

Working with biological sequence data

Installing Biopython:

We will need a command prompt/terminal

- On OS X:
 - Open terminal window
or
 - Open terminal in Jupyter
- On Windows:
 - Go to "Start"
click "Run"
click "Command Prompt"

Home

localhost:8888/tree

ABP

jupyter

FilesRunningClusters

Select items to perform actions on them.

Home

anaconda

Applications

Box Sync

Desktop

Documents

Downloads

Dropbox

envs

github

Movies

Music

Upload

New

Text File

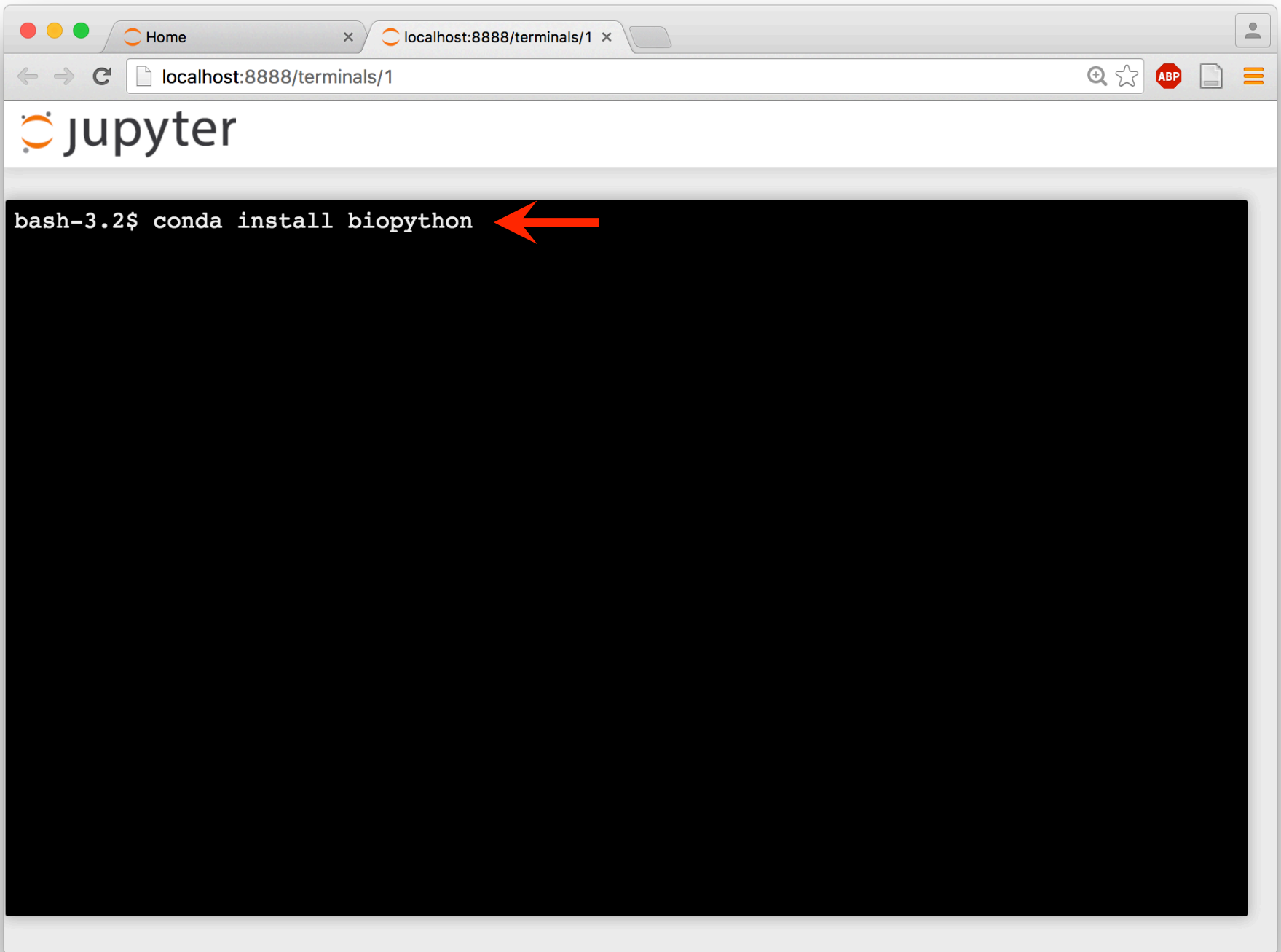
Folder

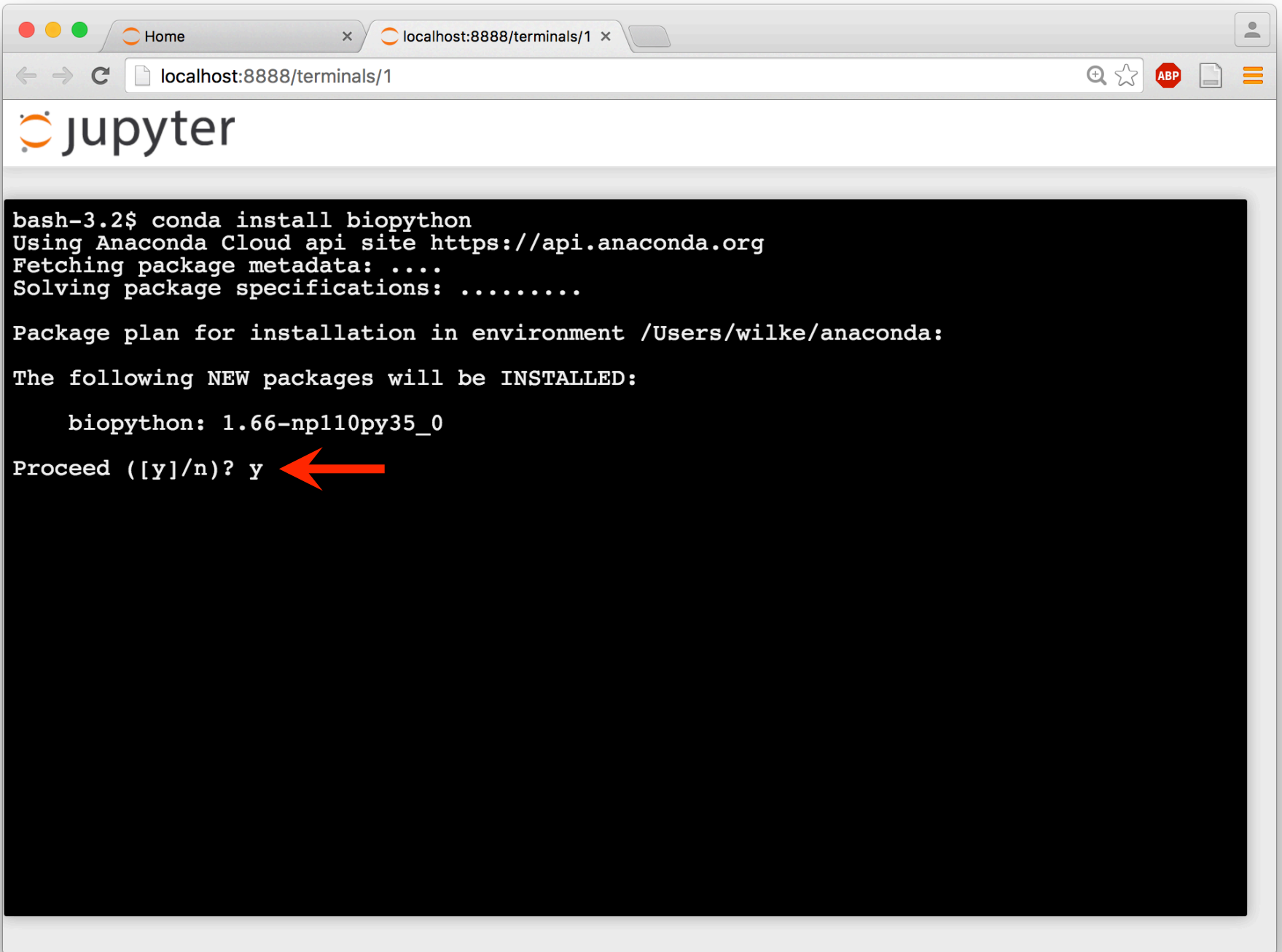
Terminal

Notebooks

Python 3

localhost:8888/tree#





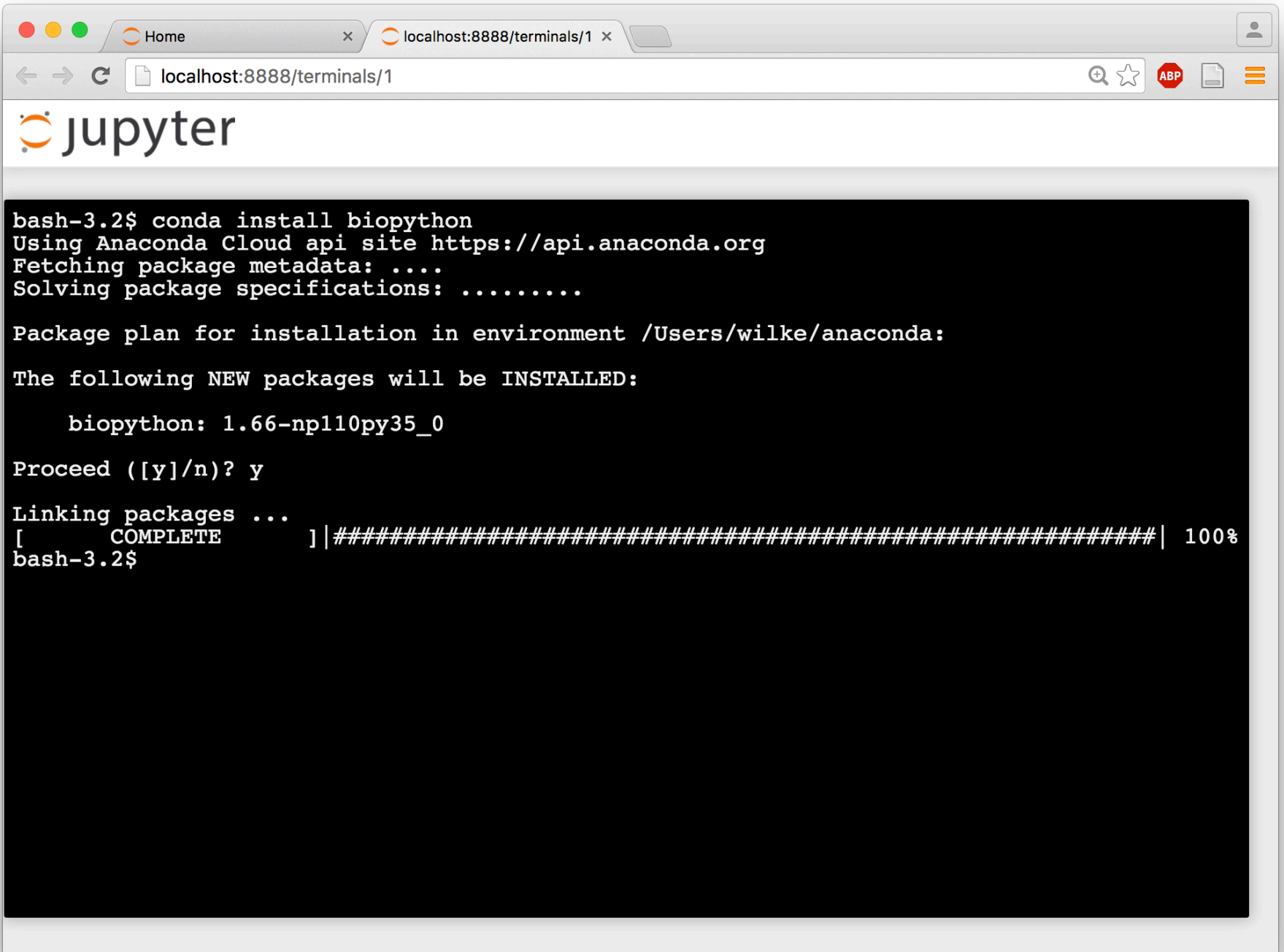
```
bash-3.2$ conda install biopython
Using Anaconda Cloud api site https://api.anaconda.org
Fetching package metadata: ....
Solving package specifications: .....

Package plan for installation in environment /Users/wilke/anaconda:

The following NEW packages will be INSTALLED:

    biopython: 1.66-np110py35_0

Proceed ([y]/n)? y
```



```
bash-3.2$ conda install biopython
Using Anaconda Cloud api site https://api.anaconda.org
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Package plan for installation in environment /Users/wilke/anaconda:

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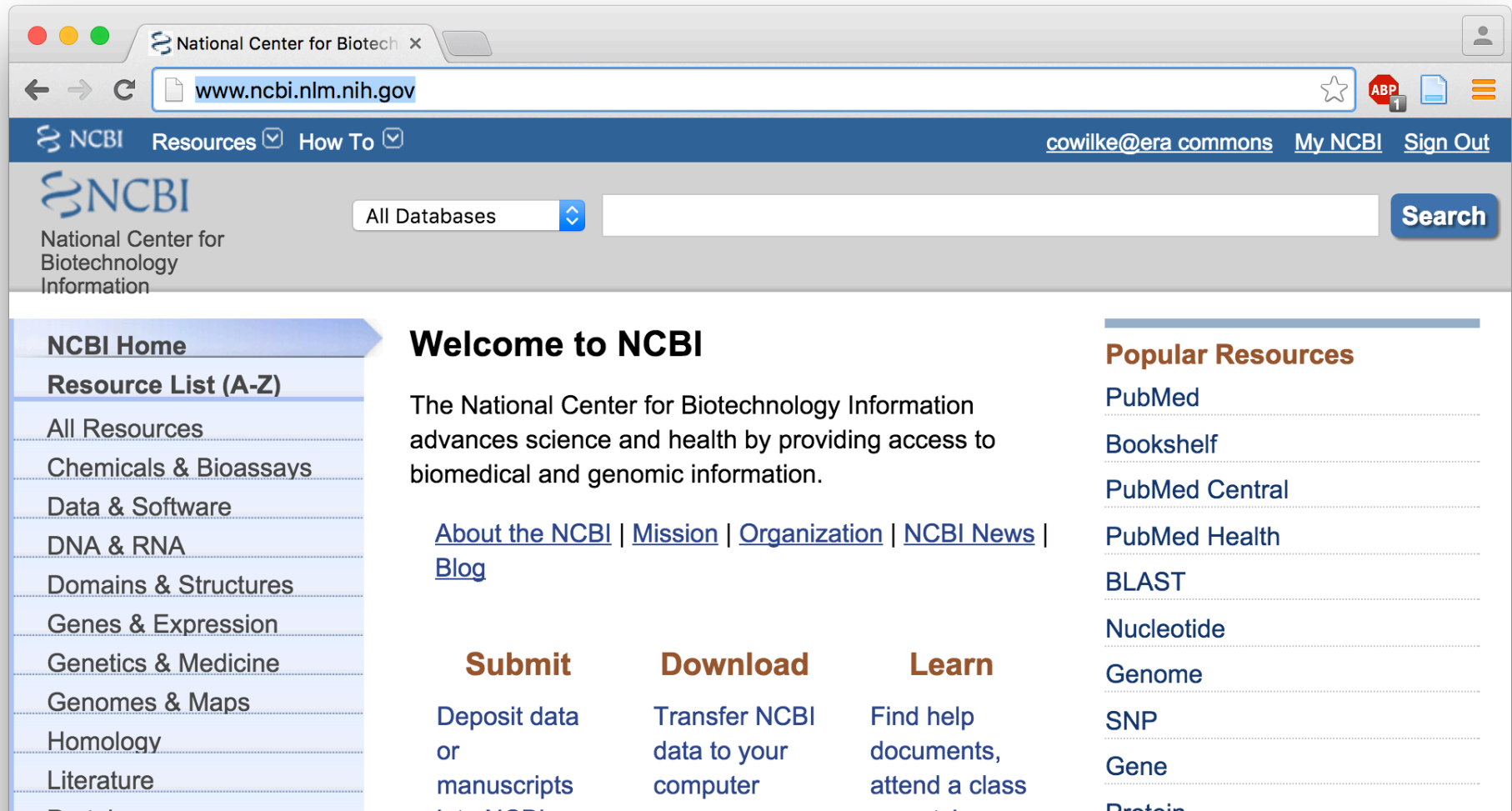
    biopython: 1.66-np110py35_0

Proceed ([y]/n)? y

Linking packages ...
[      COMPLETE      ]|#####| 100%
bash-3.2$
```

Getting biological data: The NCBI databases

<http://www.ncbi.nlm.nih.gov/>



The screenshot shows the NCBI website homepage. At the top, there's a browser window with the address bar showing 'www.ncbi.nlm.nih.gov'. Below the browser window, the NCBI logo is on the left, and a navigation bar contains 'Resources' and 'How To' dropdown menus. On the right of the navigation bar, there's a user profile icon, a star, a red 'ABP' icon, a document icon, and a hamburger menu icon. Below the navigation bar, there's a search bar with a dropdown menu set to 'All Databases' and a 'Search' button. On the left side, there's a 'NCBI Home' section with a 'Resource List (A-Z)' and a list of resources: All Resources, Chemicals & Bioassays, Data & Software, DNA & RNA, Domains & Structures, Genes & Expression, Genetics & Medicine, Genomes & Maps, Homology, and Literature. In the center, there's a 'Welcome to NCBI' section with a paragraph about the center's mission and a list of links: About the NCBI, Mission, Organization, NCBI News, and Blog. Below this, there are three columns: 'Submit' (Deposit data or manuscripts), 'Download' (Transfer NCBI data to your computer), and 'Learn' (Find help documents, attend a class). On the right side, there's a 'Popular Resources' section with a list of resources: PubMed, Bookshelf, PubMed Central, PubMed Health, BLAST, Nucleotide, Genome, SNP, Gene, and Protein.

National Center for Biotechnol x

← → ↻ www.ncbi.nlm.nih.gov ☆ ABP 1

NCBI Resources ▾ How To ▾ cowilke@era commons My NCBI Sign Out

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Biotechnology
Information

All Databases ▾ Search

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Data & Software
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Domains & Structures
Genes & Expression
Genetics & Medicine
Genomes & Maps
Homology
Literature

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Bookshelf
PubMed Central
PubMed Health
BLAST
Nucleotide
Genome
SNP
Gene
Protein

Try search for "KT220438"

The screenshot shows a web browser window with the address bar displaying `www.ncbi.nlm.nih.gov/gquery/?term=KT220438`. The page title is "KT220438 - GQuery: Glob: x". The NCBI logo and navigation links (Resources, How To) are visible in the header. The user is logged in as `cowilke@era commons` with links to "My NCBI" and "Sign Out".

The main heading is "Search NCBI databases" with a "Help" link. A search input field contains "KT220438" and a "Search" button. Below the search bar, the results are summarized as "Results found in 2 databases for 'KT220438'".

The search results are displayed in a light blue box:

- [Influenza A virus \(A/NewJersey/NHRC_93219/2015\(H3N2\)\) segment 4 hemagglutinin \(HA\) gene, complete cds](#)
- 1,701 bp cRNA.
- Lab_host: MDCK. Country: USA: New Jersey. Segment: 4. Isolation_source: nasopharyngeal swab. Collection_date: 17-Jan-2015.
- Accession: **KT220438.1** GI: 887493048
- [GenBank](#) [FASTA](#) [Graphics](#)

Below the search results, there are two sections: "Literature" and "Genes".

Literature		Genes	
Books	0	EST	0
MeSH	0		

Under "Literature", the text "books and reports" and "ontology used for PubMed indexing" is visible. Under "Genes", the text "expressed sequence tag sequences" and "collected information about" is visible.

Direct link to search results

<http://www.ncbi.nlm.nih.gov/gquery/?term=KT220438>

A genbank record is just a simple text file

LOCUS KT220438 1701 bp cRNA linear VRL 20-JUL-2015
 DEFINITION Influenza A virus (A/NewJersey/NHRC_93219/2015(H3N2)) segment 4
 hemagglutinin (HA) gene, complete cds.
 ACCESSION KT220438
 VERSION KT220438.1 GI:887493048
 KEYWORDS .
 SOURCE Influenza A virus (A/New Jersey/NHRC_93219/2015(H3N2))
 ORGANISM Influenza A virus (A/New Jersey/NHRC_93219/2015(H3N2))
 Viruses; ssRNA viruses; ssRNA negative-strand viruses;
 Orthomyxoviridae; Influenzavirus A.
 REFERENCE 1 (bases 1 to 1701)
 AUTHORS Sitz,C.R., Thammavong,H.L., Balansay-Ames,M.S., Hawksworth,A.W.,
 Myers,C.A. and Brice,G.T.
 TITLE GEISS Influenza Surveillance Response Program
 JOURNAL Unpublished
 REFERENCE 2 (bases 1 to 1701)
 AUTHORS Sitz,C.R., Thammavong,H.L., Balansay-Ames,M.S., Hawksworth,A.W.,
 Myers,C.A. and Brice,G.T.
 TITLE Direct Submission
 JOURNAL Submitted (29-JUN-2015) Operational Infectious Diseases, Naval
 Health Research Center, 140 Sylvester Rd., San Diego, CA 92106, USA
 COMMENT ##Assembly-Data-START##
 Sequencing Technology :: Sanger dideoxy sequencing
 ##Assembly-Data-END##
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 Jersey/NHRC_93219/2015(H3N2))"
 /mol_type="viral cRNA"
 /strain="A/NewJersey/NHRC_93219/2015"
 /serotype="H3N2"

FEATURES

source

Location/Qualifiers

1..1701

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Jersey/NHRC_93219/2015(H3N2))"

/mol_type="viral cRNA"

/strain="A/NewJersey/NHRC_93219/2015"

/serotype="H3N2"

/isolation_source="nasopharyngeal swab"

/host="Homo sapiens"

/db_xref="taxon:1682360"

/segment="4"

/lab_host="MDCK"

/country="USA: New Jersey"

/collection_date="17-Jan-2015"

gene

1..1701

/gene="HA"

CDS

1..1701

/gene="HA"

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/codon_start=1

/product="hemagglutinin"

/protein_id="AKQ43545.1"

/db_xref="GI:887493049"

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SSFFSRLNWLTHLNYTYPALNVTMPNNEQFDKLYIWGVHHPGTDKDQIFLYAQSSGRI
TVSTKRSQQAVIPNIGSRPRIRDIPSRSISYWTIVKPGDILLINSTGNLIAPRGYFKI
RSGKSSIMRSDAPIGKCKSECITPNGSIPNDKPFQNVNRITYGACPRYVKHSTLKLAT
GMRNVPEKQTRGIFGAIAGFIENGWEGMVDGWYGFRHQNSEGRGQAADLKSTQAAIDQ
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ORIGIN

```

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1501 acttatgacc acaatgtgta cagggatgaa gcattaaaca accggttcca gatcaaggga
1561 gttgagctga agtcagggtg caaagattgg atcctatgga tttcctytgc catatcatgt
1621 tttttgcttt gtgttgcttt gttggggttc atcatgtggg cctgccaaaa gggcaacatt
1681 aggtgcaaca tttgcatttg a

```