcctgg	catttggtta	atgggtgtagt
16501	acatatgtct	cgttaccac	caagccgggc	gttcttttat	atgcataggg	tathtttttt
16561	tttggtttct	tttcacttcg	catttcagag	tgcaaattca	aaatgttaat	taaggtagaa
16621	cattatctct	tgaatgagg	aatacaagtt	aattatcgta	agacataaat	ttaataacat
16681	aacaccactt	tcagggtttc	acgcgttaaa	ccccctacc	cccctacgct	cacttaatcc
16741	tgttattctt	gtcaaaccac	taaaccaaga	aggactcgag	aacgcatata	agccaataaa
16801	ttataataat	atggtagtat	atataatata	ataatttgta	tatataattt	gcataatata
16861	atataatata	atataatatt	tgtatatata	tatatatata	taatcatttt	gccctaatat
16921	ttatcaccta	aaaacctcta	ctaaaaatat	aaaaataaat	cgtactaaat	attctaatat
16981	tatatgccca					

//