

02a-Large-Alignment

March 26, 2025

1 Test 02: Large Alignment

1.0.1 Overview

This notebook demonstrates iterative alignment of a large testcase.

For this demonstration, testcase 1a0cA_1ubpC from PREFAB is used as it contains 50 biological sequences.

Expected runtime: ~30 seconds or less

1.0.2 Context

This notebook is intended to test the following requirements of MALi:

Requirement 4.1 - Can align structural benchmarking test cases containing as many as 30 sequences. - The notebook demonstrates alignment of a testcase of 50 sequences.

Requirement 4.2 - Can align a structural benchmarking test case of at least 20 sequences within 60 seconds. - The testcase of 50 sequences is aligned in less than 10 seconds.

1.0.3 Installing Prerequisites

```
[1]: !pip install biopython
```

```
Requirement already satisfied: biopython in  
c:\users\pdmoo\appdata\local\programs\python\python310\lib\site-packages (1.85)  
Requirement already satisfied: numpy in  
c:\users\pdmoo\appdata\local\programs\python\python310\lib\site-packages (from  
biopython) (1.26.2)
```

Imports

```
[2]: import os  
import shutil  
import subprocess  
import time  
from presentation_helper import PresentationHelper
```

MALi v1.31

```
[3]: ALIGNER_NAME = "MALi-v1.31"  
ALIGNER_PATH = "MALi-v1.31/MALi.exe"
```

```
OUTPUT_FOLDER = "data/output"
```

```
[4]: # creating empty output folder
if os.path.exists(OUTPUT_FOLDER):
    shutil.rmtree(OUTPUT_FOLDER)
os.makedirs(OUTPUT_FOLDER)
```

Testcase

```
[5]: TESTCASE_NAME = "1a0cA_1ubpC"
INPUT_FILEPATH = f"data/input/{TESTCASE_NAME}"
OUTPUT_FILEPATH = f"data/output/{TESTCASE_NAME}"
```

Viewing Testcase

```
[6]: presenter = PresentationHelper()

[7]: presenter.present_unaligned_fasta(INPUT_FILEPATH)
```

Displaying Sequences from data/input/1a0cA_1ubpC:

```
>1a0cA
NKYFENVSKIYEGPKSNPNYSFKFYNPPEEVIDGKTMEEHLRFSIAYWHTFTADGTDQFGKATMQRPNHYTDPMDIAKA
RVEAAFEFFDKINAPYFCFHDRDIAPEGDTLRETNKNLDTIVAMIKDYLKTSKTKVLWGTANLFSNPRFVHGASTSCNAD
VFAYSAAQVKKALEITKELGGENYVFWGGREGYETLLNTDMEFELDNFARFLHMAVDYAKEIGFEGQFLIEPKPKEPTKH
QYDFDVANVLAFLRKYDLDKYFKVNIEANHATLAFHDFQHELRYARINGVLGSIDANTGDMLLGWDTDQFPTDIRMTTLA
MYEVIKMGGFDDKGLNFDKVRASFEPEDLFLGHIAGMDAFAGKFKVAYKLVKDRVDFDKFIEERYASYKDGIGADIVSG
KADFRSLEKYALERSQIVNKSQRQELLESILNQYLFA
```

```
>13|1a0cA|gi|37526188
HRYFERVNRISYEGRQSNNPLAFRHYNPEEIIILGKKMKDHLRFVAVCYWHNFCWDGTMFGSGAFERFWQKGGDALELAKL
KADVAFEFFYKLNIPFYCFHDIDVAPEGCSLKEYIYNLGVMSDILADKQAETGVKLLWGTANCFTHPRYAAGASTNPDNLN
IFAYASAQVCQVMQMTKKLGGENYVLWGGREGYESLLNTDLRQEREQIGRFMQMVVDYKYKIGFQGTLLIEPKPQEPTKH
QYDYDVATVYGLKQFGLENEIKVNIEANHATLAGHSFQHEVATAIALGILGSIDANRGDAQLGWDTDQFPNSVEENSLV
MYEILKAGFTTGGLNFDKVRQRSIDIDDLFYGHIGAITMALSLKSAVKILVDGKLDEYVAQRYSGWNSSELGRDILEG
KMTLDEVAHYAETLVQEPKHRSGQELLENLINRYIY
```

```
>55|1a0cA|gi|139830
NEYWQGVDDIKYIGHQDKKSLGFQYYNPDEVIGGKKMRDWLRFVAVYWHTFDQRLVDPFGDGTAQRPHYDITDPMDLAL
AKVDAAFEFYHKLGVLDYLCFHDRDLAPEGDTLRETNRNLDKVIDKIVDYQKQTMKVLWNTSNMFTNPRFVAGAATSPDA
DVFAYAAAQLKHSLEIGKRVAENYVFWGGREGYESLWNTNMKLEQEHAAKFFHMAKDYANEIGFDAQMLLEPKPKEPST
HQYDFDAATTIAFMKEYDLDDKDFKLNLEGNHANLAGHTYQHEIRVAREANLLGSLDANQGDKLIGWDIDEFSPDLYEATA
AMYEVVENGSIIPRGGLNFDKPRRSSFAANDLFYGHIVGIDTFAAGLRVALKMKQDGFLEKLVDARYSSYQSGVGAEIE
AGTADFKSLESYAIDKPKSELIAATSSDPLEEVKDTINHYI
```

```
>24|1a0cA|gi|3334499
YFDNISTIAYEGPASKNPLAFKFYNPEEKVGDKTMEEHLRFSVAYWHTFTGDGSDPFGAGNMIRPWNKYSGMDLAKARVE
AAFEFFEKLNIPFFCFHDVDIAPEGETLKETYKNLDIIIVDMIEEYMKTSKTKLLWNTANLFTHPRFVHGAATSCNADVFA
YAAAKVKKGLEIAKRLGAENYVFWGGREGYETLLNTDMKLELDNLARFLHMAVDYAKEIGFDGQFLIEPKPKEPTKHQYD
```

FDVATALAFLQTYGLKDYFKFNIEANHATLAGHTFEHELVRARIHGMLGSVDANQGDMLLGWDTDEFPTDLYSTTLAMYE
ILKNGGLGRGGLNFDKAVRRGSFEPEDLFYAHIAGMDSFAVGLKVAHRLIEDRVFDEFIEERYKSYTEGIGREIVEGTAD
FHKLEAHALQLGEIQNQSGRQERLKTLLNQYL

>28|1a0cA|gi|13474199

FFGDIQIKIYEGPDSTNPLAYRFYNPDEVVAGKRLEDHLRFAYAYWHSFAWPGGDPFGGQTFDRPWFPKAGGIDTMELAK
LKADVAFEMFSLGAPYFCFHDADVRPEGKDFSESAARLDEIADYFAGMKQTGVKLLWGTANLFSHRRFMSGAAATNPDP
DVFAYAAATVKSCIDVTKRLKGENYVLWGGREGYETLLNTDLAREQEAGRFLSLVVDYKHKIGFKGTILIEPKPQEPTK
HQYDYDVATVYGFLLKRFGLKEKEVKNIEQGHAILAGHSFEHELALANALGVFGSIDMNRNDYQSGWDTQDFPNNVPEMAL
AYYQILQAGGFKTGGTNFDAKLRRQSLDPQDLLIGHIGMDACARGLAAAARMVEDKALSAPLAERYAGWNSAEGKAMLS
GKRTLEDIAERVVKKKIEPQPRSGRQELLENIVNRYV

>2|1a0cA|gi|32470780

KHGLSLTHAEADHRAKARDFVKQMIDFGGKYNAPIIGSMQGWGGDISRDQALAFREALDELGPYAAQYNVPLFYEPL
NRYETNLLRTVDEGVEFCKTLSTDNIKLLADLFHMNIEEADLAAAIRAGKGYVGHIFVDSNRQ

>23|1a0cA|gi|34395196

EFFPGIPKIKIYEGPSSKNPLAYKWNAAEEVILGKKMKDWMRFSVAFWHTFRGTGGDPFGAPTKSWPWEDGTNSLDMARR
MRAHFMEKLGVDRCFHDRIAPDGKTLTETNKNLDEIVELAKKQEETNIKPLWGTAQLFMHPRYMGAATSPEVKV
YAYGAAQVKKALEVTHYLGGENYVFWGGREGYQTLNTDMKRELDHLASFLQAAVDYKKKIGFNGTLLIEPKPQEPTKHQ
YDWDVATTFSLQKYGLTGEFKINVECNHATLSGHSCHHELETARINGLLGNIDANTGDPQIGWDTQDLTDISEATLVM
SSVVKNGGLAPGGFNDAKLRRRESTDVEDMFLAHISGMDTLARGLRNVVKLIEDGSLDELVRKRYQSFSEIGALIEAGK
GDFETLEKKVLEWGEPVPSGKQELAEILFQAAL

>3|1a0cA|gi|32034802

SNYFDKIEKVYEGADSTNPF AFKHYNPNEVILGKTMAEHLRLAVCYWHTFCWTGNDMFGVGS�DRSWQKTGDLLEGAKQ
KAEIAFEFFQKLGIPIYCFHDVDIAPEGNSYKEYVHNHFTMVDILEKKQAETGVKLLWGTANCFTNPRYMSGASTNPNPE
VFSWAASQVFNAMNATKRLGGENYVLWGGREGYETLLNTDLKREREQIGRFMQMVVEHKKIGFNGTLLIEPKPQEPTKH
QYDYDVATVYGFLLKRFGLKEKEIKVNIENHATLAGHTFQHEIATAAALDIFGSIDANRGDPQLGWDTQDFPNSVEENTLV
MYEILKAGGFTTGGFNDAKIRRQSTDPYDLFHGHIGAIDVLALSLKRAAKMIEDKTLQGIVDQRYAGWNGDLGQQLAG
KASLEDLAKIVESKALDPKPVSGQEQEYLENLVNNYIY

>29|1a0cA|gi|22984909

YFEHIPEIRYEGPQSDNPLAYRHYDKSKKVLGKTL EEHLRIAVCYWHTFVWPVGVDIFGQGTFRRPWQQAGDAMERARQKA
DSAFEFFSKLGTPIYTFHDTDVSPGSSSLKEYSENFLRITDY LARKQEDTG I KLLWGTANLFSHPRYAAGAATSPDPEVF
AFAATQVRHALDATQRLGGDNVVLWGGREGYDTLLNTDLMRERDQLARFLH MVVDHAAKIGFKGSLLIEPKPQEPTKHQY
DYDVATVHGFLLQHGLEKEIRVNIENHATLAGHSFHHEIATAYALGIFGSVDANRGDPQNGWDTQDFPNSVEELTLAFY
EILKHGGFTTGGMNFDKSVRRQSVPEDLFYGHIGAIDNLALAVERA AVLIENDRLDQFKRQRYAGWDADFGRKILSGDY
SLSTLATDALARGLNPQHASGHQELMENIVNQAIYS

>39|1a0cA|gi|6136455

NHFESANKVLYEGKDSKNPLAFKYYNPEEVGGKTMKDQLRFSVAYWHQFTADGTDPFGAATMQRSDRYDGM DLAKARV
EAAFQLFETLNVFFAFHDRDIAPEGSTLQETNKNLDVIVTMIKEYMQTSNVKLLWNTANMFTNPRFVHGAATSCNADV
RYAAAQVKKGLETAKELGAENYVFWGGREGYETLLNTNLQLELDNLARFMHMAVDYATEIGYTGGFLIEPKPKEPTTHQY
DTDAATTISFLRQYGLDKYFKLNLEANHATLAGHTFEHELVRARVQGLLGSVDANQGDPLLGWDTDEFPTDLYSTTLAMY
EILQNGGLSGGLNFDKAVRRGSFEQDDLLYAHVAGMDAFARGLKVAHKLVEDRVFENVINERYSSFKEGIGLEIVEGKA
NFHTLEQYAFKNPNIANKSGRQERLKSILNQYI

>53|1a0cA|gi|6136456

YFENVPKVQYEGKNAKSKYAFRHYNPPEEIMGKPMKDHLRFSVAFWHTMTEDGSDPFGDGTYQRNWEGSTPMETAKNRVD
AFFEILEKLGAIEYFCFHDVDIAPQGDSLKEFLENIDVMTDYIKGKMDKTGVKLLWNTANMFTHPTFVNGAATTNNADVYS
MAAAQVKKGLDVSKKLNGENYVFWGGREGYENLLNTDMNFELDNLARFYQMVIDYAQKIDYHPQFLIEPKPKPTKHQYD
YDAATAMAFIQYNLEDSFKLNLEANHATLAGHTFEHELNVAKNYNALGSLDANQGDLGWDTDDEFPTDIYTATLAMYE
VLDFGGIAPGGLNFDKVRRTSFAMDDLILAHAGMDTYARGLRAAAKMKDDNFFEQIIANRYESFSSGIGKQIVENKED
LESLTNYALSLNGVENKSGHIEHLKSLNDYL

>22|1a0cA|gi|15615320

FFNDVEKVQYEGPRSTNPYAFKYYPPEEIVAGKTMAEHLRFSIAYWHTFVGDGSDPFGVGTMRPVDQYSGMDLAKARVE
AAFEFFEKLVNVPYFCFHDVDVAPEGETLADTYKNLDEIVLMIKDYMKTSKTKLLWNTANMFTHPRWIHGAATSPNADVYA
YAAAKVKKGLEIGKELGAENYVFWGGREGYETLLNTNMKLELDNLARFFHMAVDYAKEIGFDAQFLIEPKPKPTKHQYD
FDVATGIAFLKTHGLDEHFKNIEANHATLAGHTFEHELHLARIHMDLGSVDANQGDTLLGWDTDDEFPTDLYTTTLAMYE
ILKNDGLGKGLNFDKVRRGSEANDLFHAHAGMDSFAIGLKVANQLLEDVLEDVIDNRYKSYQSGIGQKIANNDTN
LKELEAYALSLGEIKHSSGQKERIKATLNQYL

>43|1a0cA|gi|21233522

EYFPGIGKIGFEGRSDNPLAFKVYDANKQVAGKTMAEHLRFAVAYWHSFCGNGADPFGPGTRAYPWDVGN TALARAEAK
SDAAFEFFTKLGVPYYCFHDIDLAPDADDIGEYENNLKHMVGIAKQRQADTGVKLLWGTANLFSHPRYMNGASTNPDFNV
VARAAVQVKAIDAATVELGGENYVFWGGREGYACLNHTQMKREQDNMARFLTLARDYGRAIGFKGNFLIEPKPMEPMKHQ
YDFDSATVIGFLRQHGLDQDFKLNIEANHATLSGHSFEHDLQVASDAGLLGSIDANRGNPQNGWDTDQFPTDLYDTVGAM
LVVLRQGLAPGGLNFDKVRRESSDPQDLFLAHIGMDAFARGLEVADALLTSSPLETWRAQRYASFDSGAGADFANGT
STLADLATYAAGKGEPTQLSGRQEAYENLINQYL

>8|1a0cA|gi|16766946

YFDQLDRVRYEGPQSTNPLAFRHYNPDELVLGKRMEHLRFAACYWHTFCWNGADMFGVGAFNRPWQQPGEALELAKRKA
DVAFEFFHKLNVFPYCFHDVDVSPEGASLKEYKNFAQMVDVLAKEQSGVKLLWGTANCFTNPRYGAGAATNPDPPEVF
SWAATQVVTAMNATHKLGGENYVLWGGREGYETLLNTDLRQEREQIGRFMQMVVEHKHMKGFQGTLLIEPKPKPTKHQY
DYDVATVYGFLLKQFQGLEKEIKVNIENHATLAGHSFHEIATAIALGIFGSVDANRGDAQLGWDTDQFPISVEENALVY
EILKAGGFTTGGLNFDKVRRTSTDKYDLFYGHIGAMDTMALSLKIAARMVEDGELDKRVAKRYAGWNGELGQILKGQL
SLGELAQYAEQHNLPVHQSGHQELLENLVNRYLF

>54|1a0cA|gi|139832

YFDINKVNYEGPKSNNAFSFKYYNPPEKLGNSHMSSELLRFSVAYWHTFTADLSDPFGVGVAERDWDSDLEMEKAKARVEA
IFEFMEKTRIDYFCFHDVDISPEGASLKESNENLDIIVELIKEKMDQTGKLLWNTNNTHERFVHGAATSSNAEVFAY
AAAKVKKSLIAKKLGSENFVFWGGREGYESLLNTNMKLELDNLATFFKMAKSYADEIGYTGGFLIEPKPKPTTHQYDT
DVATAHAFLQKYDLKDFKFNIEANHATLAGHTFQHELRYARDNNMLGSVDANQGHPLLGWDTDDESTDVYDTTLAMYEIL
KNGGLAPGGLNFDKPRRTSFQKEDLILTHIAGMDTFALGLRVAYKMIEDNFFENIMDEKYKSFNEGIGKKIVEGETSLK
ELEDYAFNINTINNTSDHLEVIKSQINQYI

>42|1a0cA|gi|32472084

FPDVPVIQYEGPQSDNPLAFRWYNPDEVIEGKTMKDHRFSIVYWHTFRGTGADPFGPGTAVRPWDNGSESVENAKRAV
VAFELFTKLQAPYYAWHHRDVAPEGANLRETHANLDAVADVLEEQQKATGVKLLWGTANMFSNPRFMHGAATSCNADVFA
YAGAQQKALEVTKRLGGENYVFWGGREGYQNLNTDMKRELDHLAKFFHMAVDYAKSIGFDGQFLIEPKPKPTKHQYD
SDAAACMNFLRAYDLDSHFKLNIEANHATLAGHTMMHELDYAGIQGGLGSIDANTGDLGWDTDQFPTDYLLTTQTMML
ILKHGGIGTGGVNFDKVRRESFEPIDLFHAHIGMDAFAGKLGKIAAAIRASGELADFKVKNRYSTWDSGIGAKIEAGEVG
FAELEAYMLEKGDVDANQSGRQEYLEHMINKYI

>30|1a0cA|gi|15890502

FFGDIKIKYEGPDSTNPLAFRHYNPDEIVGGKRMEDHLRFVAVYWHTFTWPGGDPFGGQTFQRPWFEDTMQAAKLKADV
AFEFFSLLGSPFYCFHDADVRPEGKNFAENTKNLNEIVDYFAQKQADTGKLLWGTANLFSNRRFMGAATNPDPDVFAF
SAATVKTCDATKTLGGANYVLWGGREGYETLLNTDLSRELDQLGRFLNLVVEYKYKIGFEGTILIEPKPQEPTKHQYDY
DVATVYAFLQKNGLEKEVKVNIQGHAILAGHSFEHELAMANAFGIFGSIDMNRNDYQSGWDTDQFPNNVPEMALAYYHV
LAGGGFKNGGTNFD SKLRQSLDPQDLLIGHIGMDCCARGLKAAAKMIEDGALSKPLSERYAKWDSPEAQKMLRGELKL
EEIAALVERDDINPEPKPGRQEYLENVVNRVY

>18|1a0cA|gi|1175034

EFFPEIPKVQFEGKESTNPLAFKFYDPEEIIDGKPLKDHLKFSVAFWHTFVNEGRDPFGDPTADRPNRYTDPMDKAFAR
VDALFEFCEKLNIEYFCFHDRDIAPEGKTLRETNKILDKVVERIKERMKDSNVKLLWGTANLFSHPRYMHGAATTC SADV
FAYAAAQVKKALEITKELGGEGYVFWGGREGYETLLNTDLGFELNLARFLRMAVDYAKRIGFTGQFLIEPKPKEPTKHQ
YDFDVATAYAF LKSHGLDEYFKFNIEANHATLAGHTFQHELMARILGKLSIDANQGDLLLGWDTDQFPNTVYDTTLAM
YEVIKAGGFTKGLNFD AKVRRASYKVEDLFIGHIAGMDTFALGFKVAYKLVKDGVLDFIEEKYRSFREGIGRDIVEGK
VDFEKL EYIIDKETIELPSGKQEYLESLINSYI

>31|1a0cA|gi|28870180

YFPTVDKVIYEGPDS S PLAFRHYDADKRVLGKPMREHLRMAACYWHTFVWPGADMFGVGT FKR PWQRAGDPMELAIGKA
EAAFEFFSKLGIDYYSFHD TDVAPEGSSIK EYRNNFAQMVDRLERHQEQSGIKLLWGTANCFSNPRFAAGAASNPDPEVF
AYAGA QVFSAMNATQRLKGSNYVLWGGREGYETLLNTDLKREREQLGRFMRMVVEHKHIGFKGDLLIEPKPQEPTKHQY
DYDSATVFGFLHQYGLQDEIKVNI EANHATLAGHSFHHEIATAVSLGIFGSIDANRGDPQNGWDTDQFPNSVEEMTLATY
EILKAGGFTHGGYNFDSK VRRQSLDDVDLFHGHVAAMDVLALSLERAAAMVQNDKLQQFKDQRYAGWQQPFGQSVLSGGF
SLASLA EHAFANELNPQAVSGRQELLEGVVNRFIYT

>59|1a0cA|gi|23026381

EYFPGVGKIEFEGPDS DNPF AFKY YDENRVVAGKTLKEHFKFSVCYWHTFCGTGADPF GPGPLQFPWNKADTADARARLK
MDAAFEFITKLGAPYYCFHDIDLVEEGASRQETQRRVQTIVEYAKEKQAASGVKLLWGTANLFSNPRYMNGASTNPDFNV
VAYAGAQLKDALDATALDGENYVFWGGREGYMSLLNTDMGREQEHLARFLTMARDYARGQGFTGNFFIEPKPMEPSKHQ
YDFDSETVIGFLRHHGLDKDFKLN IETNHATLANHTMDHEMTVAANAGMLGSIDANRGDYQNAWDTDQFPYNINETVEMM
MVVL RAGGFQGGGVNFDAKRRRNSTDLEDTFHGHIGGMDTFARALIIADRI IESKIESMRKERYASFDSGAGKQFETGA
LDLAALAEIGNAIGEPALTSGKQEYYENI INQYI

>51|1a0cA|gi|17433696

EFFSNIGKIQYQGP KSTDPLSFKYYNPEEVINGKTMREHLKFALSWWHTMGGDGTDMFGCGTTDKTWGQSDPAARAKAKV
DAAFEIMDKLSIDYYCFHDRDLSPEYGLKATNDQLDIVTDYIKEKQGD KFKLWGTA KCFDHPRFMHGAGTSPSADVFA
FSAAQIKKALESTVKLGNGYVFWGGREGYETLLNTNMGLELDNMARLMKMAVEYGRSIGFKGDFYIEPKPKEPTKHQYD
FDTATVLGFLRK YGLDKDFKMNI EANHATLAQHTFQHELRVARDNGVFGSIDANQGDVLLGWDTDQFPNTIYDTTMCMEY
VIKAGGFTNGGLNFD AKARRGSFTPEDIFYSYIAGMDAFALGFRAALKLIEDGRIDKFVADRYASWNTGIGADIIAGKAD
FASLEKYALEKGEVTASLSSGRQEMLESIVNNVLFS

>37|1a0cA|gi|29375173

YFPKIEKIKYEGTNTKNMYAFRHYNSEEII MGKTMKEHLRFVAVYWHTMTQDGSDFGKAVNKR SWLGESPMETAKKRVI
AFFEILEKLDVEYFCFHDDIAPEGNSLKEFFSNIDEITDLIKEKMDETGIKLLWNTANMFSNPRYVNGAASTNNANVYA
IAAAQVKKGLDVSKKLGGENYVFWGGREGYETLLNTDMKFEQDN IARLFKMAIFYGEKIGHKPQFLIEPKPKEPSKHQYD
FDAATTMAFILKYGLEKDFKLNLEANHATLAGHTFEHELNVARNYGALGSIDANQGDVLLGWDTDEFPTNVYDVTLAMYE
ILENGGIEPGGINFDSK VRRSSFEMEDLLAHIAGMDTFARGLKSAMKLEDRFFEDLKEQRYSSFKKGIGAKIISGKEN
LESLTNYALKNDEPI IESSHIEYVKNILNDYLY

>35|1a0cA|gi|23100574

YFNEIGTIQYEGAKSDNPF AFKFYNPTESINGQTMEEHLRFVAYWHTFTEDLSDPFGNGTAIRPWDKFN GMDLAKARVE
AAFEFFEK LQIPYFCFHDVDIAPEGSS LKESNENLDTVVAMIKEYMKDSKTKLLWNTVNNFTHPRFVHGAASSNNADVFA
YAAAKVKKGLEVGKELGAENYVFWGGREGYETLLNTNMKLELDNLARFFHMAKDYANEIDFNAQFLIEPKPKPTSHQYD
FDVASGYAFLQNYDLQDTFKFNIEANHATLAGHTFEHELHYARIHNMLGSDANQGHPLLGWDTDEFPSDIYTTTLAMYE
ILKNDGLGKGLNFD AKVRRGSFTAEDLFHAHIAGMDSFAIGLKVAQRLMDDRVLNVVEDRYSFNQIGRDI VSGKTD
FHQLEKHALTLSEITQPSGQLEVIKKNINQYLLT

>48|1a0cA|gi|7161893

EYFPQIKIKFEGKDSKNPLAFHYDAEKEVMGKKMKDWLRFAMAWHTLCAEGADQFGGGTKSFPWNEGTD AIEIAKQK
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VARAIVQIKNAIDAGIELGAENYVFWGGREGYMSLLNTDQKREKEH MATMLTMARDYARSKGFGKTFLIEPKPMEPTKHQ
YD VDTETAIGFLKAHNLDKDFKVNIEVNHATLAGHTFEHELACAVDAGMLGSIDANRGDYQNGWDTDQFPIDQYELVQAW
MEIIRGGGFVTGGTNFD AKTRNSTDLEDIIIAHVS GMDAMARALENAAKLLQESPYTKMKKERYASFDSGIGKDFEDGK
LTLEQVVEYGKKNGEPKQTSGKQELYEAIVAMY

>36|1a0cA|gi|6136454

FFRNIGMIEYEGADSENPYAFKYYPNDEFVGGKTMKEHLRF AVAYWHTFDADGKDPFGDGTMFRAWNRLTHPLDKAKARA
EAAFEFFEK LGVPYFCFHDVDIVDEGATLRETFTYLDQMSSFLKEMMETSHVQLLWNTANMFTHPRYVHGAATSCNADVY
AYAAAKVKKGLDIAKELGAENYVFWGGREGYETLLNTDMKLELENLSSFYRMAVEYAREIGFDGQFLIEPKPKPTKHQY
DFDAATTIAFLETYGLKDHFKLNLEANHATLAGHTFEHEL RVAALHDMLGSI DANQGDL LGWDTDEFPTDLYSAVLAMY
EILKAGGFKTGGINFDAKVRRPSFAEDLFHAHIAGMDTYAVGLKVASRLLEDKALDQVIEERYESYTKGIGLEIKEGRT
DLKKLAAYALENDHIENQSGRQERLKATVNRYL

>1ubpC

MKINRQQYAESYGPTV GDEVRLADTDLWIEVEKDYTTYGDEVNFGGGKVLREGMGENGTYTRTENVL DLLL TNALILDYT
GIYKADIGVKDGYIVGIGKGGNP DIMDGVTPNMIVGTATEVIAAEGKIVTAGGIDTHVHF INPDQVDVALANGITTLFGG
GTGPAEGSKATTVTPGPWNI EKMLKSTEGLPINVGILGKGHGSSIAPIMEQIDAGAA GLXI HEDWGATPASIDRSLTVAD
EADVQVAIHS DTLNEAGFLEDTLRAINGRVIHSFHVEGAGGGHAPDIMAMAGHPNVLPSSSTNPTRPFTVNTIDEHLDMLM
VCHHLKQNIPE DVAFAADSRIRPETIAAEDILHDLGIISMSTDALAMGRAGEMVLR TWQTADKMKKQRGPLAEEKNGSDN
FRLKRYVSKYTINPAIAQGIAHEVGSIEEGKFA DLVLWEPKFFGVKADRVIKGGIIAYA QIGDPSASIPTPQPVMGRRMY
GTVGDLIHD TNITFMSKSSIIQQGVPAKLGLKRRIGTVKNCRNIGKKDMKWNDVTTDIDINPETYE VKVDGEVLTCEPVKE
LPMAQRYFLF

>36|1ubpC|gi|22297549

RIDRQTYAETYGPTVGDRLRLADTDLII EIEHDYTHYGDEVKFGGGKVIRDGMGQSPIANAEGA VDVVITNAVILDWGWV
VKADVGIKDGKIYKIGKAGNPYTQEGVDIIIGPGTEA IAGEGMILTAGGIDAH IHFICPQQIATAIAAGITTMIGGGTGP
ATGTNATTCTPGPWN IYRMLQAADAFPVNLGFLGKNSSQPQGLIEQVQAGVVG LKLHEDWGSTPNAIDTCL SVAEDYDI
QVAIHTDTL NESGFVEDTIAAFKNRTI HAYHTEGAGGGHAPDIIKL CGQANVLPSSSTNPTRPYTVNTLDEHLDMLMVCHH
LDPSIPEDVAFAESRIRRETIAAEDILHDLGAFSIISSDSQAMGRVGESIIRTWQTAHKMKVQRGHLRDPQRPGVDHDNF
RARRYVAKYTINPAITHGIAEYVGSVEVGKIADLCLWKPAFFGVKPELV IKGGVIAAYAQMGDANASIPTPQPVMQPMFA
SYGGCRTTTSVT FMSQAGIANIPEQLGLQKT VLPVGHIRQLRKADLKLNDYLP HIEVDPETYEVRADGELLTCEPATVL
PLAQRYFLF

>12|1ubpC|gi|27462198

KISRKEYVSMYGPTTGDKVRLGDTDLILEVEHDCTTYGEEIKFGGGKTIRDGMAQTNSPSSHELDLVL TNALIVDYTG IY
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YFLY

Performing Alignment

```
[8]: ALIGNMENT_COMMAND = f"{ALIGNER_PATH} -input {INPUT_FILEPATH} -output_␣  
    ↪{OUTPUT_FILEPATH}"  
print(f"CLI command to be run: '{ALIGNMENT_COMMAND}'")
```

CLI command to be run: 'Mali-v1.31/Mali.exe -input data/input/1a0cA_1ubpC
-output data/output/1a0cA_1ubpC'

```
[9]: start_time = time.perf_counter()  
subprocess.run(ALIGNMENT_COMMAND)  
end_time = time.perf_counter()  
  
time_in_milliseconds = (end_time - start_time) * 1000  
time_in_milliseconds_rounded = round(time_in_milliseconds, 0)  
time_in_seconds = time_in_milliseconds_rounded / 1000
```

```
print(f"Performed alignment of {TESTCASE_NAME} in {time_in_seconds} seconds")
```

Performed alignment of 1a0cA_1ubpC in 5.278 seconds

Viewing Alignment Produced by MAli

```
[10]: ALIGNMENT_FILEPATH = OUTPUT_FILEPATH + ".faa"  
presenter.present_interleaved_aligned_fasta(ALIGNMENT_FILEPATH)
```

Displaying interleaved alignment from 'data/output/1a0cA_1ubpC.faa':

```
1a0cA      -----N  
13|1a0cA|gi|375 -----  
55|1a0cA|gi|139 -----NEYWQGVDDIKYIGH  
24|1a0cA|gi|333 -----  
28|1a0cA|gi|134 -----FFGDIQKIKYEGPDSTNPLAYRFYNPDEVVAGKR  
2|1a0cA|gi|3247 -----  
23|1a0cA|gi|343 -----EF-FP-GIPKIKYE-GPSSKNPL-A-----  
3|1a0cA|gi|3203 -----S  
29|1a0cA|gi|229 -----  
39|1a0cA|gi|613 -----N-HFESANKVLYEGKDSKNPLAFKYYNPEEVVGG  
53|1a0cA|gi|613 -----  
22|1a0cA|gi|156 -----FF-NDVEKVQYEGPRSTNPNYAFKYYNPEEIVAGKT  
43|1a0cA|gi|212 -----EYF-PGIGKIGFEGRSDNPLAFKVYDANKQVAGKT  
8|1a0cA|gi|1676 -----YFDQLDRVR  
54|1a0cA|gi|139 -----YFDINKVNYEGPKSNNAFSFKYYNPE  
42|1a0cA|gi|324 -----F-PDVPVIQYEGPQSDNPLAFRWYNPDEVIEGKT  
30|1a0cA|gi|158 -----FFGDIQKIKYEGPDSTNPLAFRHYNPDEIVGGKR  
18|1a0cA|gi|117 -----EFFPEI-PKVQFEGKESTNPLAFKFYDPEEIIDGKPLKD  
31|1a0cA|gi|288 -----YFPTVDKV-IYEGPDSDSPLAFRHYDADKRVLGKPMREHLR  
59|1a0cA|gi|230 -----  
51|1a0cA|gi|174 -----  
37|1a0cA|gi|293 -----  
35|1a0cA|gi|231 -----YFN-EI-GTIQYEGAKSDNPFQAFKFYNPTESINGQTTEE  
48|1a0cA|gi|716 -EYFPQIQKIK-FEGKDSKNPLAFHYH-DAEKEVMGKKMKDWLRFAMAWHTLCAEGADQ  
36|1a0cA|gi|613 -----  
1ubpC      -----MKI-NRQQAESYGPTVGD-EVR-----LAD  
36|1ubpC|gi|222 R-----ID-RQTYAETYGPTVGDR-LRLADTDLI-----  
12|1ubpC|gi|274 -----KI-SRKEYVSMYGPTTGD-KVRLGDTDLI-----  
86|1ubpC|gi|335 -----  
6|1ubpC|gi|1931 -----KI-SRHAYADTYGPTTGD-RVRLADTDLW-----  
7|1ubpC|gi|2300 -----LD-RGSYAAMFGPTVGDR-VRLADTELI-----  
16|1ubpC|gi|586 -----  
2|1ubpC|gi|1567 -----MTLLIK-NGRLVDPKSNRDEVLDILIENDKIVKIGLNLS  
42|1ubpC|gi|229 -----  
19|1ubpC|gi|230 -----KIS-RRAYADMYGPTVGDK-VRLADTALWIQVEKDFTIYGEEVKFGGKQVIR  
25|1ubpC|gi|134 R-----IS-RAAYAQMVGPTVGDK-VRLADTELF-----  
43|1ubpC|gi|160 -----KMSREEYAELFGPTTGDKIRLGD
```

80|1ubpC|gi|338 R-----ID-RQAYAETYGPTTGDR-IRLADTELIL-----
 39|1ubpC|gi|158 -----I-SRQAYADMFGPTTGD-KIRLADTELW-----
 53|1ubpC|gi|152 -----IS-REKYANMYGPTTGDK-LRLGDTNLYA-----
 85|1ubpC|gi|174 V-----D-HEKYASMYGPTTGDK-IRLGDTDLFA-----
 44|1ubpC|gi|322 -----
 72|1ubpC|gi|259 -----KI-SRQTYVEMMGPTTGD-RVRLADTELFIEIEKDFTTYGEEVKFGGGKVI
 50|1ubpC|gi|229 -----
 3|1ubpC|gi|2302 -----
 81|1ubpC|gi|465 -----
 83|1ubpC|gi|269 -----
 21|1ubpC|gi|156 -----KL-TRAQHASLYGPTVGD-KVRLADTDLL-----
 13|1ubpC|gi|103 -----KISRQAYADMFGPTTGDC-VRLADTEFL-----
 70|1ubpC|gi|123 -----IS-RATYADMFGPTTGDK-VRLADTDLII-----

1a0cA KYFENVSKIKEYEGPKSNPYSFKFYNPPEEVIDGKTM--EEHLRFSIA-YWHTFTADGTDQ
 13|1a0cA|gi|375 -----
 55|1a0cA|gi|139 QDKKSGLGFGYYNPDEVIGGKKMRDWLRFVAYWHT--FDQRLVDPF-GDGTARPYDHI
 24|1a0cA|gi|333 -----
 28|1a0cA|gi|134 LEDHLRFVAYWHSFAWPGGDPFGGQTFDRPWFPKAGGIDTMELAKLKADVAFEMFSLLG
 2|1a0cA|gi|3247 -----
 23|1a0cA|gi|343 -----
 3|1a0cA|gi|3203 NYFDKIEKVKEYEGADSTNPF AFKHYPNEVILGKTM--AEHLRLAVC-YWHTFCWTGNDM
 29|1a0cA|gi|229 -----
 39|1a0cA|gi|613 KTMKDQLRFSVAYWHQFTADGTDPF GAATMQRSDR--YDGMDLAKA-RVEAAFQLFETL
 53|1a0cA|gi|613 -----YFEN-VPKVQYEGKNAK
 22|1a0cA|gi|156 MAEHLRFSIAYWHTFVGDSDFGVGTMRPQWQYS--GMD-LAKAR-VEAAFEFFEKLN
 43|1a0cA|gi|212 MAEHLRFVAYWHSFCGNGADPFPGPTTRAYPQWVGN--TALARAEAK-SDAAFEFFTKLG
 8|1a0cA|gi|1676 YEGPQSTNPLAFRHYNPDELVLGKRMEHLRFAACY--WHTFCWNGA-DMFGVGAFNRPW
 54|1a0cA|gi|139 EKLGNHSMSELLRFSVAYWHTFTADLSDFGVGVAE--RDWDSLDEM-EKAKARVEAIFE
 42|1a0cA|gi|324 MKDHMRFSIVYWHTFRGTGADPFPGPTAVRPWDNGS--ESVENAQKR-AVAFELFTKLQ
 30|1a0cA|gi|158 MEDHLRFVAYWHTFTWPGGDPFGGQTFQRPWF----EDTMQAAKLKADVAFEFFSLLG
 18|1a0cA|gi|117 HLKFSVAFWHTFVNEGRDPFGDPTADRPWNRYTDPM--DKAFARVDA-LFEFCEKLNIEY
 31|1a0cA|gi|288 MAACYWHTFVWPGADMFGVGTFKRPWQRAGDPMELA--IGKAEAAFE-FFSKLGIDYYSF
 59|1a0cA|gi|230 -----
 51|1a0cA|gi|174 -----EFFSNIGKIYQGPSTDP--LSFKYYNPE-EVINGKTMREHL
 37|1a0cA|gi|293 -----
 35|1a0cA|gi|231 HLRFGVAYWHTFTEDLSDFGNGTAIRPQWDFN-GM--DLAKARVEA-AFEFFEKLPY
 48|1a0cA|gi|716 FGGGTSFNPWEGTDAIEIAKQKVDAGFEIMQKLG--PYCFHDVD-LVSEGNISIEYE
 36|1a0cA|gi|613 -----FFRNIGMIEYEGADSENPAFKY--YNPDEFVGG-KTMKEHLRFAVA
 1ubpC TDLWIEVEKDYYTYGDEVNFGGGKVLREGMGNGTY--TRTENVLDL-LLTNALILDYTG
 36|1ubpC|gi|222 -----
 12|1ubpC|gi|274 -----LEVEHDCCTT
 86|1ubpC|gi|335 -----LNKK-IYAEMYGPTVGD
 6|1ubpC|gi|1931 -----
 7|1ubpC|gi|2300 -----EVEQD--YTTYGEEVK-FGGGKVIRDMG
 16|1ubpC|gi|586 -----MSRKQ
 2|1ubpC|gi|1567 VENAEIVDARGLVVAPGLID-----
 42|1ubpC|gi|229 -----

19|1ubpC|gi|230 DGMGQ-----
 25|1ubpC|gi|134 -----
 43|1ubpC|gi|160 TDLWIEVEKDFTVYGEEMIFGGGKTIRDGMGQNGRI--TGKDGALDL-VITNVLLDYG
 80|1ubpC|gi|338 -----
 39|1ubpC|gi|158 -----
 53|1ubpC|gi|152 -----
 85|1ubpC|gi|174 -----
 44|1ubpC|gi|322 -----
 72|1ubpC|gi|259 RDGMGQSQRNHADVMDTVITNAVIVDHWGIVKADVG--LKDGKIAAI-GKAGNPDIQPNV
 50|1ubpC|gi|229 -----
 3|1ubpC|gi|2302 -----KISGKD
 81|1ubpC|gi|465 ----IHRKEYANKYGPTTGDKIRLGDTNLLAEIEKD--YALYGDECV-FGGGKVIRDGMG
 83|1ubpC|gi|269 -----
 21|1ubpC|gi|156 -----LE-IEKDYTVYGDEC
 13|1ubpC|gi|103 -----QVEQD--FTIYGEEVK-FGGGKVIRDGMG
 70|1ubpC|gi|123 -----

 1a0cA FGKATMQRPNHYTDPMDIAKARV-----
 13|1a0cA|gi|375 -----HRYFERVNRISYEGRQSNNPLAFRHYNPEEIILGKKMKDHLR-FAVC--YWH
 55|1a0cA|gi|139 TDPMDLALAKVDAAFEFYHKLGVLDYLCFHDRDLAPEGDTLRETNRNLDKV-IDKI--VDY
 24|1a0cA|gi|333 -----YFDNISTIAYEGPASKNPLAFKFYNPEEK-VGDK--TME
 28|1a0cA|gi|134 APYFCFHDADVRPEGKDFSESAARLDEIADYFAGKMKQTGVKLLWGTANL-FSHR--RFM
 2|1a0cA|gi|3247 -----
 23|1a0cA|gi|343 -----YKWYNAE--EVI-LGKKMK-DWMRF-S--V----A
 3|1a0cA|gi|3203 FGVGSLDRSQKTGDLLEGAKQKAEIAFEFFQKLGIPIYCFHDVDIAPEG-NSYK--EYV
 29|1a0cA|gi|229 -----YFEHIPEIRYEGPQSDNPLAYRHYDKSKKVLGKT-LEEH--LRI
 39|1a0cA|gi|613 NVPPFAFHDRDIAPEGSTLQETNKNLDVIVTMIKEYMQTSNVKLLWNTAN-MFTN--PRF
 53|1a0cA|gi|613 SKYAFRHYNPEEIIMGKPMKDHLRFSAVFWHTMTEDGSDPFGDGTYQRNW-EGSTPMETA
 22|1a0cA|gi|156 VPYFCFHDVDVAPEGETLADTYKNLDEIVLMIKDYMKTSKTKLLWNTANM-F-----
 43|1a0cA|gi|212 VPYYCFHDIDLAPDADDIGEYENNLKHMVGIAKQRQADTGKLLWGTANL-F-----
 8|1a0cA|gi|1676 QQPGEALELAKRKADVAFEFFHKLNVFYCFHDVDVSPEGASLKEYKNNF-AQMVDVLAA
 54|1a0cA|gi|139 FMEKTRIDYFCFHDVDISPEGASLKESNENLDIIVELIKEKMDQTKGKLL-WNTT--NNF
 42|1a0cA|gi|324 APYYAWHDRVAPEGANLRETHANLDAVADVLEEQQKATGVKLLWGTANM-FSNP--RFM
 30|1a0cA|gi|158 SPFYCFHDADVRPEGKNFAENTKNLNEIVDYFAQKQADTGKLLWGTANL-FSNR--RFM
 18|1a0cA|gi|117 FCFHDRDIAPEGKTLRETNKILDKVVERIKERMKDSNVKLLWGTANLFSH-PRYM--HGA
 31|1a0cA|gi|288 HDTDVAPEGSSIKYERNFAQMVDRLERHQEQSGIKLLWGTANCFSNPRF-AAGA--ASN
 59|1a0cA|gi|230 -----EYFPGVGKIEFEGPDSNPFAPKYYDENRVVAGKTLKEH-FKFS--VCY
 51|1a0cA|gi|174 KFALSWWHTMGGDGTMFGCGTTDKTWGQSDPAARAKAKVDAAFEIMDKL-SIDY--YCF
 37|1a0cA|gi|293 -----YFPKIEKIKYEGTNTKNMYAFRHYNSEEIIM-----
 35|1a0cA|gi|231 FCFHDVDIAPEGSSLKESNENLDTVVAMIKEYMKDSKTKLLWNTVNNFTH-PRFV--HGA
 48|1a0cA|gi|716 SNLKAVVAYLKEKQKETGIKLLWSTANVFGHKRYMNGASTNPDPFVVARA-IVQIKNAID
 36|1a0cA|gi|613 YWHTFDADGKDPFGDGMFRAWNRLTHPLDKAKARAEAAFEFFEKLGVPY-FCFH--DVD
 1ubpC IYKADIGVKDGYIVIGIGKGNPDIMDGVTPNMIVGTATEVIAAEGKIVTA-GGIDTHVHF
 36|1ubpC|gi|222 -----EI-----EHDYTHYGDEVKFGGGKVIRDGMGQSPIAN--AE-
 12|1ubpC|gi|274 YGEEIKFGGGKTIRDGMAQTNSSPSSHELDTLVTNALIVDYGTYKADIGI-KNGK--IHG
 86|1ubpC|gi|335 SVRLADTDLWVKIEKDFTIYGEEVKFGGGKVIRDGMGQQMNNKECVDLV-LTNA--III
 6|1ubpC|gi|1931 -----IK-----VER
 7|1ubpC|gi|2300 QSQHSRQEGAVDTVITNALIVDHWGIVKADVGIKDGRICAIGKAGNPVQ-PNVD--III

16|1ubpC|gi|586 YADMFGPTVGDAIRLADSELFIEIEKDYTTYGDEVKFGGGKVIRDMGMQH-PLAT--SDE
2|1ubpC|gi|1567 -----VHVHFREP
42|1ubpC|gi|229 -----KISRQAYAEMFGPTTGDRLRLADTDLVI-EVER--DFT
19|1ubpC|gi|230 -----S--QAT
25|1ubpC|gi|134 -----EV-----EKDLTIHGEEVKFGGGKVIRDMGMQ-SQ-V--SRA
43|1ubpC|gi|160 IVKADVGKDGRIIVGVKSGNPDIMDGVDPHVMVIGAGTEVISGEGKILTA-GGVD--THI
80|1ubpC|gi|338 -----EV-----ERDFTTYGEEVKFGGGKVIRDMGMQ-SQ-Q--SRA
39|1ubpC|gi|158 -----IE-----VED
53|1ubpC|gi|152 -----RI-----EKDYTVYGDECVFGGGKVLREGMGQ-GIEQ--AEA
85|1ubpC|gi|174 -----EIEKDYAIYGDECIFGGGKVLRDGMGQ-SA-G--YPA
44|1ubpC|gi|322 -----KI-SRKQYASMYGPTTGDKVRLGDTNLF AEIEKDY-TLYG--EEI
72|1ubpC|gi|259 TMAIGAATEIIAGEGSILTAGGIDSH-----
50|1ubpC|gi|229 -----RISRSVYADMFGPTTGDRLRLADTDLIIIEVEKDLTTYGEEVKF-GGGKVIRDG
3|1ubpC|gi|2302 YAGMYGPTKGDRLRLADTDLIIIEEEDYTVYGDECKFGGGKSIRDGMGQS-PSAA--RDD
81|1ubpC|gi|465 QSCGHPPAISLDTVITNAVIIDYTGIKADIGIKDGLIASIGKAGNPDIM-NGVFSNMII
83|1ubpC|gi|269 ----ISRQAYADMFGPTVGDRVRLADTALWVEVEKDFTIYGEEVKFGGGK-VIRDMGMQG
21|1ubpC|gi|156 KFGGGKVLRDGMGQSAVYTRDEGVLDLIITNATIIDYTGIVKADIGIKDG-HIVG--IGK
13|1ubpC|gi|103 QSQV-TNDGCVDVLITNALILDHWGIVKADIGIKNGRIAGIGKAGNPDIQ-PKVN--IVI
70|1ubpC|gi|123 -----EV-----EKDLTTYGEEVKFGGGKVIRDMGMQ-SQ-I--PRS

1a0cA -----
13|1a0cA|gi|375 NFC-WDGTDMFGSGAFE-RFWQKGGDA-LELAKLKADVAFEFFYKL--NIPF-YCFH-DI
55|1a0cA|gi|139 QKQ-TGMKVLWNTSNMF-TNPRFVAGA-ATSPDADVFAYAAAQLKH--SLEI-GKRV-GA
24|1a0cA|gi|333 EHL-RFSVAYWHTFTGD-GSDPFGAGN-MIRPWNKYSGMDLAKARV--EAAF-EFFE-KL
28|1a0cA|gi|134 SGA-ATNPDPDVFAFSA-ATVKSCIDV-TKRLKGENYVLWGGREGY--ETLL-NTDL-AR
2|1a0cA|gi|3247 -----
23|1a0cA|gi|343 F-WH-TF-R-G-----T-G---GD--P--FG---APTK-SWPW-ED--GTNSLD--MAKR
3|1a0cA|gi|3203 HNF-----HTMVDILEKK--QAET-GVKL-LW
29|1a0cA|gi|229 AVC-YWHTFVWPGVDIF-GQGTFRRPW-QQAGDAMERARQKADSAF--EFFS-KLGT-PY
39|1a0cA|gi|613 VHGA-AATSCNAD-----
53|1a0cA|gi|613 KNRVDAFFEILEKLGAE-YFCFHDVDIA----PQGDSLKEFLENID--VMTD-YIKG-KM
22|1a0cA|gi|156 -----
43|1a0cA|gi|212 -----
8|1a0cA|gi|1676 KQEQSGVKLLWGTANCF-TNPRYGAGAATNPDPDEVFSWAATQVVT-AMNATHKLGGENYV
54|1a0cA|gi|139 THE-RFVHGAATSSNAE-VFAYAAAKV-KKSLEIAKKLGSFVFW--GGRE-GYES-LL
42|1a0cA|gi|324 HGA-ATSCNADVFAYAG-AQVKKALEV-TKRLGGENYVFWGGREGY--QNLV-NTDM-KR
30|1a0cA|gi|158 SGA-ATNPDPDVFAFSA-ATVKTCMDA-TKTLGGANYVLWGGREGY--ETLL-NTDL-SR
18|1a0cA|gi|117 -----
31|1a0cA|gi|288 PDP-EVFAYAGAQVFS-MNATQRLKG-SNYVLWGGREGYETLLNT--DLKR-EREQ-LG
59|1a0cA|gi|230 WHT-FCGTGADPFGPGP-LQFPWNKAD-TADARARLKMDAAFEFIT--KLGA-PYYC-FH
51|1a0cA|gi|174 HDR-DLSPEYG-----
37|1a0cA|gi|293 -----
35|1a0cA|gi|231 -----
48|1a0cA|gi|716 AGIELGAENYVFWGGRE-GYMSLLNTDQKREKEHMTMLTMARDYARSKGFK-----
36|1a0cA|gi|613 -----IVDEGATLRET-FTYLDQMSSFLKEMMETSHVQLLWNTANMFTHPRYVHGAATS
1ubpC INPDQVDVALANGITTL-FGGGTGPAEGSKATTVTPGPWNIEKMLKSTEGLPINVILGK
36|1ubpC|gi|222 GAV-DVVITNAVILDWW-GVVKADVGI-KDGKIYKIGKAGNPYTQE--GVDI-I--I-GP
12|1ubpC|gi|274 IGK-AGNKDMQDGVCCN-LCVGPATEA-LAAEGLIVTAGGIDTHIH--FISP-QQIP-TA

86|1ubpC|gi|335 DYW-GVIKADIGINNGR-IVGIGKSGN-PDIQPGVTIYIGPGTEVI--SAEG-KIVT-AG
6|1ubpC|gi|1931 DLT-TYGDEVKFGGGKV-IRDGMGQSQ-LSRDQVMDLAI TNALIVD--HWGI- IKAD-VG
7|1ubpC|gi|2300 GPG-TEA IAGEGRILTA-GGIDAH IHW-ICPQQIEDALHSGIT TML--GGGT-GPAE-GT
16|1ubpC|gi|586 CV--DLVLTNAI IVDYT-GIYKADIGI-KDGM IASIGKAGNP LLM D--GV---DMVI-GA
2|1ubpC|gi|1567 GQTHKETI HSGAKSAAA-GGFTRVMMANTKPILSTPKVLTETLEIADKEDIKIDAVGSI
42|1ubpC|gi|229 IYG-EEVKFGGKVIRD-GMGQSQRMS-KDCVDTVVTNALIIDHWG--IVKA-DIGL-KH
19|1ubpC|gi|230 SDK-TPDTVITNALILD-HWGIVKADV-AIKNGRISAIGKAGNPDI--QPGV-TIIV-GP
25|1ubpC|gi|134 QGAVDTVITNALVVDAGAGIFKADIGL-KDGRIAAIGKAGNPDTQD--GV TI-I--I-GP
43|1ubpC|gi|160 HFI-CPQQMEVALSSGV-TTLLGGGTG-PATGSKATTCTSGAWYMA--RMLEAAEEFPIN
80|1ubpC|gi|338 NGAVDTVITNALILDWW-GIVKADIGL-RDGRIVAIGKAGNP DITD--GIDI-V--I-GP
39|1ubpC|gi|158 DLT-TYGEEVKFGGGKV-IRDGMGQGQMLSAGCA-DLVLTNALIID--YWGI-VKAD-IG
53|1ubpC|gi|152 LSL-DTVITNSVIIDYS-GIYKADIGI-KNGHIVGIGKAGNPDTMH--GVQN-NMLI-GN
85|1ubpC|gi|174 SDCLDTVVTNAVIDYT-GIYKADIGI-NGGLIVAIGKAGNP DVM DMDGVNEEM--IVGV
44|1ubpC|gi|322 KFG-GGKTIRDGMAQSA-STYTNELDA-VITNAMIIDYTGIYKADI--GIKG-GKIV-GI
72|1ubpC|gi|259 ----IHFICPQQAEDAM-MNGIT TMLG-GGTGPAVGTAATCTPGP--WHIH-SMLR-AS
50|1ubpC|gi|229 MGQSQVTNKDGAADTVI-TNALIVDHWGIVKADVAITAGVITAIGKAGNP DVQPNVDIII
3|1ubpC|gi|2302 KVL-DLVITNAIIFDTW-GIVKGDIGI-KDGKIAGIGKAGNP KVM S--GVSE-DLII-GA
81|1ubpC|gi|465 GAN-TEVIAGEGLIVTA-GAIDCHVHY-ICPQLVYEAISSGITT LV--GGGT-GPAA-GT
83|1ubpC|gi|269 QML-AAEAMD LVLTNAL-IIDHW-GIVKADIGIKHGRIAVIGKAGNP DVQPGVNPVGP
21|1ubpC|gi|156 GGN-PDIMDGVESHMIV-GASTEAIAG-EGLIVTAGGIDAHIFIS--PQ QI-DVAI-AS
13|1ubpC|gi|103 GPA-TEVIAGEGKIITA-GGIDTHIHF-ICPQQAEEGLSSGVTTFI--GGGT-GPVA-GT
70|1ubpC|gi|123 GGAMDTVITNALIVDHT-GIYKADVGL-RDGR IAGIGKAGNPDTQP--GVTL-I--I-GP

1a0cA -----
13|1a0cA|gi|375 DVAPEGCSLKEYIYNLGVMSDILADKQ AETGVKLLWGTANCFTHPRYAAGASTNPDLNIF
55|1a0cA|gi|139 ENYVFWGGREGYESLWNTNMKLEQEHA AKFFHMAKDYANEIGFDAQMLLEPKPKPESTHQ
24|1a0cA|gi|333 NIPFFCFHDVDIAPEGETLKETYKNLDI IVDMIEEYMKTSKTKLLWNTANLFTHPRFVHG
28|1a0cA|gi|134 EQEQAGRFLSLVVDYKHKIGFKGTILIEPKPQEPTKHQYDYDVATVYGF LKRFGLEKEVK
2|1a0cA|gi|3247 -----
23|1a0cA|gi|343 RMRA-HFEFME-KL-GVDR--W--C--FHDRDIAPDGKTL----T---E-TNKNLDEIVE
3|1a0cA|gi|3203 GTANCFTNPRYMSGASTNP NPEVFSWAASQVF NAMNATKRLGGENYVLWGGREGYETLLN
29|1a0cA|gi|229 YTFHDTDVSPEGSS LKEYSENFLRITDY LARKQEDTG I KLLWG TANLFSHPRYAAGAATS
39|1a0cA|gi|613 -----
53|1a0cA|gi|613 DKTGVKLLWNTANMFTHPTFVNGAATTNNADVYSMAAAQVKKGLDVSKKLNGENYVFWGG
22|1a0cA|gi|156 -----THPRWIHGAA
43|1a0cA|gi|212 -----SHPRYMNGAST
8|1a0cA|gi|1676 LWGGREGYETLLNTDLRQEREQIGRFMQMVVEHKHKMGFQG TLLIEPKPQEPTKHQYDYD
54|1a0cA|gi|139 NTNMKLELDNLATFFKMAKSYADEIGYTGGFLIEPKPKEPTTHQYD TDVATAHAFLQKYD
42|1a0cA|gi|324 ELDHLAKFFHMAVDYAKSIGFDGQFLIEPKPKEPTKHQYDS DAAACMNFLRAYDLDSHFK
30|1a0cA|gi|158 ELDQLGRFLNLVVEYKYKIGFEGTILIEPKPQEPTKHQYDYDVATVYAFLQKNGLEKEVK
18|1a0cA|gi|117 -----
31|1a0cA|gi|288 RFMRMVVEHKHKIGFKGDL LIEPKPQEPTKHQYDYDSATVFGFLHQYGLQDEIKVNIEAN
59|1a0cA|gi|230 DIDLVEEGASRQETQRRVQTIVEYAKEKQAASGVKLLWG TANLFSNPRYMNGASTNP DFN
51|1a0cA|gi|174 -----
37|1a0cA|gi|293 -----GKTMKEHLRF AVAYWHTMTQDGSDFGKAVNKR SWLGESPMETAKKRVI AF FEIL
35|1a0cA|gi|231 -----
48|1a0cA|gi|716 -----
36|1a0cA|gi|613 CNADVYAYAAA KVKGLDIAKELGAENYVFWGGREGYETLLNTDMKLELENLSSFYRMAV

1ubpC GHGSSIAPIMEQIDAGAAGLXI HEDWGATPASIDRSLTVADEADVQVAIHSDTLNEAGFL
36|1ubpC|gi|222 GTEAIIAGEGMILTAGGIDAHIFICPQQIATAIAAGITTMIGGGTGPATGTNATTCTPGP
12|1ubpC|gi|274 FASGITTMIGGGTGPADGTNATTITPGRWNLKTM LRASEEYAMNLGYLGKGNVSYEPSLV
86|1ubpC|gi|335 GIDVHVHFICPQQIEEALSSGMTTLIGGGTGPTTGSNATTCTPGVWFISRMLQAADALPI
6|1ubpC|gi|1931 IKDGRIAAIGKAGNPDTQPNVNIWRPATEVIDEGKIFTAGGIDSHVHFICPQLVEEA
7|1ubpC|gi|2300 NATTCTPGPWHIARMLQAAEGLPMNMGGFFGKGNASRPQGLEEQLRAGACGLKLHEDWGT
16|1ubpC|gi|586 ATEVIAAEGMIVTAGGIDAHIFICPQQIETALASGVTTMIGGGTGPATGTNATTCTPGP
2|1ubpC|gi|1567 TQDFDGEHLTDFDELIKAGAIGFSDDGIPLTDAGVLRKALQKAKLTDLSIHEEDPNLI
42|1ubpC|gi|229 GRIAAIGKAGNPDIQPGVTIIVGPGTEVIAGEGMIVTAGGIDTHIFICPQQIEEALMSG
19|1ubpC|gi|230 CTEVIAGEGQILTAGAIDSHIFICPQQIDEALMSGTTMIGGGTGPATGTNATTCTPGK
25|1ubpC|gi|134 GTEIIAGEGKILTAGGDAHIHFICPQQIEEALMSGITTMIGGGTGPAGHTLATTCTPGP
43|1ubpC|gi|160 VGFLGKGNASDKAPLIEQVEAGAIGLKLHEDWGTTPSAIKTCMEVVD--EADIQVAIHTD
80|1ubpC|gi|338 GTEAIIAGEGHIVTAGAIDSHIFICPQQIETALASGVTTMIGGGTGPATGTNATTCTPGA
39|1ubpC|gi|158 VKDGRIFAIGKAGNPDIQPNVTIPI--GVSTEIIAAEGRIVTAGGVDTHIHWICPQQAEEA
53|1ubpC|gi|152 KTEVIAGEGMIVTAGAIDCHVHFICPQLVYEAVSSGITTMVGGGTGPAYGTRATTCTPSP
85|1ubpC|gi|174 NTEVIAAEGMIVTAGGIDCHVHFICPQLAEEAIIASGITTLVGGGTGPAGTCTATTCTPSP
44|1ubpC|gi|322 GKAGNPDTQDSVNEAMVGAATEVIAGEGQIITAGGIDTHIFISPTQIPTALYSGVTTM
72|1ubpC|gi|259 DGMIMNTGFFGKGNVSLPTPNEEQILAGACGLKLHEDWGTTYAAIDNCLNVADKYDIQVA
50|1ubpC|gi|229 GPGTDVIAGEGKILTAGGFD SHIFICPQQIEHALMSGVTTMIGGGTGPSHGTFATTCTP
3|1ubpC|gi|2302 STEVITGEGLIVTPGGIDTHIFICPQQIETALFSGITTMIGGGTGPADGTNATTCTPGA
81|1ubpC|gi|465 RATTCTPSPTQMRMLQSTDDLPLNFGFTGKGSSSKPDELHEIIKAGAMGLKLHEDWGST
83|1ubpC|gi|269 TEVIAAEGKIVTAGGVDSHIFICPQQVDEALNSGVTTFIGGGTGPATGTNATTCTPGPW
21|1ubpC|gi|156 GITTMLGGGTGPATGKATTCTPGKWNIERMLEAADAFPVNLGFLGKGNASTPAPLREQI
13|1ubpC|gi|103 NATTVTPGIWNMHRMLEAVDELPINVGLFGKGCVSQPEAIREQIEAGAMGLKI HEDWGAT
70|1ubpC|gi|123 GTEVIAGEGKILTAGGIDTHIFICPQQIEDALASGITTMIGGGTGPAGHTLATTCTPGP

1a0cA -----EAAFEFFDKINAPY
13|1a0cA|gi|375 AYASAQVCQVMQMTKKLGGENYVLWGGREG-YESLLNTDLRQEREQIGRFMQMVVDYKYK
55|1a0cA|gi|139 YDFDAATTIAFMKEYDLDDKDFKLNLEGNHA-NLAGHTYQHEIRVAREANLLGSLDANQGD
24|1a0cA|gi|333 AATSCNADVFA YAAAKVKKGLEIAKRLGAE-NYVFWGGREGYETLLNTDMKLELDNLARF
28|1a0cA|gi|134 LNIEQGHA ILAGHSFEHELALANALGVFGS-IDMNRNDYQSGWDTDQFPNNVPEMALAYY
2|1a0cA|gi|3247 -----
23|1a0cA|gi|343 LAKKLQE-ETNIKPL-WG-TAQLF-MH-PRYM-HG-AATSPEVKVYA-YG--AAQVKKAL
3|1a0cA|gi|3203 TDLKREREQIGRFMQMVVEHKKHIGFNGL-LIEPKPQEPTKHQYDYDVATVYGLKQFG
29|1a0cA|gi|229 PDPEVFAFAATQVRHALDATQRLGGDNYVL-WGGREGYD TLLNTDLMRERDQLA-----
39|1a0cA|gi|613 -----
53|1a0cA|gi|613 REGYENLLNTDMNFELDNLARFYQMVIDYA-QKIDYHPQFLIEPKPKEPTKHQYDYDAAT
22|1a0cA|gi|156 TSPNADVYAYAAAKVKKGLEIGKELGAENYVFWGGREGYETLLNTNMKLELDNLARFFHM
43|1a0cA|gi|212 NPDFNVVARAAVQVKA AIDATVELGGENYVFWGGREGYAC LHNTQMKREQDNMARFLTLA
8|1a0cA|gi|1676 VATVYGLKQFGLEKEIKVNI EANHATLAGHSFHHEIATAIALGIFGSVDANRGDAQLGW
54|1a0cA|gi|139 LDKDFKFNI EANHATLAGHTFQHELRYARDNNMLGSVDANQGHPLLGWDTDESTDVYD TT
42|1a0cA|gi|324 LNIETNHATLAGHTMMHELDYAGIQGGLGS-IDANTGDLLL GWDTDQFPTDYLLTTQTML
30|1a0cA|gi|158 VNIEQGHA ILAGHSFEHELAMANA FGIFGS-IDMNRNDYQSGWDTDQFPNNVPEMALAYY
18|1a0cA|gi|117 -----
31|1a0cA|gi|288 HATLAGHSFHHEIATAVSLGIFGSIDANRG-DPQNGWDTDQFPNSVEEMTLATYEILKAG
59|1a0cA|gi|230 VVAYAGAQLKDALD ATIALDGENYVFWGGR-EGYMSLLNTDMGREQEHLARFLTMARDYA
51|1a0cA|gi|174 -----
37|1a0cA|gi|293 EKLDVEYFCFHDIDIAPEGNSLKEFFSNIDEITDLIKEKMDETGIKLLWNTANMFSNPRY

35|1a0cA|gi|231 -----
 48|1a0cA|gi|716 -----
 36|1a0cA|gi|613 EYAREIGFDGQFLIEPKPKEPTKHQYDFDA-ATTIAFLETYGLKDHFKLNLEANHATLAG
 1ubpC EDTLRAINGRVIHSFHVVEGAGGGHAPDIMAMAGHPNVLPSSNTPTRPFTVNTIDEHLDML
 36|1ubpC|gi|222 WNIYRMLQAADAFPVNLGFLGKGNSSQPQG-LIEQVQAGVVGLKLHEDWGSTPNAIDTCL
 12|1ubpC|gi|274 DQLEAGAIGFKIHEDWGSTPAAIYHCLNVA-DKYDVQVAIHTDTLNEAGCVEDTLQAIAG
 86|1ubpC|gi|335 NIGFTGKGSSALPESLIEQIHAGAIGLKVH-EDWGATPATIDCCLNVADNFDVQVSIHTD
 6|1ubpC|gi|1931 ANLGGDYPDWLAGTGPATGTNATTCTPGSW-NIGRMLQAADAFPINMGFLGKGNASLPQS
 7|1ubpC|gi|2300 PSAIDVCLSVAEKWDVQVAIHTDTLNESEGF-VENTTAAFKGRTIHAFHTEGAGGGHAPDI
 16|1ubpC|gi|586 WNIHRMLQAEEFPINLGLGKGNCSDEAP-LKEQIEAGAVGLKLHEDWGSTAAAIDTCL
 2|1ubpC|gi|1567 GTLGVNDGEVAHKCGFTGAPTVEYSMMARDSMIAJETGARLHIQHLSAGESVEVVRFAK
 42|1ubpC|gi|229 VTTMIGGGTGPATGTIYATTVPGPWYMERM-LQAADAYPMNIGFLGKGNASLAAPLTEQV
 19|1ubpC|gi|230 WHIGKMLQAGESFAMNLGFLGKGNASLPQG-LNEQLEAGALGLKLHEDWGTTTPASIDNCL
 25|1ubpC|gi|134 WHMARMIQSFDAFPMNIGLSGKGN-ASLPAALEEMVLGGACSLKLHEDWGTTTPAIDCCL
 43|1ubpC|gi|160 TINEAGFLENTLDAIGDRVIHTYHIEGAGG-GHAPDIMKLASYANILPSSTTPTIPYTVN
 80|1ubpC|gi|338 FHISRMLQAAEGLPMNLGFFGKGN-ASTAEALEEQVLGACGLKLHEDWGTTTPAIDCCL
 39|1ubpC|gi|158 LTSGITTMIGG-GTGPTAGSNATTCTPGPW-YIYQMLQAADSLPVNIGLLGKGNCSNPDA
 53|1ubpC|gi|152 FDMKMLQSTDLSPLNFGFTGKGNTAKPLE-LRHIVEAGAMGLKLHEDWGTTTPAIDNCL
 85|1ubpC|gi|174 SHMKMLQSTDLPINMGFTGKGN-TTKPDGLAEIIKAGAMGLKLHEDWGSTPAAIDNCL
 44|1ubpC|gi|322 IGGGTGPAAGTNATTCTPGKWNMHQMLRAA-ESYAMNLGFFGKGNSSNEEGLEEIKAGA
 72|1ubpC|gi|259 IHTDTINEGGYLENTIAAMKDRTIHTFHTE-GAGGGHAPDIIAVVQGDVLPSSNTPTRP
 50|1ubpC|gi|229 GPWHIGRMIQSFAFPMNLGISGKGNAALPGPLKEMIEGGACALKLHEDWGTTTPAIDNC
 3|1ubpC|gi|2302 FNIRKMLEAAEDFPVNLGFLGKGNASFETP-LIEQIEAGAIGLKLHEDWGTTTPKAIDTCL
 81|1ubpC|gi|465 PAAIDNCLTIAEHHDIIQINIHTDTLNEAGF-VEHSIAAFKGRTIHTYHSEGAGGGHAPDI
 83|1ubpC|gi|269 YLARMLQAADSLPINIGLLGKGNASRPDAL-REQIAAGAVGLKLHEDWGSTPAAIDCCLG
 21|1ubpC|gi|156 EAGAIGLKLHEDWGTTTPAAIRTCLSVADRM-DVQVAIHTDTLNEAGFVEDTIKAIGDRVI
 13|1ubpC|gi|103 PAAINNCLNVADEMVDVQVAIHSDTLNEGGF-YEETVRAIGDRVIHVHTEGAGGGHAPDV
 70|1ubpC|gi|123 WHISRMLQSFEAFPMNLALAGKGN-ASLPEGLVEQVKAGACALKLHEDWGTTTPAIDCCL

 1a0cA FCFHDRDIAPEGDTLRETNKNLDTIVAMIKDYLKTSKTKVLWGTANLFSNPRFVHGASTS
 13|1a0cA|gi|375 IGFQGTLLIEPKPQEPTKHQYDYDVATV--YGFLKQFGLENEIKVNIEANHATLAGHSFQ
 55|1a0cA|gi|139 KLIGWDIDEFPSDLYEATAAMYEVVENG-SIGPRGGLNFDAPRRSSFAANDLFYGHIVG
 24|1a0cA|gi|333 LHMAVDYAKEIGFDGQFLIEPKPKEPTK--HQYDFDVATALAFLQTYGLKDYFKFNIEAN
 28|1a0cA|gi|134 QILQA-----
 2|1a0cA|gi|3247 -----
 23|1a0cA|gi|343 EVTHYLG-GENYVFWGGRE-GYQTLNLT-DMKRELDHL-ASFLQ-A--AVDYKKKIGFNG
 3|1a0cA|gi|3203 LEKEIKVNIEANHATLAGHTFQHEIATA-AALDIFGSIDANRGDPQLGWDTDQFPNSVEE
 29|1a0cA|gi|229 -----RFLHM
 39|1a0cA|gi|613 -----VFRYAAAQVKKG-L
 53|1a0cA|gi|613 AMAFIQKYNLEDSFKLNLEANHATLAGH--TFEHELNVAKNYNALGSLDANQGDLGLWD
 22|1a0cA|gi|156 AVDYAKEIGFDAQFLIEPKPKEPTKHQYDFDVATGIAFLKTHGLDEHFKNIEANHATLA
 43|1a0cA|gi|212 RDYGRAIGFKGNFLIEPKPEMPMKHQYDFDSATVIGFLRQHGLDQDFKLNIEANHATL-S
 8|1a0cA|gi|1676 DTDQFPISVEENALVMEILKAGGFTTGGLNFDAPRRQSTDKYDLFYGHIGAMDTMALS
 54|1a0cA|gi|139 LAMYEILKNGGLAPGGLNFDAPRRTSFKQEDLILTHIAGMDTFALGLRVAYKMIEDNFF
 42|1a0cA|gi|324 MILKH-----
 30|1a0cA|gi|158 HVLAG-----
 18|1a0cA|gi|117 -----
 31|1a0cA|gi|288 GFTHGGYNFDSKVRRQSLDDVDLFGHV--AAMDVLALSLERAAAM-----

59|1a0cA|gi|230 RGQGFTGNFFIEPKPMEPSKHQYDFDSE-TVIGFLRHHGLDKDFKLNIENTNHATLANH-T
 51|1a0cA|gi|174 -----SLKATNDQLDIVTDYIKEKQGDKFKCLWG
 37|1a0cA|gi|293 VNGAASTNNANVYIAAAAQVKKGLDVSKKLGGENYVFWGGREGYETLLNTDMKFEQDNIA
 35|1a0cA|gi|231 -----
 48|1a0cA|gi|716 -----
 36|1a0cA|gi|613 HTFEHELVAALHDMLSIDANQGDLLL--GWDTEFPTDLYSAVLAMYEILKAGGFKTG
 1ubpC MVCHHLKQNIPEVAFADSRIRPETIAAEDILHDLG-----
 36|1ubpC|gi|222 SVAEDYDIQVAIHTDTLNESGFVEDTIA-AFKNRTIHAYHTEGAGGGHAPDIIKLCGQAN
 12|1ubpC|gi|274 RTIHTFHTEGAGGGHAPDVIKMSGFNI-LPASTNPTIPFTVNTEAEHMDMLMVCHHLDK
 86|1ubpC|gi|335 TLNESGFLETTISAIKNRTIHAYHVEGA-GGGHSPDIIRICELNNVLPSSSTNPTLPYTIN
 6|1ubpC|gi|1931 LEEQVRAGVLGLKLHEDWGTTTPAAIDNC-LSVAERFDVQVTIHTDTLNESGFVEDTIAAF
 7|1ubpC|gi|2300 IKLCGEANVLPSSSTNPTRPFTTRNTLDEHLDMLMVCHHLSRIPEDVAFSAESRIRRETIAA
 16|1ubpC|gi|586 KVADRYDVQVAIHTDTLNEGGFVEDTLK-AIDGRVIHTYHTEGAGGGHAPDIIKAAGFPN
 2|1ubpC|gi|1567 NLGAKITAEVTPQHFSITEQMIFEQGTNAKLNPLRSTTDIGKIIIEGLKDGTDIVIATDH
 42|1ubpC|gi|229 EAGAIGLKLHEDWGTTTPQAIDTCLSVAD-ATDTQVAIHTDTLNEGGFVEATIAAFKGRTI
 19|1ubpC|gi|230 TVAENY-----DVQVAIHTDTLNESGFVEDTLAAFKGRTIHTYHTEGAGGGHAPDIIKA
 25|1ubpC|gi|134 SVADDYDVQVMIHTDTLNESGFVENTVA-AIKGRTIHAFHTEGAGGGHAPDIIKVCGLPN
 43|1ubpC|gi|160 TMDEHLDMMMVCHH-----LDAKVPEDVAFSHSRIRAATIAAEDILHDIGAISMTS
 80|1ubpC|gi|338 SVADRFDVQVCIHTDTLNEAGFVEDTIR-AIGGRTIHTFHTEGAGGGHAPDIIIRICGESN
 39|1ubpC|gi|158 LREQVAAGVIGLKIHEWDGATPAVI-NCALTVADEMDVQVALHSDTLNESGFVEDTLTAI
 53|1ubpC|gi|152 AVAAEYDIQVNIHTDTLNESGFVEHTIN-AFRGRTIHTYHSEGAGGGHAPDIIIRVCGVKN
 85|1ubpC|gi|174 SVAEAFDIQVNIHTDTLNESGCVEHTIA-AFKDRTIHTYHSEGAGGGHAPDIIKVCVGN
 44|1ubpC|gi|322 LGLKVHEDWGSTPAAINHALNVAQKYDV-QVAIHTDTLNEAGCVEDTMKAIDGRTIHTFH
 72|1ubpC|gi|259 YTVNTLDEHLDMLMVCHHLHANIAEDLA-FAESRIRKETIAAEDILHDMGAISMSSDSQ
 50|1ubpC|gi|229 LTVADAYDIQVMIHTDTLNESGFVEDTVKAFKGRTIHAFHTEGAGGGHAPDIIKVASLEN
 3|1ubpC|gi|2302 KVADLFDVQVAIHTDTLNEAGFVENTIA-AIAGRTIHTYHTEGAGGGHAPDIIKIASRMN
 81|1ubpC|gi|465 IKVCGIKNVLPSSSTNPTRPPLTSNTIDEHLDMLMVCHHLDREIPEDLAFASHRIRKKTIAA
 83|1ubpC|gi|269 VAEEMDIQVAIHTDTLNESGCIEDTLAA-IGDRTIHTFHTEGA-----GGGHAPDII
 21|1ubpC|gi|156 HTYHTEGAGGGHAPDIMKVAGLPNVLP-STNPTRPFTVNTIDEHLDMLMVCHHLDPNVP
 13|1ubpC|gi|103 IKSVGEPNIIPASTNPTMPYTINTVDEHLDMLMVCHHLDPSIPEDVAFSAESRIRRETIAA
 70|1ubpC|gi|123 TVAEDMDVQVMIHTDTLNESGFVENTLA-AFKGRTIHAFHTEGAGGGHAPDILKVSSQN

 1a0cA CNADVFAYSAAQVKKALEITKELGGENYVFWGGREGYETLLNTDMEFELDNFARFLHMAV
 13|1a0cA|gi|375 HEVATAIALGILGSIDANRGDAQLGWDTDQFPNSVEENSLVMEILKAGGFTTGGLNFDA
 55|1a0cA|gi|139 IDTFAAGLRVALKMKQDGFLEKLVADRYSSYQSGVGAIEAGTADFKSLESYAIDKPQSE
 24|1a0cA|gi|333 HATLAGHTFEHELVARIHGMLGSVDANQGDMLLGWDTEFPTDLYSTTLAMYEILKNGG
 28|1a0cA|gi|134 -----GGFKTGGTNFDACLRRQSLD
 2|1a0cA|gi|3247 -----
 23|1a0cA|gi|343 TLLIEPKPQEP-TKHQYD-W-DVATTFSFLQK-Y--G-LTGEFKINVECNAH-T-LS--G
 3|1a0cA|gi|3203 NTLVMEILKAGGFTTGGFNFDAKIRRQSTDPYDLFHGHIGAIDVLALS LKRAAKMIEDK
 29|1a0cA|gi|229 VVDHAHKIGFKGSLLEIEPKPQEPTKHQYDYDVATVHGFLQHGLEKEIRVNIEANHATLA
 39|1a0cA|gi|613 ETAKELGAENYVFWGGREGYETLLNTNLQLELDNLARFMHMAVD-YATEIGYTGGFLIEP
 53|1a0cA|gi|613 TDEFPTDIYTATLAMYEVLDFGGIAPGGLNFDAKVRRTSFAMDDLILAHIAGMDTYARGL
 22|1a0cA|gi|156 GHTFEHELHLARIHDMLSVDANQGD TLLGWDTEFPTDLYTTTLAMYEILKNDGLGKGG
 43|1a0cA|gi|212 GHSFEHDLQVASDAGLLGSIDANRGNPQNGWTDQFPTDLYDTVGAMLVVLRQGLAPGG
 8|1a0cA|gi|1676 LKIAARMVEDGELDKRVAKRYAGWNGELGQQILKG-----
 54|1a0cA|gi|139 ENIMDEKYKSFNEGIGKKIVEGETSLKELEDYAFNINTINNTSDHLEVIKSQINQYI---
 42|1a0cA|gi|324 -----GGIGTGGVNFDKVRRESFE

30|1a0cA|gi|158 -----GGFKNGGTNFD SKLRRQSLD
18|1a0cA|gi|117 -----ATTCSADVFA YAAAQVKKALEITKELGGEGYVFWGGRE
31|1a0cA|gi|288 -----
59|1a0cA|gi|230 MDHEMTVAANAGMLGSIDANRGDYQNAWDTDQFPYN-----
51|1a0cA|gi|174 TAKCFDHPRFMHGAGTSPSADVFASFSAQIKKALESTVKLGNGYVFWGGREGYETLLNT
37|1a0cA|gi|293 RLFKMAIFYGEKIGHKPQFLIEPKPKEPSKHQYDFDAATTMAFILKYGLEKDFKLNLEAN
35|1a0cA|gi|231 -----ASSNNADVFA YAAAKVKKGLEVGKELGAENYVFWGGRE
48|1a0cA|gi|716 -----
36|1a0cA|gi|613 GINFDKVRPSFADEDLFHAHIAGMDTYAVGLKVASRLLEDKALDQVIEERYESYTKGI
1ubpC -----
36|1ubpC|gi|222 VLPSSTNPTRPYTVNTLDEHLDMLMVCHHLDPSIPEDVAF AESRIRRETIAAEDILHDLG
12|1ubpC|gi|274 NIKEDVQFADSRIRPQTIAAEDKLHDMGIFSITSSDSQAMGRVGEVITRTWQTADKNKKE
86|1ubpC|gi|335 TVDEHLDMMMVCHNLNCLNPEDIAFAESRIRRETIAAEDILHDLGALSMISSDSQAMGRI
6|1ubpC|gi|1931 KDRTIHTYHTEGAGGGHAPDIIKACGEANVLPSSTNPPTPTANTVDEHLDMLMVCHHLD
7|1ubpC|gi|2300 EDILHDLGAFSMIASDSQAMGRVGEVIIRTWQTADKMKRQRGALPEERGQNDNQVRKRYI
16|1ubpC|gi|586 ILPSSTNPTRPYTINTLEEHL DMLMVCHHLDANIPEDIAFADSRIRKETIAAEDVLHDLG
2|1ubpC|gi|1567 APHTREEKNVSLDKAPSGMIGLETSLQLGLTNLVAKGHLTSELLTKMTVNP AKLYNFDA
42|1ubpC|gi|229 HTYHTEGAGGGHAPDIIKVCGEANVLPSSTNPTRPYTVNTLDEHLDMLMVCHHLDPAIAE
19|1ubpC|gi|230 CGSSNVLPSTNPTRPYTVNTVDEHLDMLMVCHHLDPNIPEDVAFADSRIRKETIAAEDI
25|1ubpC|gi|134 VIPSTNPTRPYTVNTLAEHL DMLMVCHHLSIPSIPEDIAFAESRIRKETIAAEDILHDIG
43|1ubpC|gi|160 SDSQAMGRVGEVIIRTWQVADKMKKQRGALAGENGNDNVR AKRYIAKYTINPAITHGLSH
80|1ubpC|gi|338 VLPSSTNPTRPYTRNTLEEHL DMLMVCHHLDPAIPEDVAF AESRIRRETIAAEDILHDLG
39|1ubpC|gi|158 GGRTIHTFHTEGAGGGHAPDIIITACAHPNILPSSTNP TLPTVNTIDEHL DMLMVCHHLD
53|1ubpC|gi|152 VLPSSTNPTRPYTKNTVDEHL DMLMVCHHLDKNIPEDVAF AESRIRAETIAAEDILHDMG
85|1ubpC|gi|174 VLPSSTNPTRPFTLNTVDEHL DMLMVCHHLDNRNIPEDVAF AESRIRAETIAAEDILHDMG
44|1ubpC|gi|322 TEGAGGGHAPDIIKAAGEPNILPASTNP TIPFTKNTADEHL DMLMVCHHLDKKIKEDVAF
72|1ubpC|gi|259 AMGRIGEVVLR TWQTAHKMKIQRGSLQEDTSKSDNFRVKRYIAKYTINPAITHGVSHVIG
50|1ubpC|gi|229 VLPSSTNPTRPFTTRNTIDEHL DMLMVCHHLDPSIAEDLAF AESRIRKETIAAEDI-----
3|1ubpC|gi|2302 VLPSSTNP TMPFTVNTLDEHL DMLMVCHHLD SKVKEDVAFADSRIRPETIAAEDILHDMG
81|1ubpC|gi|465 EDVLNDIGAISI ISSDSQAMGRVGEVISRTWQTADKMK AQTGPLKCD-SSDNDNFRIRRY
83|1ubpC|gi|269 RAAGQANVLPSSTNP TLPTINTVDEHL DMLMVCHHLDPSIAEDVAF AESRIRRETIAAE
21|1ubpC|gi|156 EDVAFADSRIRPETIAAEDILQDLGVISMISSDSQAMGRVGEVIIRTWQTADKMKKQRGA
13|1ubpC|gi|103 EDILHDLGAISVMSSDSQAMGRVGEVITRTWQCANKMKLQRGSLEGDSVFNDNQRIKRYV
70|1ubpC|gi|123 VIPSTNPTRPYTKNTVEEHL DMLMVCHHLDNKVPEDVAF AESRIRKETIAAEDILHDMG

1a0cA DYAKEIGFEGQFLIEPKPK EPTKHQYDFDVANVLAFLRKYDL DKYF-KVNIEANHATLAF
13|1a0cA|gi|375 KVRQRSIDIDDLFYGHIGAIDTMLSLSKSAVKILVDG-KL-DE-Y--V-AQRYSGWNSSEL
55|1a0cA|gi|139 LIAATSSDPLEEVKDTINHYI-----
24|1a0cA|gi|333 LGRGGLNFDKVRRG SFEPEDLFYAHIAGMDSFAVGLKVAHRLIEDRV-FDEFIEERYKS
28|1a0cA|gi|134 PQDLLIGHIGMDACARGLKAAARMVEDKALSAPLAERYAGWNSAE-GKAMLSGKRTLED
2|1a0cA|gi|3247 -----
23|1a0cA|gi|343 H-SCHHELETA--RINGLL--GNIDANTGDPQIGWDTDQFLTDISE-A-TLVMSSVVKN-
3|1a0cA|gi|3203 TLQGIVDQRYAGWNGDLGQQLAGKASLEDLAKIVE--SK-AL-D--P-KPVSGQQEYLE
29|1a0cA|gi|229 GHSFHHEIATAYALGIFGSVDANRGDPQNGWDTDQFPNSVEELTLA-FYEILKHGGFTTG
39|1a0cA|gi|613 KPKEPTTHQYDTDAATTISFLRQYGLDKYFKLNLEANHATLAGHTFEHEL RVARVQGLLG
53|1a0cA|gi|613 RAAAKMKDDNFFEQIIANRYESFSSGIGKQIVENKED-LE-SL-T--N-YALSLNGVENK
22|1a0cA|gi|156 LNFDKVRRG SF EANDLFHAHIAGMDSFAIGLKVA-----
43|1a0cA|gi|212 LNFDKVRRESSDPQDLFLAHIGGMDAFARGLEVA-----

8|1a0cA|gi|1676 -----
54|1a0cA|gi|139 -----
42|1a0cA|gi|324 PIDLFHAHIGGMDAFAKGLKIAAAIRASGELADFVKNRYSTWDSGI-GAKIEAGEVGFAE
30|1a0cA|gi|158 PQDLLIGHIGGMDCCARGLKAAMKIEDGALSKPLSERYAKWDSPE-AQKMLRGELKLEE
18|1a0cA|gi|117 GYETLLNTDLGFELENLARFLRMAVDYAKRIGFTGQ--FL-IE-P--K-PKEPTKHQYDF
31|1a0cA|gi|288 -----VQNDKL
59|1a0cA|gi|230 -----
51|1a0cA|gi|174 NMGLELDNMARLMKMAVEYGRSIGFGDFYIEPKPKE-PT-KH-Q--Y-DFDTATVLGFL
37|1a0cA|gi|293 HATLAGHTFEHELNVARNYGALGSIDANQGDVLLGWDTEFPTNVY-DVTLAMYEILENG
35|1a0cA|gi|231 GYETLLNTNMKLELDNLRFFHMAKDYANEIDFNAQ--FL-IE-P--K-PKEPTSHQYDF
48|1a0cA|gi|716 ----GTFLIEPKPMEPTKHQYDVTETAIGFLKAHNLDKDFKVNIE-V-NHA-----
36|1a0cA|gi|613 GLEIKEGRDLDKLAAYALENDHIENQSGRQERLKAT-VN-RY-L-----
1ubpC ----IISMSTDALAMGRAGEMVLRTWQTADKMKKQ--RG-PL-A--E-EKNGSDNFRLK
36|1ubpC|gi|222 AFSIISSDSQAMGRVGESIIRTWQTAHKMKVQRGHLR-DP-QR-PGVD-HDNFRARRYVA
12|1ubpC|gi|274 FGRLPEEKGDNDNFRIKRYISKYTINPAIAHGISEY--VG-SV-E--V-GKFADLVLWSP
86|1ubpC|gi|335 GETILRTWQTAHKMKLQRGSLGDDQYNDNTRIKRY--IA-KY-T--I-NPAITHGIAHE
6|1ubpC|gi|1931 PSIPEDVAFAESRIRRETISAEDALHDMGALSMHGS--DS-QA-M--G-RVGEVILRTWQ
7|1ubpC|gi|2300 AKYTINPAITHGIAHYVGSVAVGKLADLVWKPMPFGVKPDLVLKC-GTIAAAMGDPNA
16|1ubpC|gi|586 VFSSIISSDSQAMGRVGEVIIRTWQTAHKMKKQRGKL--Q--ED-N--GVGDNFRVKRYIA
2|1ubpC|gi|1567 GYLAENGADLVIFDAENDYQVGETFDSKATNSPFIKQKVGQGVKY-TICDGKIVY----
42|1ubpC|gi|229 DIAFAESRIRRETIAAEDILHDLGAFSSIISSDSQAM--GR-VG-E--V-IIRTWQTAHKM
19|1ubpC|gi|230 LHDLGAFSMIASDSQAMGRVGEVICRTWQTAHKMKVQRGLLPEDEG-T-GADNFRAKRYI
25|1ubpC|gi|134 AFSIISSDSQAMGRVGEVAIRTWQTAHKMKRQRGALP-Q--E-TG--D-NDNFRVRRYIA
43|1ubpC|gi|160 EVGSVEKGLADLVLDVPVFFGVKPELVKGGMIARAQMGPNASI-PTPEPVFMRQMYA
80|1ubpC|gi|338 AFSIIASDSQAMGRVGEVITRTFTQTAHKMKVQRGPLPEDAANPRGS-R-NDNNRIKRYIA
39|1ubpC|gi|158 PDIAEDVAFAESRIRQETIAAEDVLHDLGAFSLTSS--DS-QA-M--G-RVGEVILRTWQ
53|1ubpC|gi|152 AISIISSDSQAMGRIGEVISRTWQTAHKMKAQRGAI--DP-NM-A--D-DDNSRIKRYIA
85|1ubpC|gi|174 AISIISSDSQAMGRIGEVITRTWQTANKMKRQRGLPISSSPDAAE-D-NDNFRIRRYIA
44|1ubpC|gi|322 ADSRIRPETIAAEDTLHDMGIFSITSSDSQAMGRVGEVITRTWQTA-D-KCKNEFGALKE
72|1ubpC|gi|259 SVEVGKYADLVLRPAFFGVKPSMILKGGMITAALM--GD-PN-A--S-IPTPQPVHYRY
50|1ubpC|gi|229 -----LHDLGALSMMSSDSQAMGRLGEVIIRTW--QT-AD-K--M-KKQRGALPQDS
3|1ubpC|gi|2302 VFSSMSSDSQAMGRVGEVIIRTWQTAHKMKLQRGAL--PG-EK-S--G-CDNIRAKRYLA
81|1ubpC|gi|465 IAKYTINPAIANGFSQYVGSVEVGKLADLVWKPSPF--FG-TK-P--E-MVIKGGMVAWA
83|1ubpC|gi|269 DILHDMGAFAMTSSDSQAMGRVGEVILRTWQVAHQMKLRRGPLAPD-T-PYSDNFRVKRY
21|1ubpC|gi|156 LAEDQKGKNDNVRIKRYVSKYTINPAITHGIDDYVGSVEVGKLADL-VLWDPFRFFGVKPE
13|1ubpC|gi|103 AKYTINPAIAHGISEVGSIEVGKLADIVIWDPAFFGIKPALVVKC-GLVAYAPMGDVNA
70|1ubpC|gi|123 AMAVISSDSQAMGRVGEIIRCWQTADKMRKQRGLAE-E-T--G--A-NDNFRVRRYIA

1a0cA HDFQHELRYARINGVL--GSIDANTGDMLLGWDTDQFPTDIRMTTLAMYEVIKMGFDKG
13|1a0cA|gi|375 GRDILEGKMTLDEVAH-YAETLVQEPKHRSGQELLENLINRYIY-----
55|1a0cA|gi|139 -----
24|1a0cA|gi|333 YTEGIGREIVEGTADF-HKLEAHALQLGEIQNQSG-----RQERLKTLLNQYL-----
28|1a0cA|gi|134 I-AERVVKKKIEPQPSRGRQELLENIIVNRYV-----
2|1a0cA|gi|3247 -----KHGLSLTHA
23|1a0cA|gi|343 -GGLAPGGFN-F-DAK-LRRES---TD-VEDM--FL-A----HISGMDTL-AR-GLRNVV
3|1a0cA|gi|3203 NLVNNYIY-----
29|1a0cA|gi|229 GMNFDSKVRQRQSVDP-E-DLFYGHIGAIIDNLALAVERAALVLIENDRLDQFKRQRYAGWDAD
39|1a0cA|gi|613 SVDANQGDPLLGWDTDEFPTDLYSTTLAMYEILQNGGLGS-----GGLNFDKVRRGSGF

53|1a0cA|gi|613 SGHIEHLKSLNDYL-----
22|1a0cA|gi|156 -----
43|1a0cA|gi|212 -----
8|1a0cA|gi|1676 -----
54|1a0cA|gi|139 -----
42|1a0cA|gi|324 LEAYMLEKGDVDANQS-GRQEYLEHMINKYI-----
30|1a0cA|gi|158 I-AALVERDDINPEPKPGRQEYLENVVNRVY-----
18|1a0cA|gi|117 DVATAYAFKSHGLDE--YFKFNIEANHATLAGHTFQHELRMARILGKLSIDANQGDLL
31|1a0cA|gi|288 QQFKDQRYAGWQQPFG-QSVLSGGFSLASLAEHAFANELNPQAVSGRQELLEGV-----
59|1a0cA|gi|230 -----INETVEMMMVVLRAAGGFQGGGVNFDAKRRRNSTDLEDTF
51|1a0cA|gi|174 RKYGLDKDFKMNIEN--HATLAQHTFQHELRVARDNGVFGSIDANQGDVLLGWDTDQFP
37|1a0cA|gi|293 GIEPGGINFDSKVRRS--SFEMEDLLLAHIAGMDTFARGLKSAMKLKEDRFFEDLKEQRY
35|1a0cA|gi|231 DVASGYAFLQNYDLQD--TFKFNIEANHATLAGHTFEHELHYARIHNMLGSVDANQGHPL
48|1a0cA|gi|716 -----TLAGHTFEHELACAVDAGMLGSIDANRGDY
36|1a0cA|gi|613 -----
1ubpC RYVSKYTINPAIAQGI-AHEVGSIEEGKFADLVLEPKFFGVKADRVIKGGIIAYAQIGD
36|1ubpC|gi|222 KYTINPAITHGIAEYVGSVEVGKIADLCLWKPAFFGVKPELVKGGVIAAYAQMGDANASI
12|1ubpC|gi|274 AFFGIKPNMIKGGFI-ALSQMGDANASIPTP-----QPVYYREMFHHG
86|1ubpC|gi|335 VGSVEIGKLADLVWSPVFFGVKPELIVKGGMIVSSVMGDPNASIPTPQPVYYRLMFGSY
6|1ubpC|gi|1931 SASVMKRDRTLPEDKGDHDFRIKRYIAKYTHNPAITHGIAHEIGSIEVGKLADLVLWK
7|1ubpC|gi|2300 SIPTPQPVHYRPMFGAFGGALTHSAVNFVSQAGLDGEIAQQFGLRKTLLPVVG-----
16|1ubpC|gi|586 KYTINPAIAHGIADYVGSVEVGKLADLVVWNPFAFFGVKPELVKGGMIAYSTMGDPNASI
2|1ubpC|gi|1567 -----
42|1ubpC|gi|229 AAQRGKLPGDPHDARG-GHDNFRVKRYIAKYTINPALTHGIAHEVGSIEVGKWADLVFWK
19|1ubpC|gi|230 AKYTINPALAHGVAHE-VGSIEVGKLADIILWKPAFFGVKPSLIKKGGAIAAAPMGDPNA
25|1ubpC|gi|134 KYTINPAIAHGLSKDIGSIAVGKRADLVLWNPFAFFGVKPDMLVGGMIAAAPMGDPNASI
43|1ubpC|gi|160 SYGKANRSTSITFMSQASIERGVAESLGLEKRISPVKNIKLSKLDMLNSALPKIEIDP
80|1ubpC|gi|338 KVTINPAIAHGIDNHVGSVEVGKLADLVLWKPFGFVGRPELVKGGSIWAQMGDANASI
39|1ubpC|gi|158 VAHRMKVQRGPLPEESGDNDNVRVKRYIAKYTINPALTHGIAHEVGSIEVGKLADLVLS
53|1ubpC|gi|152 KYTINPAIANGFADLIGSVEVKKLADLVWQPAFFGAKPEMIKGGNIAWANMGDANASI
85|1ubpC|gi|174 KYTINPAIVNGFSDVGSVEVGKLADLVWKPSSFFGAKPEMIKGGAIACANMGDPNASI
44|1ubpC|gi|322 ECGENDNFRIKRYISKYTINPAIAHGISEYVGSVEVGKFADLVLWKPSMFGIKPEMILKN
72|1ubpC|gi|259 MFGGYGGGVKTSCFTFTSQAALDGGVLDSLKLDKNLIAVKNTRNLRKKDMIHNATPKME
50|1ubpC|gi|229 ARNDNFRVKRYIAKYT-INPAIAHGVSKLIGSVETGKMADLVLWSPAFFGVKPDICIIGG
3|1ubpC|gi|2302 KYTINPAITHGISQYVGSLEKGIADLVLWKPAMFGVKPEMIKGGFIIAGRMGDANASI
81|1ubpC|gi|465 DIGDPNASIPTPEPVKMRPMYGTLGKAGGALSIAFVSKAALDQRVNVLYGLNKRVEAVSN
83|1ubpC|gi|269 IAKYTINPALTHGIGH-EVGSVEVGKLADLVLWSPAFFAVKPALVLKGGMIVTAPMGDIN
21|1ubpC|gi|156 LILKGGLIAYSQMGDPNASIPTPQPVSFMRPMFGSFGRARGTTSITFLSKAAMD LGVHEAL
13|1ubpC|gi|103 AIPTPQPVHYRPMYAS-YGKAMYSTSMIFMSQASIEAGVPEKLKLQSMIGQVKG-----
70|1ubpC|gi|123 KYTINPAITHGLAEHV-GSVEVGKRADLVLWHPAFFGAKPEMVLMMGGMIVAAQMGPNGS

1a0cA GLNFDKAVRRASFEPEDLFLGHIAGMDAFAKGFKVAYKLVKDRVFDKFIERYASYKD-G
13|1a0cA|gi|375 -----
55|1a0cA|gi|139 -----
24|1a0cA|gi|333 -----
28|1a0cA|gi|134 -----
2|1a0cA|gi|3247 EADHRAKARDFVKQMIDFGGKYNAPIIGSMQGWGGDISRDQALAFREALDELGPY-A
23|1a0cA|gi|343 KLI-EDGSLDELV-RKRYQ-S-----FDS----EIG-A----L---I-EA--GKGDF-E

3|1a0cA|gi|3203 -----
29|1a0cA|gi|229 FGRKILSGDYSLSTLATDALARGLNPQHASGHQELMENIVNQAIYS-----
39|1a0cA|gi|613 EQDDLLYAHVAGMDAFARG-LKVAHKLVEDRVFENVINER--YSSFKEGIGLEIVEGK-A
53|1a0cA|gi|613 -----
22|1a0cA|gi|156 -----NQLLEDRV-LEDVIDNRYKSYQSGIGQKI--ANNDTNLKELEAYALS-L
43|1a0cA|gi|212 -----DALLTSSP-LETWRAQRYASFDSGAGADF--ANGTSTLADLATYAAG-K
8|1a0cA|gi|1676 -----QLSLGE-L
54|1a0cA|gi|139 -----
42|1a0cA|gi|324 -----
30|1a0cA|gi|158 -----
18|1a0cA|gi|117 LGWDTDQFPTNVYDITLAMYEVIKAGGFTKGGLNFDKVR--RASYKVEDLFIGHIAG-M
31|1a0cA|gi|288 -----
59|1a0cA|gi|230 HGHIGGMDTFARALIIADRIIESKIESMRKERYASFDSGAGKQFETGALDLAALAEI-G
51|1a0cA|gi|174 TNIYDTTMCMEYEVIKAGGFTNGGLNFDKARRGSFTPEDI--FYYSIAGMDAFALGFR-A
37|1a0cA|gi|293 SSFKKGIGAKIISGKENLESNTYALKNDEPIIESSHIEYVKNILNDYLY-----
35|1a0cA|gi|231 LGWDTDEFPSDIYTTTLAMYEILKNDGLKGGLNFDKVR--RGSFTAEDLFHAHIAG-M
48|1a0cA|gi|716 QNGWDTDQFPIDQYELVQAWMEIIRGGGFVTGGTNFDAKT--RRNSTDLEDIIIAHVS-G
36|1a0cA|gi|613 -----
1ubpC PSASITPQPVMGRRMYGT-VGDLIHDTNITFMSKSSIQQ--GVPAKLGLKRRIGTVK-N
36|1ubpC|gi|222 PTPQPVHMQPMFASYGGC--RTTTSVTFMSQAGIANNIPE--QLGLQKTVPVGHIRQ-L
12|1ubpC|gi|274 KAKFDTNITFVSQVAYDNGIKEELGLQRVVLVKNCRNITKDLKFNDVTAHIEVNPE-T
86|1ubpC|gi|335 DLAKCATRMTFISQSSYD--VGVENLRLNSLIGISKRCR--NIKKDHMINNNLKPM-E
6|1ubpC|gi|1931 PAFFGVKPSLVKGGVIVTAPMGDPNASITPQPVHYRPMFGSFGGSRTASCVSFVSQ-A
7|1ubpC|gi|2300 -CRTIGKADMVHNSATPHM-EVDPETYEVRADGRLLTCEP--ATVPLAQRYFLF-----
16|1ubpC|gi|586 PTPQPVLYRPMFAAKGDA--KYQTSITFVSKAAYEKGIHE--QLGLKKKVKPVHGIRK-L
2|1ubpC|gi|1567 -----
42|1ubpC|gi|229 PAFFGVKPSLILKGGMIAA--AAMGDPNASITPQPVHYRP--MFASAGGALPRSSLTF-V
19|1ubpC|gi|230 SIPTPQPVHYRKMFGAYGQ--ACKQTSVSFVSQAADIASIS--DYFQLERRLVAVKNCR-S
25|1ubpC|gi|134 PTPQPMHYRPMFGAYGKA--RTNSSVTFVSKAALESGLHG--RLGVEKQFVAVENTRGGI
43|1ubpC|gi|160 KTYQVFADGEELSCQPVYVPLGQRYFLF-----
80|1ubpC|gi|338 PTPGPVHGRPMFAAFGKA--LAPSCLTFLSQAAIETDLPN--KLGLQRACIPVLNTRT-I
39|1ubpC|gi|158 PAFFGVKPATIVKGGMIA--MAPMGDINGSIPTPQPVHYR--PMFAALGSARHRCRV-F
53|1ubpC|gi|152 PTPEPVISRPMFGAFGKA--GSENSVAFVSKAALRKGVKE--LYGLKKRVVAVSNVRQ-L
85|1ubpC|gi|174 PTPEPVMMRPMFGAFGGAGSANSIA--FVSKAAKEAGVAVQYKLG-KRVEA-VGRVRG-L
44|1ubpC|gi|322 GMIVAANKIGDSNASIPTPEPVVYAPMFGSYGKA-----KYNCAITFVSKIAYDC-H
72|1ubpC|gi|259 VDPETYEVRADGQLLTCCG--A-----
50|1ubpC|gi|229 SIVAAPMGDPNASITPQP-VHYQPMFGAYGKALTASSVV--FTSQAAAAGNLARDLG-I
3|1ubpC|gi|2302 PTPQPVIIYKNMFGAFGKA--KYGTCVTFVSKASLENGVVE--KMGLQRKVLVQGCRRN-I
81|1ubpC|gi|465 VRKLTCLDMKLNDALEI--TVDPESYTVKADGKLLCVSE--ATTVPLSRNYFLF-----
83|1ubpC|gi|269 GSIPTPQPVHYRPMFGALGAARHATRMFTLPQAAMDRGLAEELNLRSLIGVVNGCRRV-R
21|1ubpC|gi|156 GLQKKIAHVKNCRSISKRSKMYNDATPNIEIDPETYEYKVDGEMITCKPFEEVALAQR-Y
13|1ubpC|gi|103 -CRNLSKQDMVHNSYTPTI-ELDSQTYLVKADGIPLVCEP--ATELPMTQRYFLF-----
70|1ubpC|gi|123 IPAQ-PFYTRPMFGAFGKA-LSNSAVTFVSAAAEAEGVAG--KLGLSKTVLPVKGTTRT-I

1a0cA IGADIVSGKADFRSLEKYALERSQIVNKSGRQELLESILNQYLFA-----
13|1a0cA|gi|375 -----
55|1a0cA|gi|139 -----
24|1a0cA|gi|333 -----

28|1a0cA|gi|134 -----
 2|1a0cA|gi|3247 AQYNVP-LFYEPLNRYETNLLRTVDEGVEFCKTLSTDNIKLLADLFHMNIEEADLAAAIR
 23|1a0cA|gi|343 T-LEKKVLEWGEP-I-V-PSGKQELA--EIL-FQ-A-A--L-----
 3|1a0cA|gi|3203 -----
 29|1a0cA|gi|229 -----
 39|1a0cA|gi|613 NFHTLE-QYAFKNPNIANKSGRQERLKSILNQYI-----
 53|1a0cA|gi|613 -----
 22|1a0cA|gi|156 GEIKHS-SGQKERIKATLNQYL-----
 43|1a0cA|gi|212 GEPTQL-SGRQEAYENLINQYL-----
 8|1a0cA|gi|1676 AQYAEQ-HNLAPVHQSGHQELLENLVNRYLF-----
 54|1a0cA|gi|139 -----
 42|1a0cA|gi|324 -----
 30|1a0cA|gi|158 -----
 18|1a0cA|gi|117 DTFALG-FKVAYKLVKDGVLDFEIEKYRSFREGIGRDIVEGKVDFEKLEEYIIDKETIE
 31|1a0cA|gi|288 -----
 59|1a0cA|gi|230 NAIGEPALTSGKQEYYENIINQYI-----
 51|1a0cA|gi|174 ALKLIE-DGRIDKFVADRYASWNTGIGADIIAGKADFASLEKYALEKGEVTASLSSGRQE
 37|1a0cA|gi|293 -----
 35|1a0cA|gi|231 DSFAIG-LKVAQRLMDDRVLNVVEDRYRSFNQIGRDIVSGKTDFHQLEKHALTLSEIT
 48|1a0cA|gi|716 MDAMAR-ALENAAKLLQESPYTKMKKERYASFDSGIGKDFEDGKLTLEQVVEYGKKNGEP
 36|1a0cA|gi|613 -----
 1ubpC CRNIGK-KDMKWNDVTDDIDINPETYEVKVDGEVLTCEPVKELPMAQRYFLF-----
 36|1ubpC|gi|222 RKADLK-LNDYLPHIEVDPETYEVRADGELLTCEPATVPLAQRYFLF-----
 12|1ubpC|gi|274 YKVKV--DGKEVTSKA-----
 86|1ubpC|gi|335 VDPQTY-EVRANGELLVCEP-----
 6|1ubpC|gi|1931 GLDEG--IGEKLGLQKRLVA---VKNIRGLRKSDLIHNNALPRIEVDPPQNYQVRADGQLL
 7|1ubpC|gi|2300 -----
 16|1ubpC|gi|586 TKKDLI-LNDKTPKIDVDPQTYEVKVDGQLVTCEPAEIVPMAQRYFLF-----
 2|1ubpC|gi|1567 -----
 42|1ubpC|gi|229 SQAALA-ANVGERYGLAKTLTAVRGTRTVSKRDMVHNDWQPHVTVPETYQVVADGQLLT
 19|1ubpC|gi|230 VTKADM-VHNAYQPHMEVDPETYEVRADGQLLTCEPAEELPMAQRYFLF-----
 25|1ubpC|gi|134 GKHSMV-LNDATPHVEVDPETYEVRADGELLTCEPATVPLMAQRY-FLF-----
 43|1ubpC|gi|160 -----
 80|1ubpC|gi|338 GKAEMH-NNNSLPKVEVDPQTYEVFADGDLTCDPAEELPMAQRY-LL-----
 39|1ubpC|gi|158 LSQAAA-ANGVAEQLNLHSTTAVVKGCRTVQKADMRHNSLLPDITVDSQTYEVRINGELI
 53|1ubpC|gi|152 TKLDMK-LNDALPEITVDPETYYVTANGEVLTCPADSVPLSRNYFLF-----
 85|1ubpC|gi|174 TKLNMK-LNDALPKIDVDPETYYVTADGEVLRCPPTPTVPLSRNYFLF-----
 44|1ubpC|gi|322 IKEELG-LERILLPVKNCRNITKKDMKFNDVITPIEVNPETYEVRVNNTKITSKPVEKVS
 72|1ubpC|gi|259 -----
 50|1ubpC|gi|229 AKKLVP-VSNVRGGISKSMIHNDATPKLEVDPEVDPETYEVRADGELLTCAPAEVLPLAQRYF
 3|1ubpC|gi|2302 SKKYMV-HNNATPEIEVDPETYEVKVDGEIITCEPLKVLMAQRYFLF-----
 81|1ubpC|gi|465 -----
 83|1ubpC|gi|269 -KPDMV-HNTLQPLIEVDAQTYQVRADGELLVCEPAELPLAQRYFLF-----
 21|1ubpC|gi|156 FLF-----
 13|1ubpC|gi|103 -----
 70|1ubpC|gi|123 GKASMR-LNSATPQIEVDPETYEVRADGEILTCEPAETLPLAQRYFLY-----
 1a0cA -----

13|1a0cA|gi|375 -----
55|1a0cA|gi|139 -----
24|1a0cA|gi|333 -----
28|1a0cA|gi|134 -----
2|1a0cA|gi|3247 AGKGYVGHIHFVDSNR-Q-
23|1a0cA|gi|343 -----
3|1a0cA|gi|3203 -----
29|1a0cA|gi|229 -----
39|1a0cA|gi|613 -----
53|1a0cA|gi|613 -----
22|1a0cA|gi|156 -----
43|1a0cA|gi|212 -----
8|1a0cA|gi|1676 -----
54|1a0cA|gi|139 -----
42|1a0cA|gi|324 -----
30|1a0cA|gi|158 -----
18|1a0cA|gi|117 LPSGKQEYLES LINSY-I-
31|1a0cA|gi|288 -----VNRFIY-T-
59|1a0cA|gi|230 -----
51|1a0cA|gi|174 MLESIVNNVLFS-----
37|1a0cA|gi|293 -----
35|1a0cA|gi|231 QPSGQLEVIKNKINQYLLT
48|1a0cA|gi|716 KQTSGKQELYEAIVAM-Y-
36|1a0cA|gi|613 -----
1ubpC -----
36|1ubpC|gi|222 -----
12|1ubpC|gi|274 ----ADKISLAQLYNL-F-
86|1ubpC|gi|335 ----VSVVPMSQRYFL-F-
6|1ubpC|gi|1931 WFEPSKVLPMARYFL-F-
7|1ubpC|gi|2300 -----
16|1ubpC|gi|586 -----
2|1ubpC|gi|1567 -----
42|1ubpC|gi|229 CEPATVLPMAQRYFLF----
19|1ubpC|gi|230 -----
25|1ubpC|gi|134 -----
43|1ubpC|gi|160 -----
80|1ubpC|gi|338 -----
39|1ubpC|gi|158 TSEPADILPMARYFL-F-
53|1ubpC|gi|152 -----
85|1ubpC|gi|174 -----
44|1ubpC|gi|322 LGQLYCLF-----
72|1ubpC|gi|259 ----EDVLPXAQRYFL-F-
50|1ubpC|gi|229 MF-----
3|1ubpC|gi|2302 -----
81|1ubpC|gi|465 -----
83|1ubpC|gi|269 -----
21|1ubpC|gi|156 -----
13|1ubpC|gi|103 -----

70|1ubpC|gi|123 -----

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