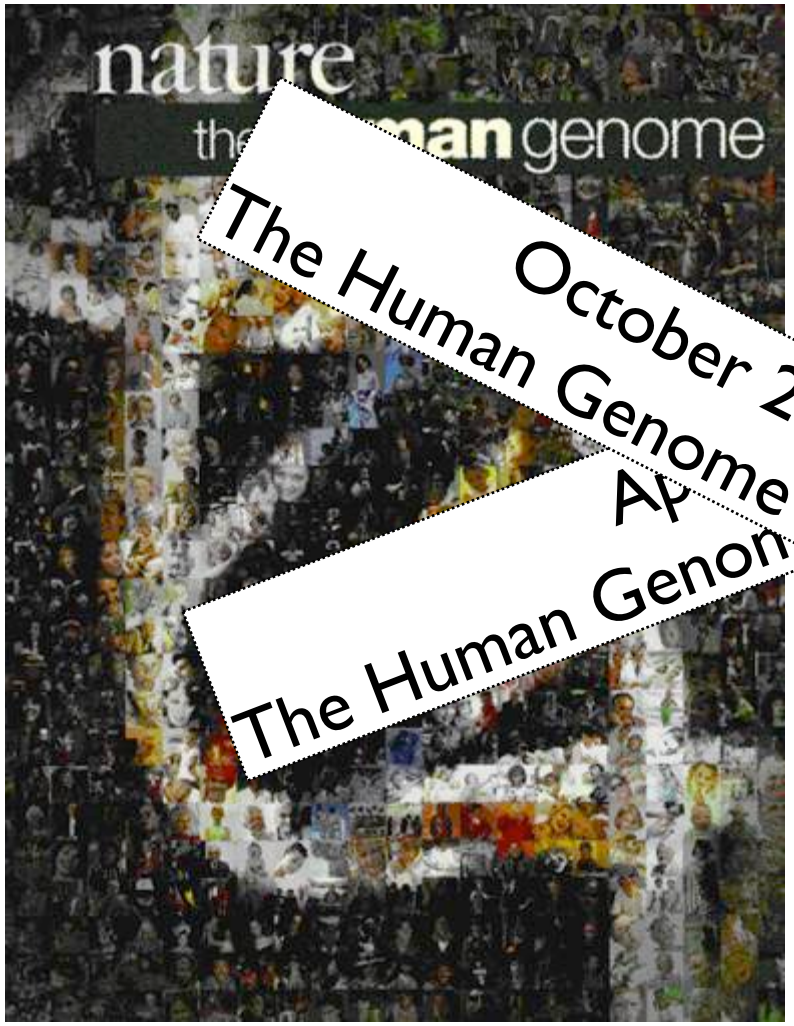
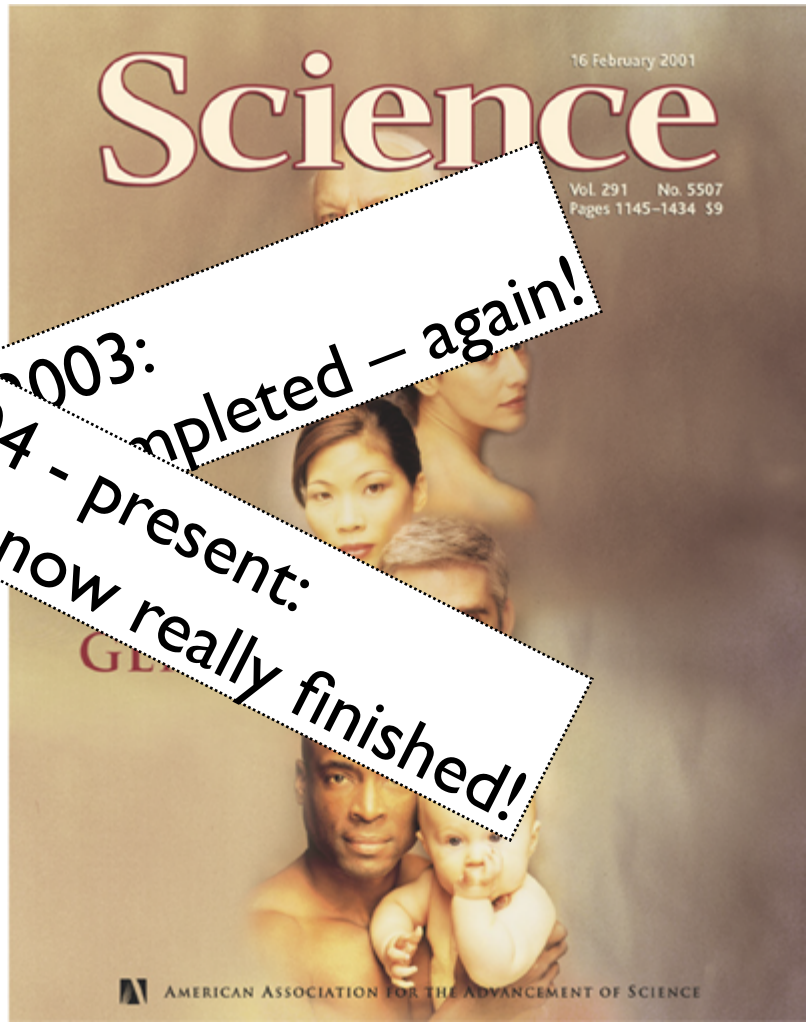
Genome Browsers

Accessing Genome Annotations &
PRACTICAL EXERCISE: Three Different Views of the BRCA1 Gene

The Human Genome Project





October 2004 - present:
The Human Genome is now really finished!

2003:
...mpleted – again!
A...
The Human Genom...

Public HGP

Celera Genomics

February 2001: Completion of the Draft Human Genome

In the Genome Race, the Sequel Is Personal

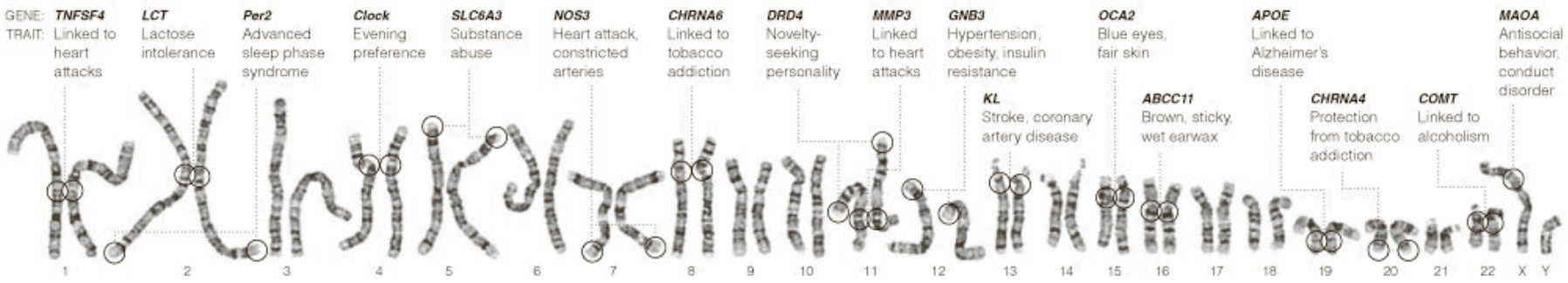
Thor Swift for The New York Times

A team led by J. Craig Venter, above, has finished the first mapping of a full, or diploid, genome, made up of DNA inherited from both parents. The genome is Dr. Venter's own.

The New York Times

September 3, 2007

DECODING HIMSELF A team led by J. Craig Venter, above, has finished the first mapping of a full, or diploid, genome, made up of DNA inherited from both parents. The genome is Dr. Venter's own.



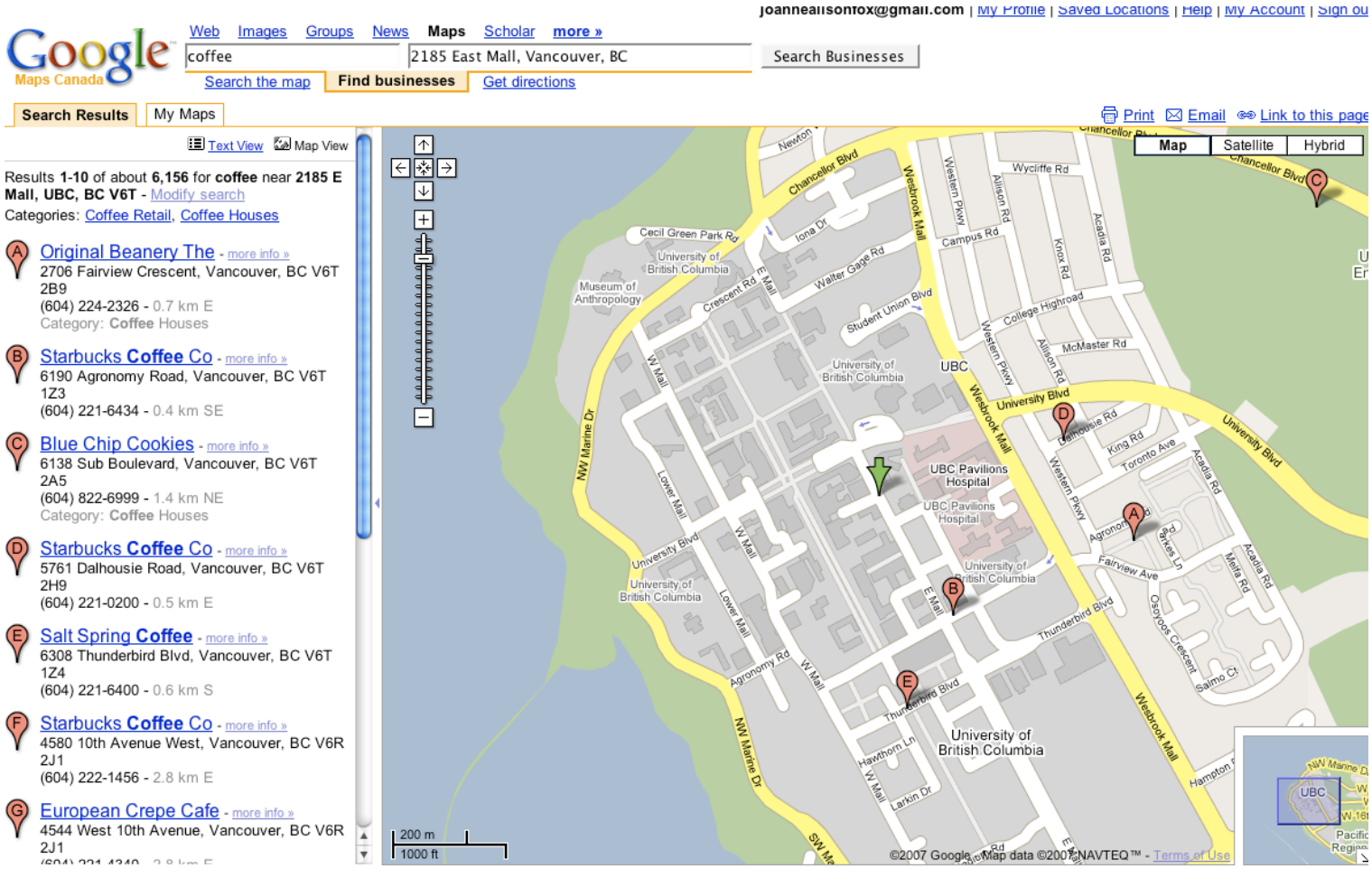
Sources: PLoS Biology; GeneCards

Genes highlighted above are linked to specific traits but do not mean the conditions are inevitable.

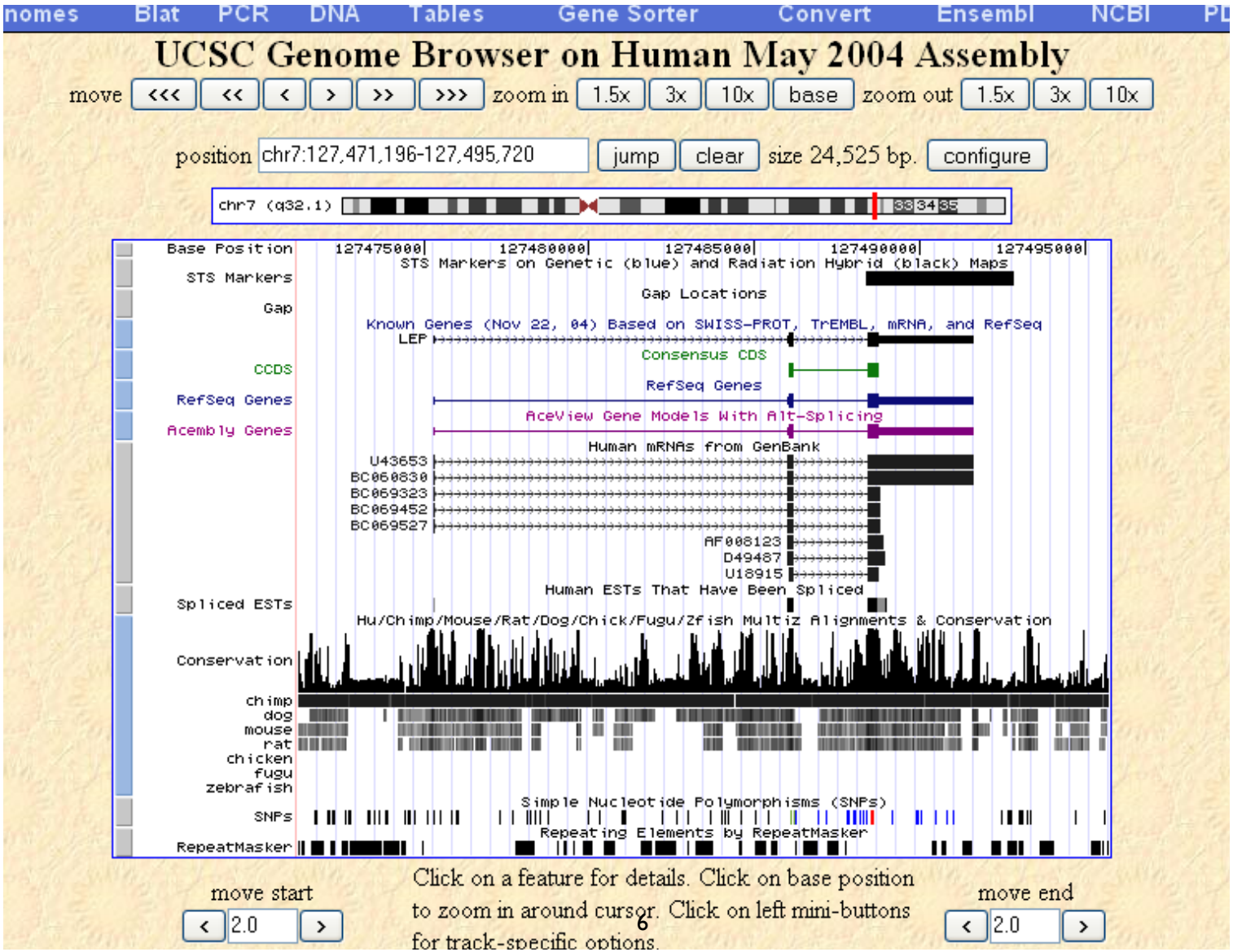
THE NEW YORK TIMES

Stanley Park
Stanley Park Shuttle
Stanley Park Shuttle (seasonal)
STANLEY PARK LOOP
19
Lost Lagoon
Deadmans Island
Devonian Harbour Park
LAGOON DR
Coal Harbour
To North Vancouver and Lonsdale Quay
SEABUS
0
500
METRES
N
CHILCO
GILFORD
PENDRELL
DENMAN
West End Community Centre
Robson Market
Barclay Heritage Square
ALBERNI
240.241.242.246.247.250.251
252.253.254.257.258.N24
PENDER
HASTINGS
19
GEORGIA
Coal Harbour Park
Harbour Green Park
Vancouver Convention & Exhibition Centre
CN IMAX Theatre
Vancouver Tourist InfoCentre
Sinclair Centre
SEABUS TERMINAL
WALKWAY
WATERFRONT
BURRARD
THURLOW
2.C21
ROBSON
5 N6
West End
HARO
BARCLAY
CARDERO
BROUGHTON
BIDWELL
Morton Park
BEACH AVE
Alexandra Park
English Bay Beach Park
English Bay
COMOX
BUTE
THURLOW
DAVIE
N6
NICOLA
BURNABY
C21
JERVIS
Nelson Park
St. Paul's Hospital
6.C23
HARWOOD
BEACH
Sunset Beach Park
PACIFIC
False Creek Ferry
Vanier Park
H.R.MacMillan Space Centre & Vancouver Museum
Gordon Southam Observatory
Vancouver Academy of Music
CHESTNUT
BURRARD BRIDGE
2.22.32.44.N22
HORNBY
HOWE
6.C23
N6
2.22.32.44
BURRARD
C21.N22
98
Royal Centre
Vancouver Art Gallery
Robson Square
UBC Downtown
GRANVILLE
Pacific Centre
Orpheum Theatre
GRANVILLE
DUNSMUIR
19.22.44
N22
N6.N8.N9
N10.N15
N17.N19
N20.N35
10.44
44
6
CORDOVA
WATER
50
Gastown
Harbour Centre/SFU
Portside Park
COLUMBIA
POWELL
4.7
4.7.8
HASTINGS
8.10.16.20.N20
PENDER
CARRALL
3
Chinatown
N35
19.N19
22
4.7.N8
KEEFER
Dr Sun Yat Sen Chinese Gardens
ABBOTT
C21.C23 50
Andy Livingstone Park
STADIUM - CHINATOWN
G.M. Place
BEATTY
N24
Canada Post
Queen Elizabeth Theatre
Vancouver Public Library
SEYMOUR
RICHARDS
HOMER
HAMILTON
SMITHE
ROBSON
GEORGIA
N15
15
EXPO BLVD
C21.C23
B.C. Place Stadium
PACIFIC BLVD
C23
Plaza of Nations
CAMBIE
NELSON
15.N15
4.7.10.16.17
4.6.7.10.16.17
5.6.8.20
N9.N10.N17
C21.C23
DRAKE
Yaletown
C21.C23
PACIFIC BLVD
C21
Coopers' Park
CAMBIE BRIDGE
PACIFIC BLVD
Creekside Park
QUEBEC
MAIN
C21.C23
3.8.19.22.N8.N19
22
GORE
PRIOR ST
NATIONAL
C23
Pacific Central Station (Bus & Railway)
Thornton Park
Science World
Aquabus
C21.C23
TERMINAL
22
MAIN STREET - SCIENCE WORLD
Granville Island Market
Arts Club Theatre
GRANVILLE BRIDGE
4.7.10.16.17.50.98
N9.N10.N17
George Wainborn Park
David Lam Park
Aquabus
False Creek Ferry
Emily Carr Institute of Art + Design
Waterfront Theatre
Sutcliffe Park
False Creek
Charleson Park
LAMEY'S MILL
6 AVE
50.84
15.N15
1 AVE
2 AVE
3 AVE
4 AVE
4.7.84
44
BURRARD
FIR
50
17
5 AVE
50
6 AVE
7 AVE
PINE
GRANVILLE
HEMLOCK
17
BIRCH
ALDER
SPRUCE
OAK
LAUREL
WILLOW
50
HEATHER
ASH
CAMBIE
YUKON
50
ALBERTA
COLUMBIA
Fairview
84
9.16.17.99.N17
9.17.99.N9
BROADWAY
9.50.99.N9
9.99.N9
BROADWAY
1 AVE
2 AVE
84
3 AVE
4 AVE
5 AVE
6 AVE
7 AVE
8 AVE
MANITOBA
ONTARIO
QUEBEC
MAIN
3.8.19.N8.N19
SCOTIA
BRUNSWICK
Mount Pleasant
GT NORTHERN
84
R 09.07

maps.google.ca



Let's Look at the Human Genome...



Objectives

- By the end of this module:

✓ You will be able to describe the following concepts: genome annotation, genome builds, and genome browsers.

✓ You will view the genomic location that contains the BRCA1 gene in the human genome using three different genome browsers.

✓ You will be able to compare and contrast the UCSC, Ensembl and MapViewer systems for visualizing genome information.

Genome Browsers

- What is a Genome Browser?
  - System for displaying, viewing, and accessing genome annotation data
- Genome annotations = knowledge attached to raw genome sequence.
  - Annotation information comes from many different sources
    - ✓ Computational pipelines
    - ✓ Research groups
    - ✓ Databases

The "Neopolitan Ice Cream" World of Genome Browsing:

- UCSC Genome Browser
- http://genome.cse.ucsc.edu/
- Ensembl
- http://www.ensembl.org/
- NCBI Map Viewer
- http://www.ncbi.nlm.nih.gov/mapview/

The underlying data is common for all three "flavors" of Genome Browsers.

- NCBI, UCSC and Ensembl use the same human genome assembly that is generated by NCBI
  - release timing is different between sites.
- Note the version of genome assembly to which you are referring
  - available precomputed info and locations of features will be different between different assemblies.

Let's compare the view of the BRCA1 gene in all three genome browsers.

Viewing the genomic region containing BRCA1

- Common features:

✓ Coordinate system is based on the build

✓ Zoom in and out

✓ Annotations displayed – ie. Gene features

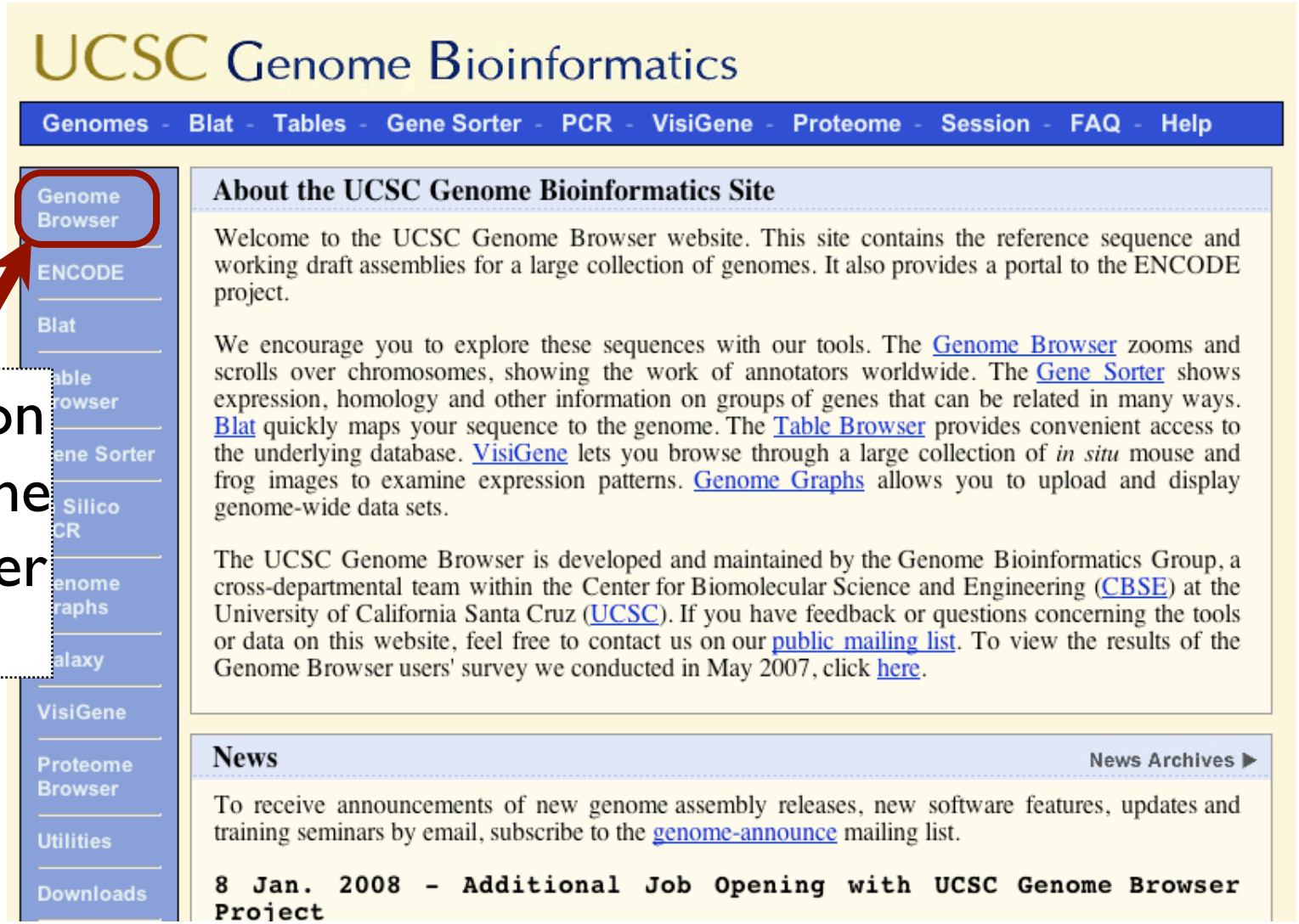
- Major Differences:

✓ Each Browser has a very different look and feel

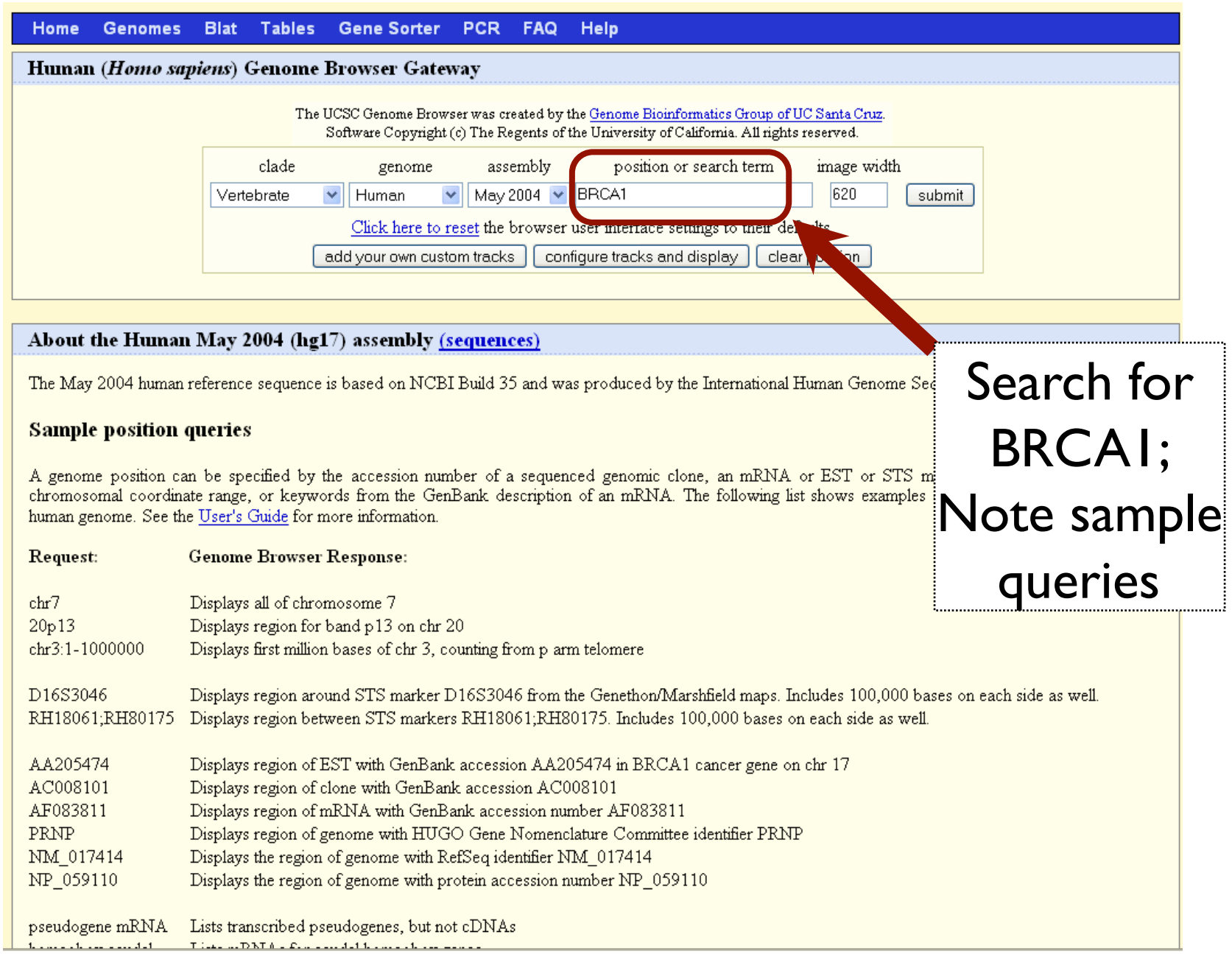
✓ Annotation information displayed differently

✓ Different ways to navigate through the information

http://genome.cse.ucsc.edu/

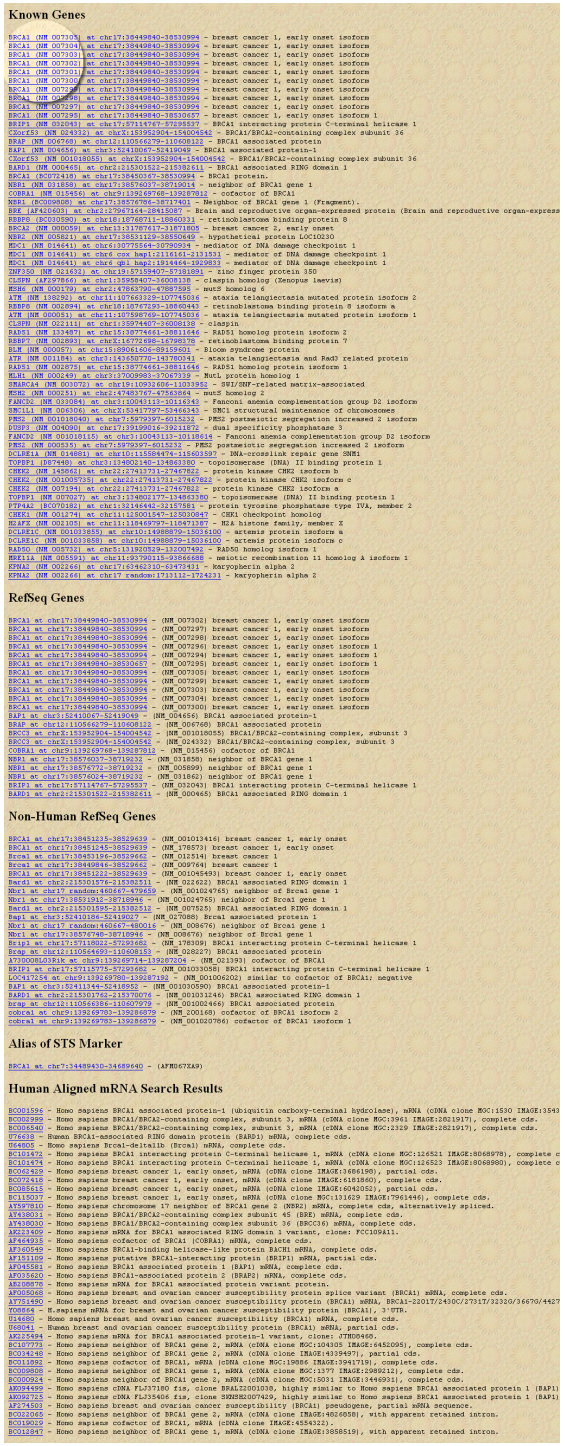


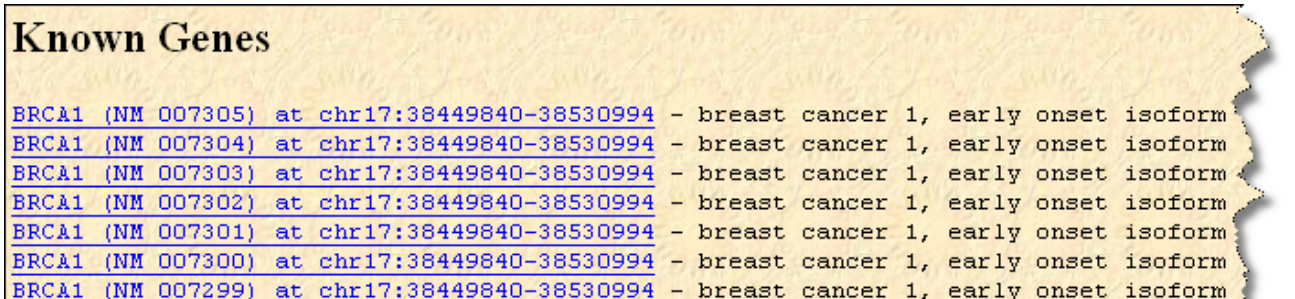
Click on Genome Browser link



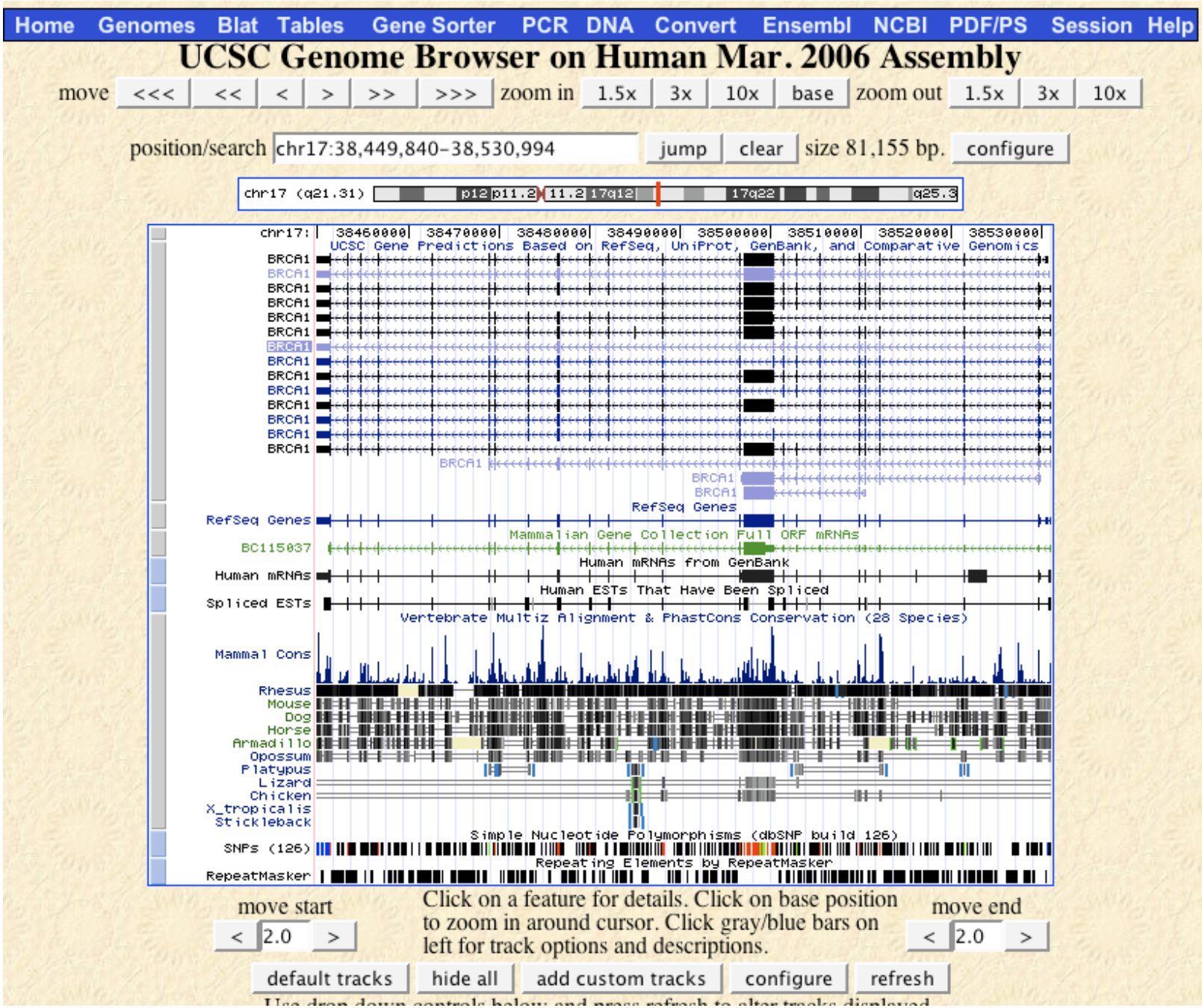
Search for BRCA1; Note sample queries

The Search Results





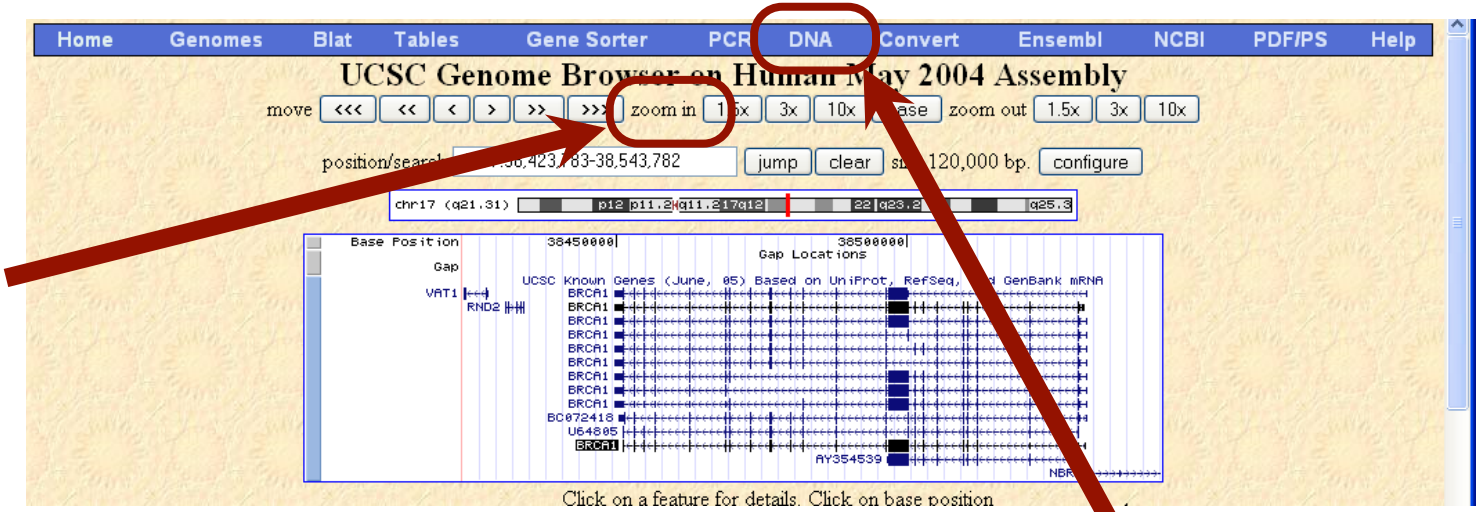
- Many BRCA1 isoforms
  - ✓ All located on chr 17
  - ✓ same chr coordinates
  - ✓ different gene structures


Home Genomes Blat Tables Gene Sorter PCR DNA Convert Ensembl NCBI PDF/PS Session Help
UCSC Genome Browser on Human Mar. 2006 Assembly
move <<< << < > >> >>> zoom in 1.5x 3x 10x base zoom out 1.5x 3x 10x
position/search chr17:38,449,840-38,530,994 jump clear size 81,155 bp. configure
chr17 (q21.31)
chr17:
38460000 38470000 38480000 38490000 38500000 38510000 38520000 38530000
UCSC Gene Predictions Based on RefSeq, UniProt, GenBank, and Comparative Genomics
BRCA1
RefSeq Genes
Mammalian Gene Collection Full ORF mRNAs
BC115037
Human mRNAs from GenBank
Human mRNAs
Human ESTs That Have Been Spliced
Spliced ESTs
Vertebrate Multiz Alignment & PhastCons Conservation (28 Species)
Mammal Cons
Rhesus
Mouse
Dog
Horse
Armadillo
Opossum
Platypus
Lizard
Chicken
X_tropicalis
Stickleback
Simple Nucleotide Polymorphisms (dbSNP build 126)
SNPs (126)
Repeating Elements by RepeatMasker
RepeatMasker
move start
< 2.0 >
Click on a feature for details. Click on base position to zoom in around cursor. Click gray/blue bars on left for track options and descriptions.
move end
< 2.0 >
default tracks hide all add custom tracks configure refresh

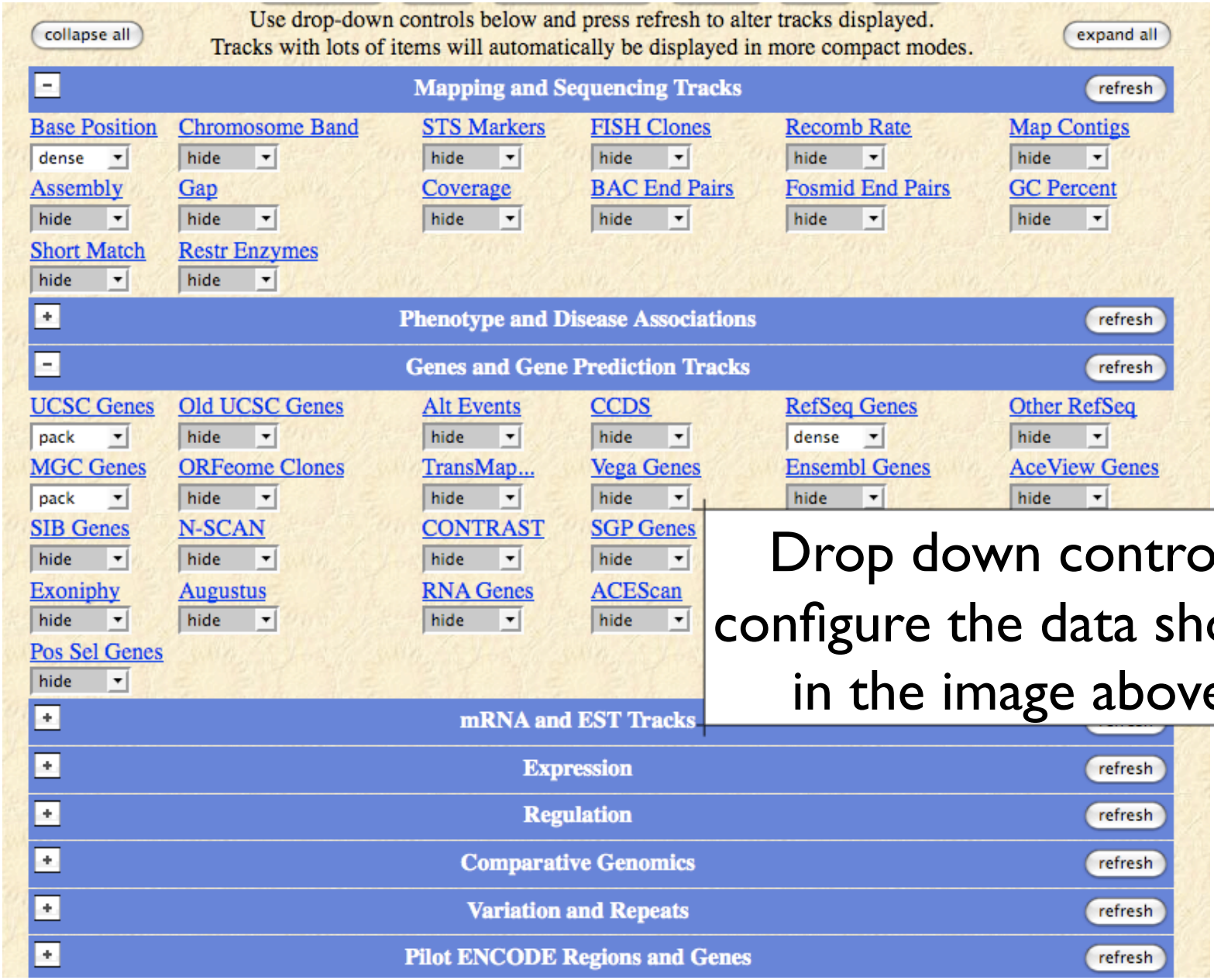
Tasks

- What genes are on either side of BRCA1 on chr 17?
- Can you figure out how to download the genomic sequence for the BRCA1 region?
- Can you figure the display to add/remove tracks that are (or are not) of interest to you?

Zoom in
Zoom out

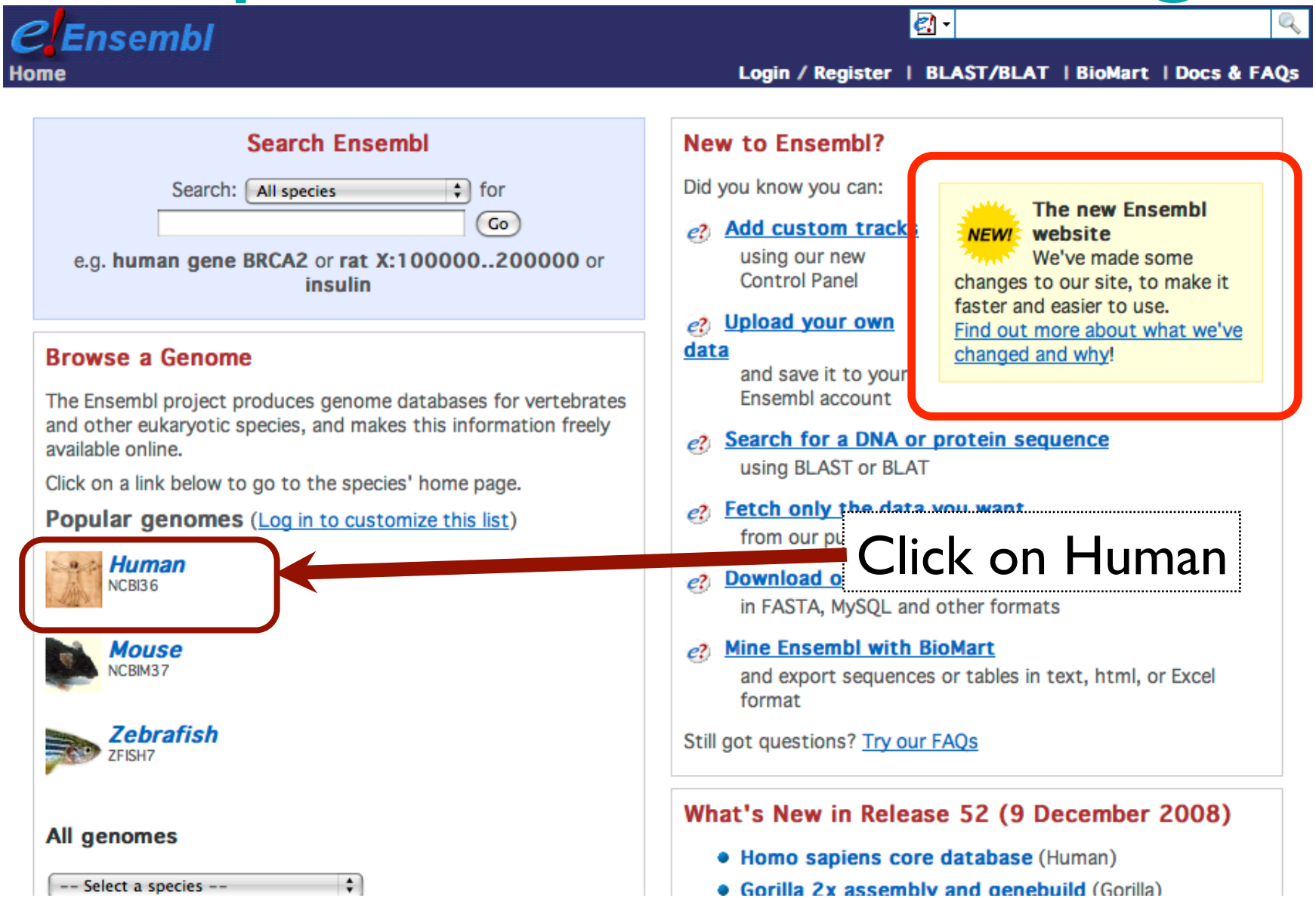


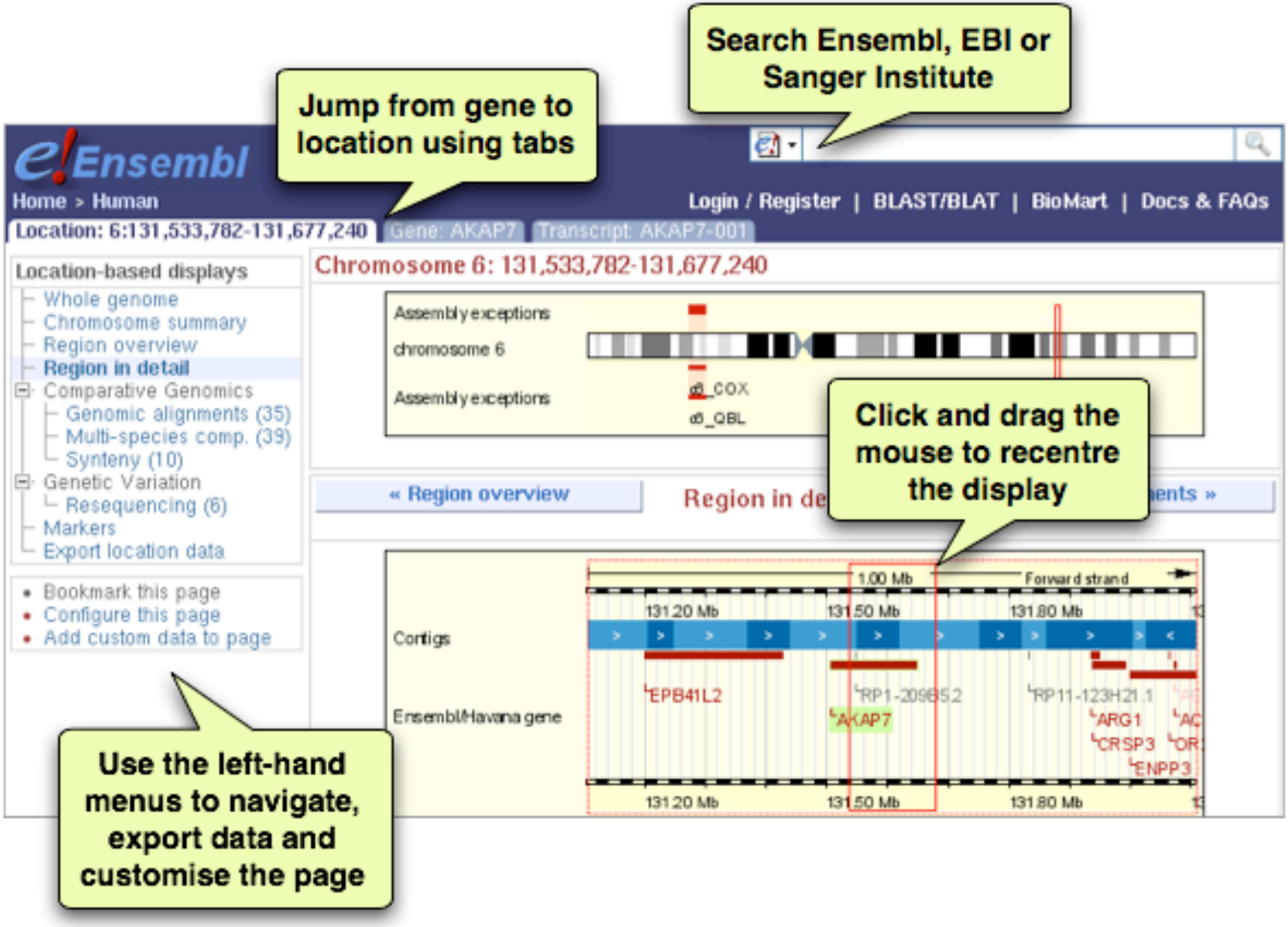
DNA link
Download
Sequence



Drop down controls configure the data shown in the image above

http://www.ensembl.org/




Search Ensembl, EBI or Sanger Institute
Jump from gene to location using tabs
Ensembl
Home > Human
Login / Register | BLAST/BLAT | BioMart | Docs & FAQs
Location: 6:131,533,782-131,677,240
Gene: AKAP7
Transcript: AKAP7-001
Location-based displays
Whole genome
Chromosome summary
Region overview
Region in detail
Comparative Genomics
Genomic alignments (35)
Multi-species comp. (39)
Synteny (10)
Genetic Variation
Resequencing (6)
Markers
Export location data
Bookmark this page
Configure this page
Add custom data to page
Chromosome 6: 131,533,782-131,677,240
Assembly exceptions
chromosome 6
Assembly exceptions
« Region overview
Region in de
Click and drag the mouse to recentre the display
1.00 Mb
Forward strand
131.20 Mb
131.50 Mb
131.80 Mb
Contigs
Ensembl/Havana gene
EPB41L2
AKAP7
ARG1
CRSP3
ENPP3
Use the left-hand menus to navigate, export data and customise the page

About this species
- Description
- Genome Statistics
  - Assembly and Genebuil
  - Top 40 InterPro hits
  - Top 500 InterPro hits
- What's New
- Sample entry points
  - Karyotype
  - Location (AL032821.2
  - Gene (BRCA2)
  - Transcript (FOXP2-203

- Configure this page
- Add custom data to page
- Export data
- Bookmark this page

Search Ensembl Human

Search for: Go

e.g. **gene BRCA2** or **AL032821.2.1.143563** or **muscular dystrophy**

Description

Assembly and Genebuild »

Assembly

This release is based on the NCBI 36 assembly of the human genome [November 2005]. The data consists of a reference assembly of the complete genome plus the Celera WGS and a number of alternative assemblies of individual haplotypic chromosomes or regions. Full list of assemblies →

The International Human Genome Sequencing Consortium have published their scientific analysis of the finished human genome.

- Nature 431, 931 - 945 (21 October 2004)
- WT Sanger Institute Press Release

Annotation

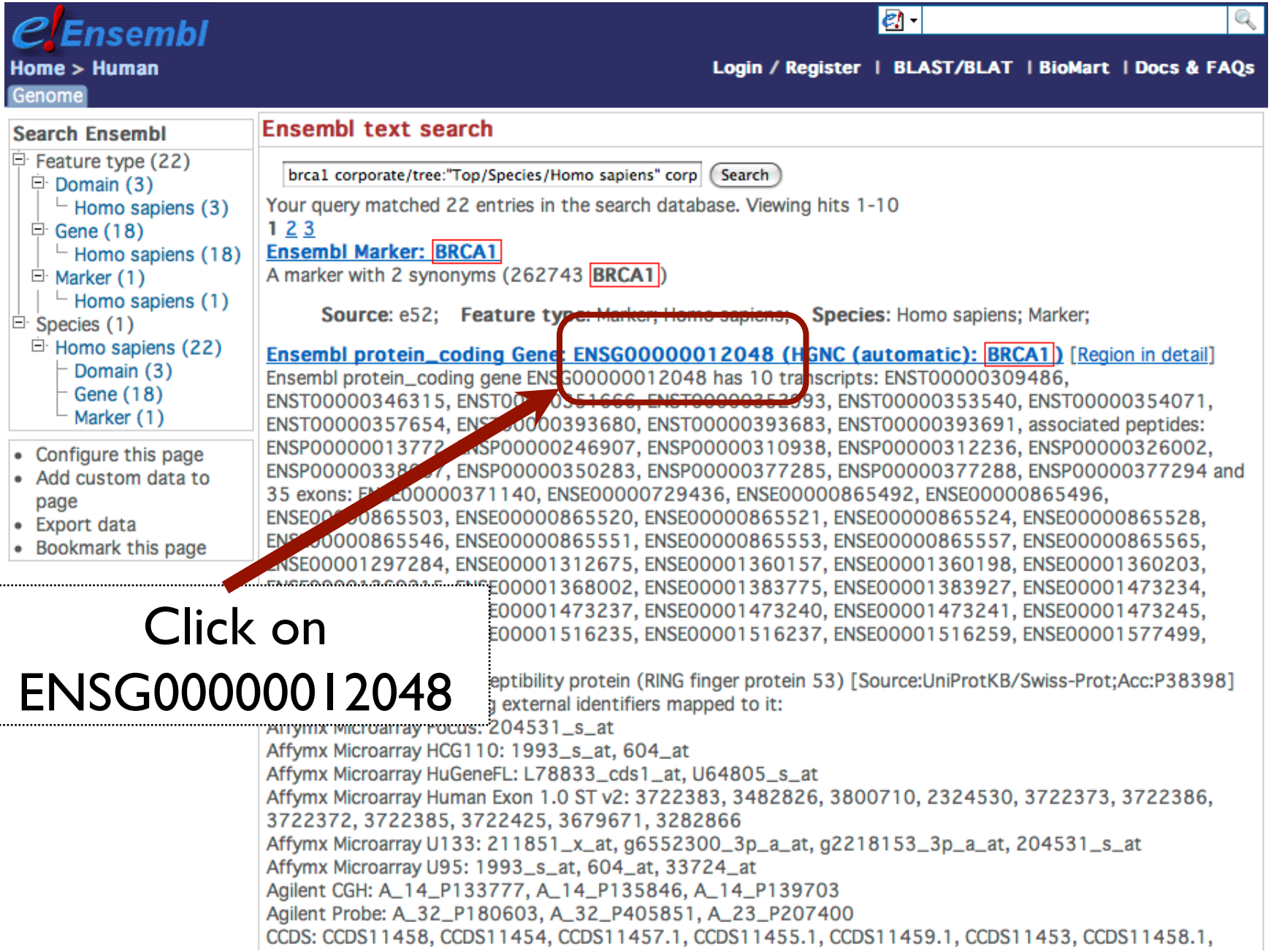
Since release 38 (April 2006) the gene annotation presented has been a combined Ensembl-Havana, geneset which incorporates more than 18,000 full-length protein-coding transcripts annotated by the Havana team with the Ensembl automatic gene build. The human genome sequence is now considered sufficiently stable that since 2004 the major genome browsers have come together to produce a common set of identifiers where CDS annotations of transcripts can be agreed and these identifiers are also shown.

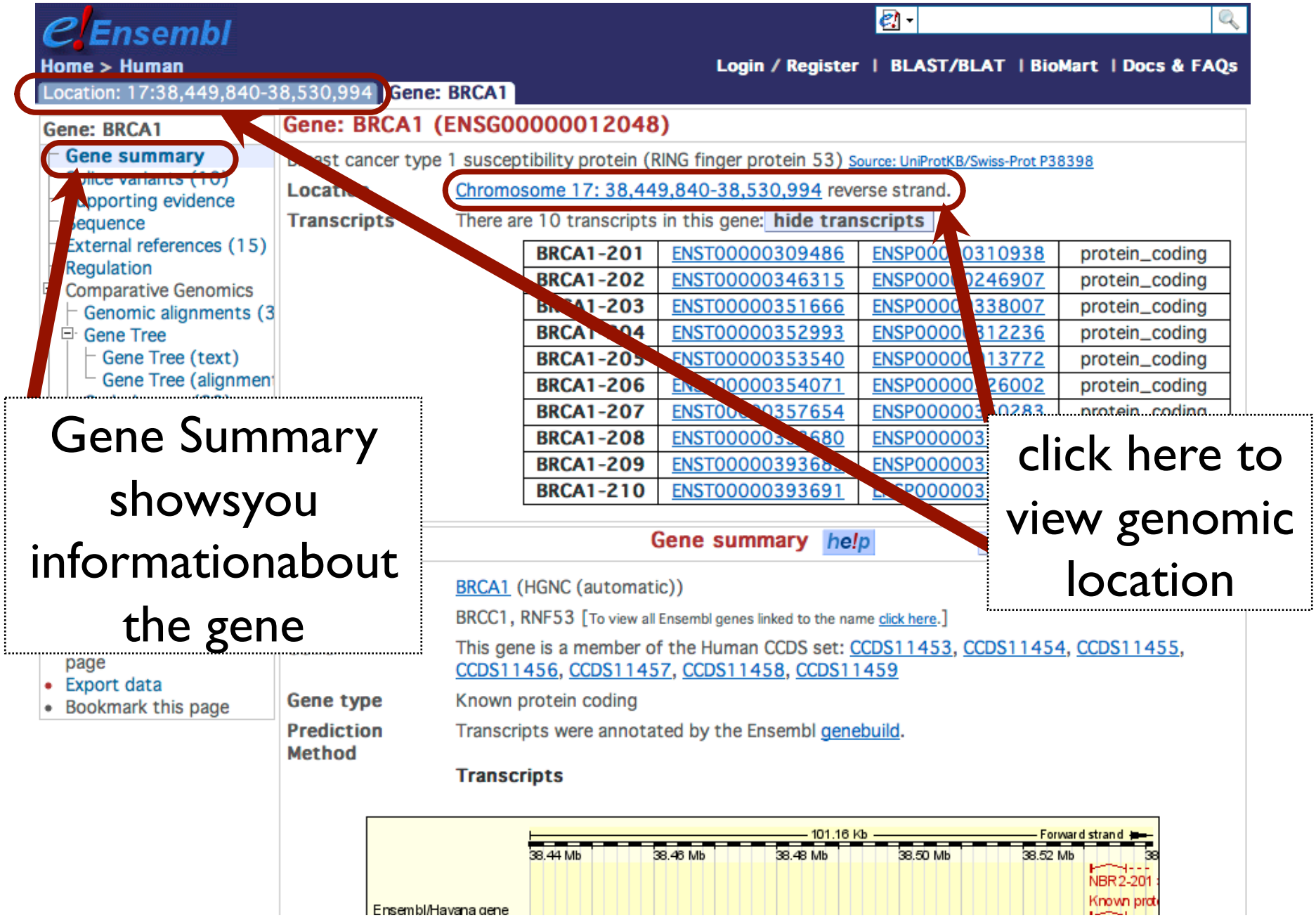
- More information about the CCDS project.

The ENCODE (ENCyclopedia Of DNA Elements) project aims to find functional elements in the human genome.

- More information about the ENCODE resources at Ensembl.

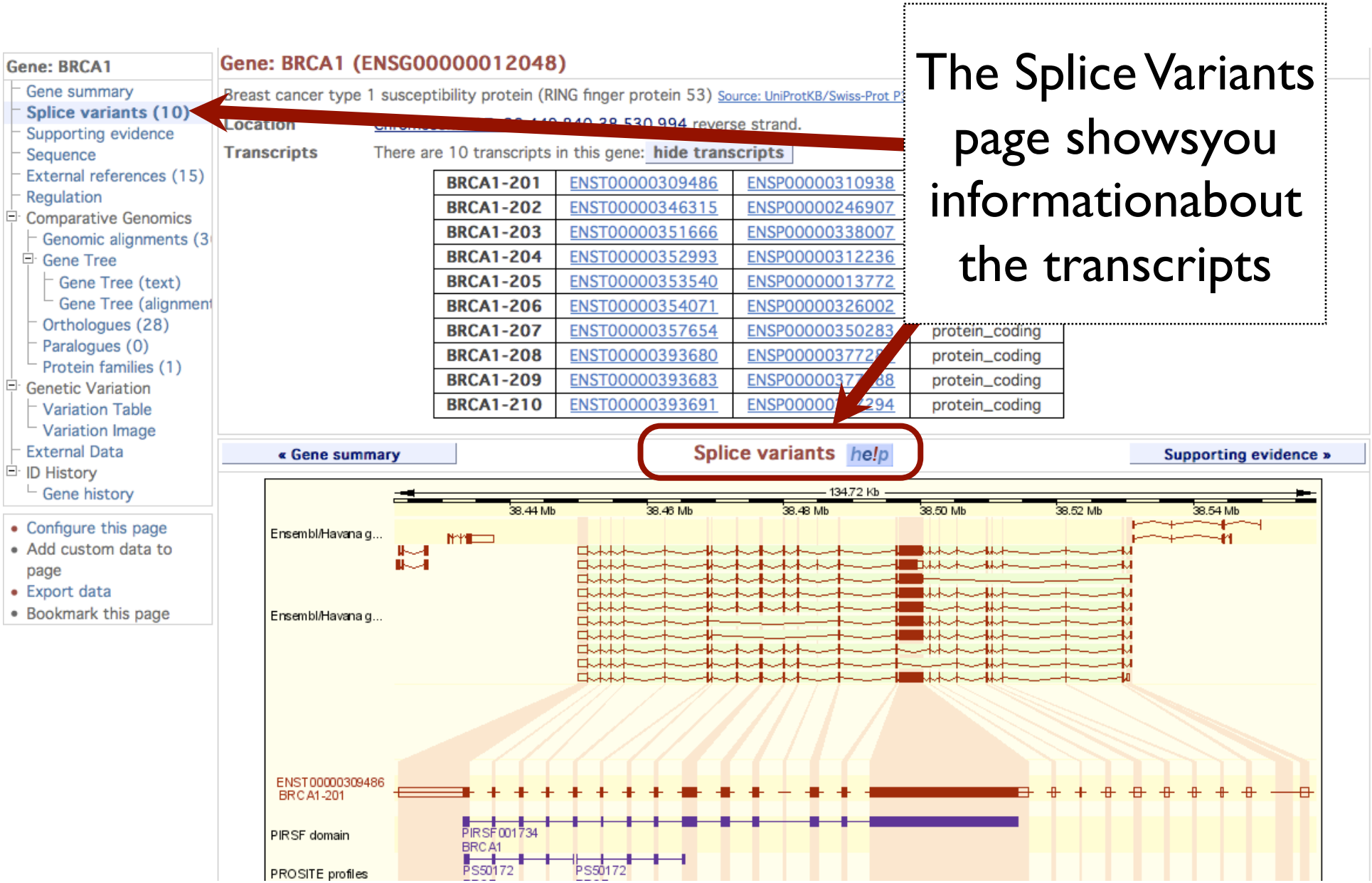
Vega Additional manual annotation of this genome can be found in Vega


Ensembl
Home > Human
Genome
Login / Register | BLAST/BLAT | BioMart | Docs & FAQs
Search Ensembl
Feature type (22)
Domain (3)
Homo sapiens (3)
Gene (18)
Homo sapiens (18)
Marker (1)
Homo sapiens (1)
Species (1)
Homo sapiens (22)
Domain (3)
Gene (18)
Marker (1)
Configure this page
Add custom data to page
Export data
Bookmark this page
Ensembl text search
brca1 corporate/tree:"Top/Species/Homo sapiens" corp
Search
Your query matched 22 entries in the search database. Viewing hits 1-10
1 2 3
Ensembl Marker: BRCA1
A marker with 2 synonyms (262743 BRCA1)
Source: e52; Species: Homo sapiens; Marker;
Ensembl protein_coding Gene: ENSG00000012048 (HGNC (automatic): BRCA1) [Region in detail]
Ensembl protein_coding gene ENSG00000012048 has 10 transcripts: ENST00000309486,
ENST00000346315, ENST00000353540, ENST00000354071,
ENST00000357654, ENST00000393680, ENST00000393683, ENST00000393691, associated peptides:
ENSP00000013772, ENSP00000246907, ENSP00000310938, ENSP00000312236, ENSP00000326002,
ENSP00000350283, ENSP00000377285, ENSP00000377288, ENSP00000377294 and
35 exons: ENSE00000371140, ENSE00000729436, ENSE00000865492, ENSE00000865496,
ENSE00000865503, ENSE00000865520, ENSE00000865521, ENSE00000865524, ENSE00000865528,
ENSE00000865546, ENSE00000865551, ENSE00000865553, ENSE00000865557, ENSE00000865565,
ENSE00001297284, ENSE00001312675, ENSE00001360157, ENSE00001360198, ENSE00001360203,
ENSE00001368002, ENSE00001383775, ENSE00001383927, ENSE00001473234,
ENSE00001473237, ENSE00001473240, ENSE00001473241, ENSE00001473245,
ENSE00001516235, ENSE00001516237, ENSE00001516259, ENSE00001577499,
eptibility protein (RING finger protein 53) [Source:UniProtKB/Swiss-Prot;Acc:P38398]
external identifiers mapped to it:
204531_s_at
Affymx Microarray HCG110: 1993_s_at, 604_at
Affymx Microarray HuGeneFL: L78833_cds1_at, U64805_s_at
Affymx Microarray Human Exon 1.0 ST v2: 3722383, 3482826, 3800710, 2324530, 3722373, 3722386,
3722372, 3722385, 3722425, 3679671, 3282866
Affymx Microarray U133: 211851_x_at, g6552300_3p_a_at, g2218153_3p_a_at, 204531_s_at
Affymx Microarray U95: 1993_s_at, 604_at, 33724_at
Agilent CGH: A_14_P133777, A_14_P135846, A_14_P139703
Agilent Probe: A_32_P180603, A_32_P405851, A_23_P207400
CCDS: CCDS11458, CCDS11454, CCDS11457.1, CCDS11455.1, CCDS11459.1, CCDS11453, CCDS11458.1,
Click on
ENSG00000012048

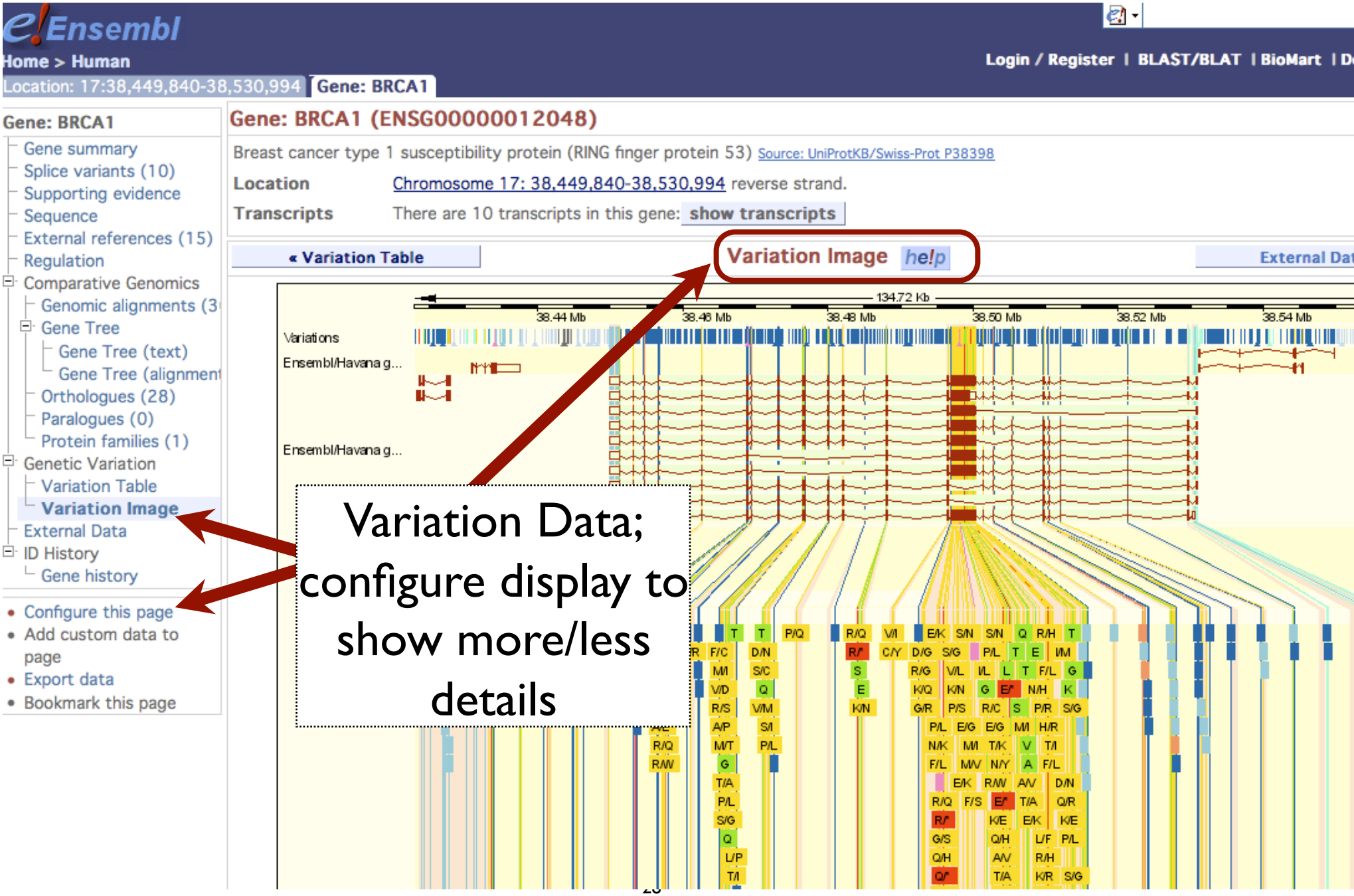

Ensembl
Home > Human
Login / Register | BLAST/BLAT | BioMart | Docs & FAQs
Location: 17:38,449,840-38,530,994
Gene: BRCA1
Gene: BRCA1
Gene summary
Gene: BRCA1 (ENSG00000012048)
Chromosome 17: 38,449,840-38,530,994 reverse strand.
Transcripts
There are 10 transcripts in this gene: hide transcripts
BRCA1-201 ENST00000309486 protein_coding
BRCA1-202 ENST00000346315 protein_coding
BRCA1-203 ENST00000351666 protein_coding
BRCA1-204 ENST00000352993 protein_coding
BRCA1-205 ENST00000353540 protein_coding
BRCA1-206 ENST00000354071 protein_coding
BRCA1-207 ENST00000357654
BRCA1-208
BRCA1-209
BRCA1-210 ENST00000393691
Gene summary help
BRCA1 (HGNC (automatic))
BRCC1, RNF53 [To view all Ensembl genes linked to the name click here.]
This gene is a member of the Human CCDS set: CCDS11453, CCDS11454, CCDS11455, CCDS11456, CCDS11457, CCDS11458, CCDS11459
Gene type
Known protein coding
Prediction Method
Transcripts were annotated by the Ensembl genebuild.
Transcripts
101.16 Kb
Forward strand
38.44 Mb
38.46 Mb
38.48 Mb
38.50 Mb
38.52 Mb
Ensembl/Havana gene
Export data
Bookmark this page
Gene Summary showsyou informationabout the gene
click here to view genomic location

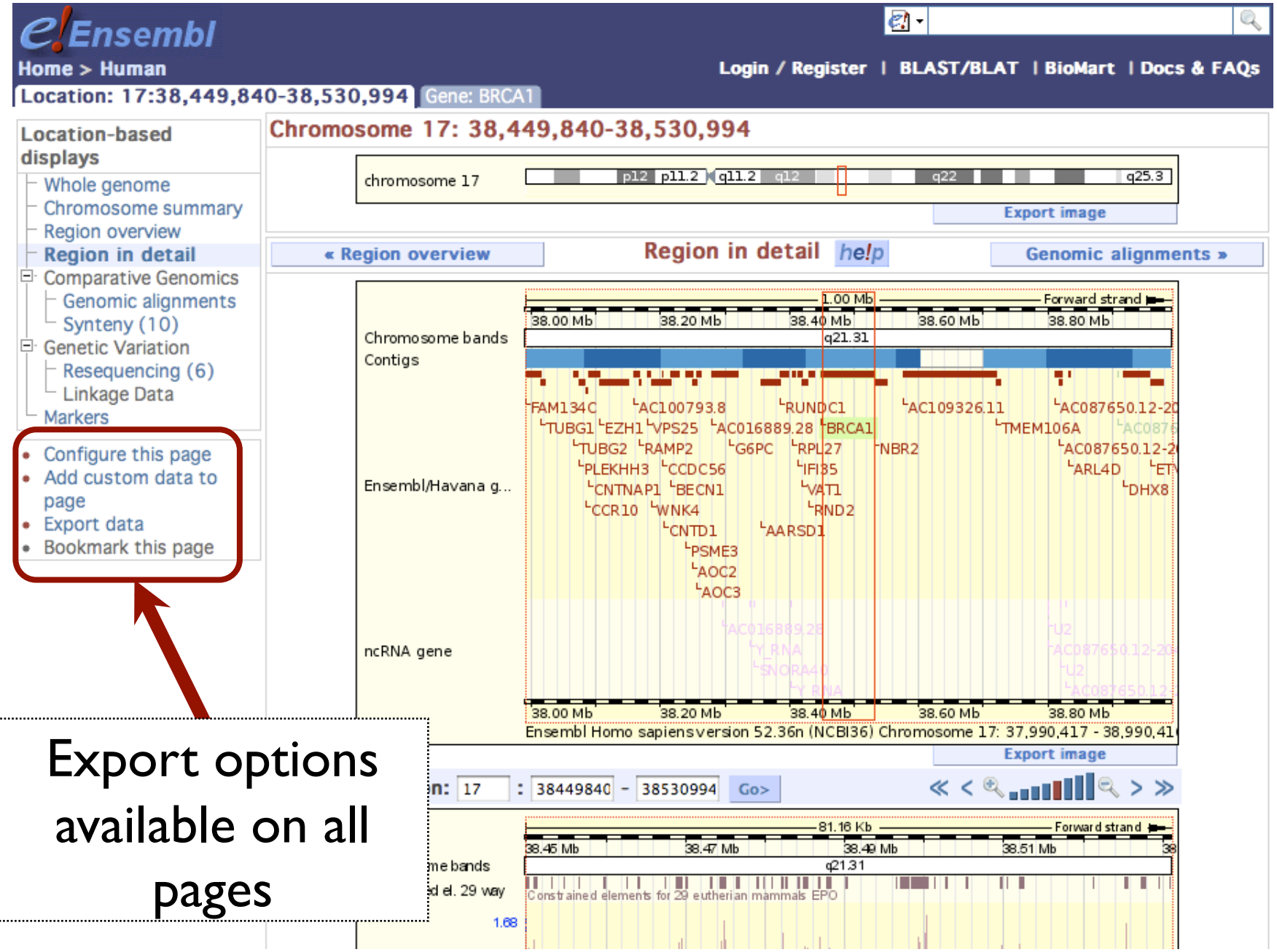
Tasks

- Explore the information presented in the Gene Summary views.
  - Can you figure out how to visualize the alternatively spliced isoforms for BRCA1?
  - What can you find out about known variations in this gene?
- Using the Location Based Displays, can you figure out how to download the genomic sequence for the BRCA1 region?

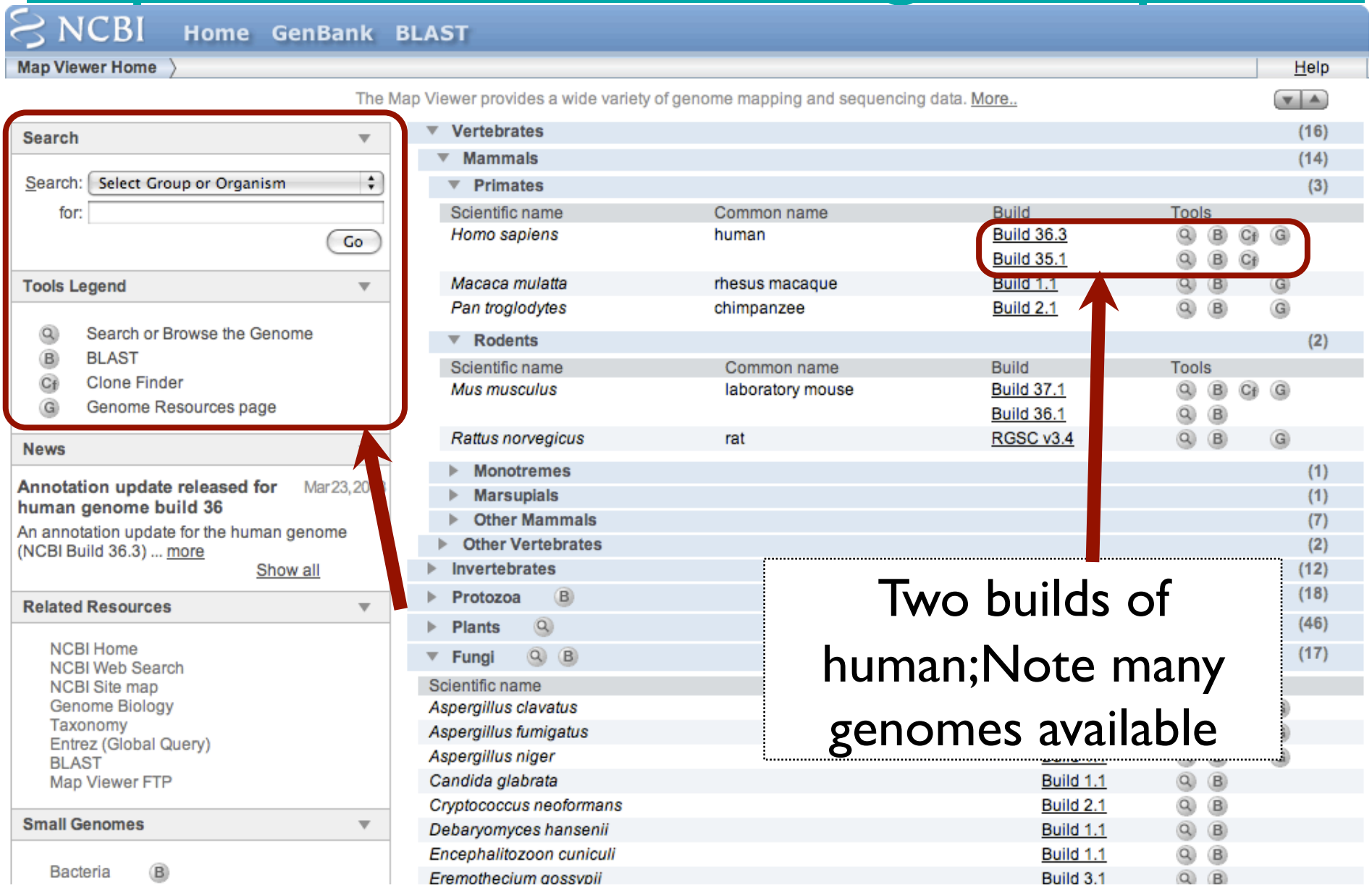


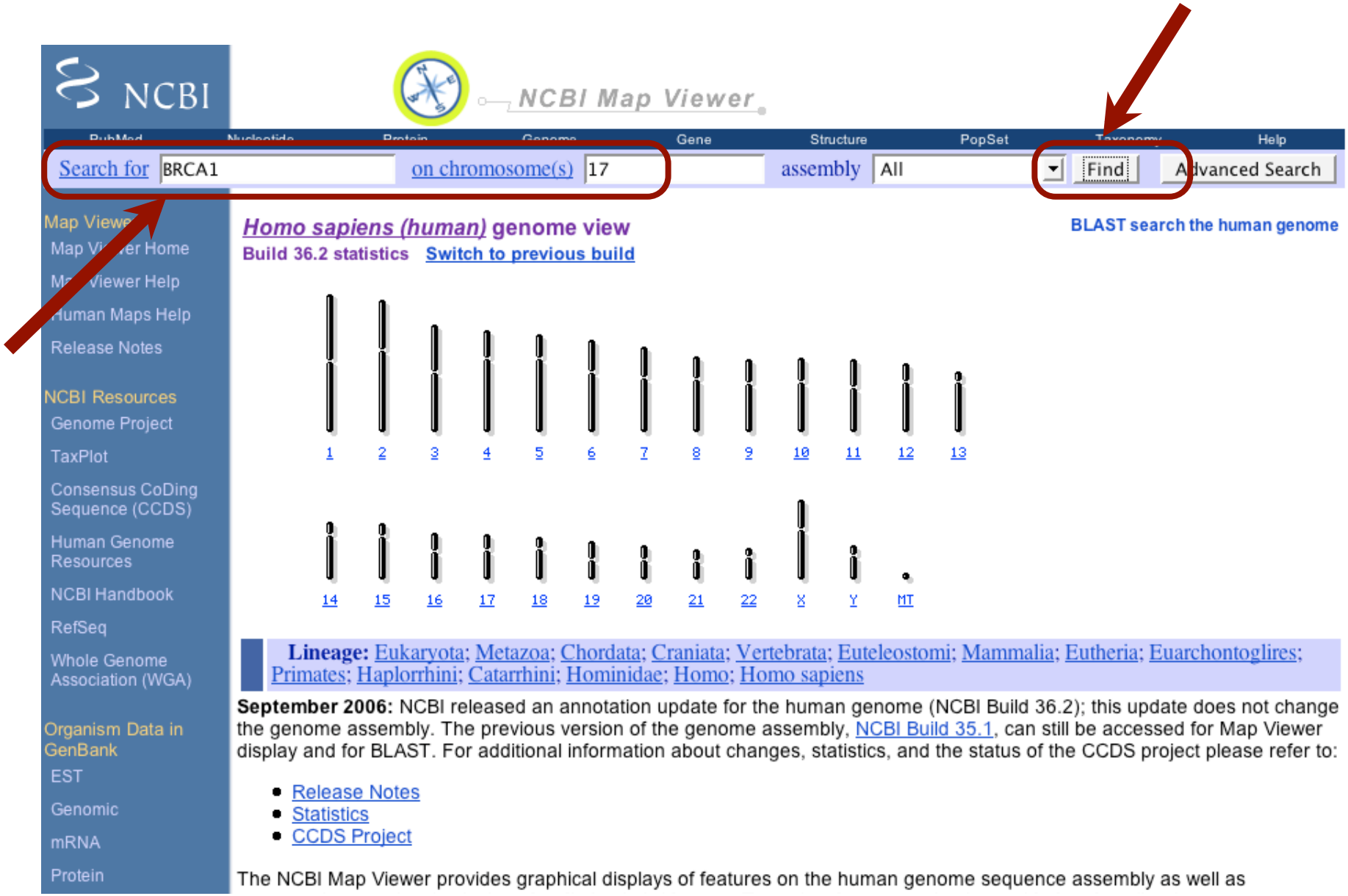
The Splice Variants page showsyou informationabout the transcripts

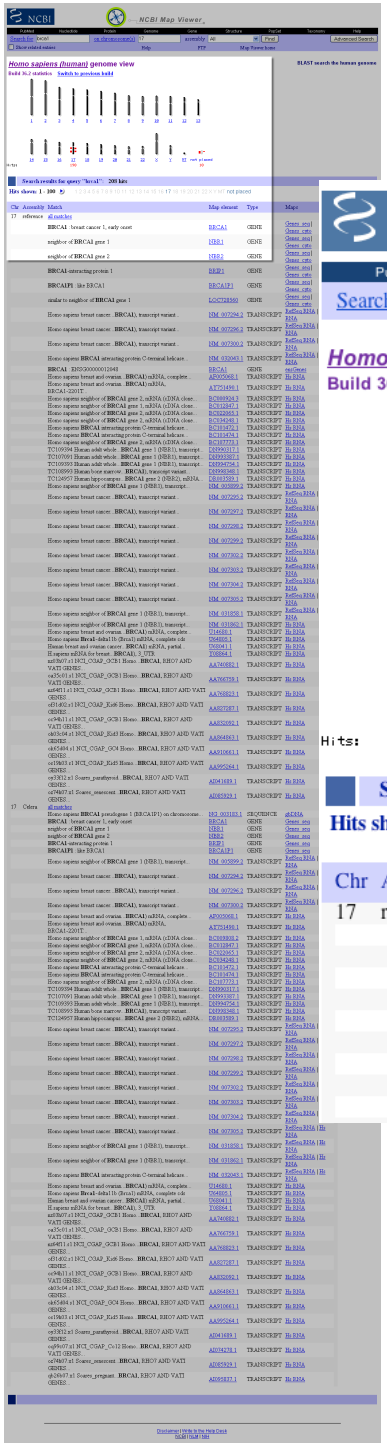

Ensembl
Home > Human
Login / Register | BLAST/BLAT | BioMart
Location: 17:38,449,840-38,530,994
Gene: BRCA1
Gene: BRCA1
Gene summary
Splice variants (10)
Supporting evidence
Sequence
External references (15)
Regulation
Comparative Genomics
Genomic alignments (3
Gene Tree
Gene Tree (text)
Gene Tree (alignment
Orthologues (28)
Paralogues (0)
Protein families (1)
Genetic Variation
Variation Table
Variation Image
External Data
ID History
Gene history
Configure this page
Add custom data to page
Export data
Bookmark this page
Gene: BRCA1 (ENSG00000012048)
Breast cancer type 1 susceptibility protein (RING finger protein 53) Source: UniProtKB/Swiss-Prot P38398
Location Chromosome 17: 38,449,840-38,530,994 reverse strand.
Transcripts There are 10 transcripts in this gene: show transcripts
« Variation Table
Variation Image help
External Dat
134.72 Kb
38.44 Mb
38.46 Mb
38.48 Mb
38.50 Mb
38.52 Mb
38.54 Mb
Variations
Ensembl/Havana g...
Ensembl/Havana g...
Variation Data; configure display to show more/less details


Ensembl
Home > Human
Login / Register | BLAST/BLAT | BioMart | Docs & FAQs
Location: 17:38,449,840-38,530,994
Gene: BRCA1
Location-based displays
Whole genome
Chromosome summary
Region overview
Region in detail
Comparative Genomics
Genomic alignments
Synteny (10)
Genetic Variation
Resequencing (6)
Linkage Data
Markers
Configure this page
Add custom data to page
Export data
Bookmark this page
Chromosome 17: 38,449,840-38,530,994
chromosome 17
p12 p11.2 q11.2 q12 q22 q25.3
Export image
« Region overview
Region in detail help
Genomic alignments »
Chromosome bands
Contigs
Ensembl/Havana g...
ncRNA gene
1.00 Mb
Forward strand
38.00 Mb 38.20 Mb 38.40 Mb 38.60 Mb 38.80 Mb
q21.31
FAM134C AC100793.8 RUNDC1 AC109326.11
TUBG1 EZH1 VPS25 AC016889.28 BRCA1 TMEM106A
TUBG2 RAMP2 G6PC RPL27 NBR2
PLEKHH3 CCDC56 IFI35 ARL4D
CNTNAP1 BECN1 VAT1 DHX8
CCR10 WNK4 RND2
CNTD1 AARSD1
PSME3
AOC2
AOC3
Ensembl Homo sapiens version 52.36n (NCBI36) Chromosome 17: 37,990,417 - 38,990,41
Export image
n: 17 : 38449840 - 38530994 Go>
81.16 Kb
Forward strand
38.45 Mb 38.47 Mb 38.49 Mb 38.51 Mb
q21.31
Constrained elements for 29 eutherian mammals EPO
1.68
Export options available on all pages

http://www.ncbi.nlm.nih.gov/mapview/




NCBI
NCBI Map Viewer
PubMed Nucleotide Protein Genome Gene Structure PopSet Taxonomy Help
Search for BRCA1 on chromosome(s) 17 assembly All Find Advanced Search
Map Viewer
Map Viewer Home
Map Viewer Help
Human Maps Help
Release Notes
NCBI Resources
Genome Project
TaxPlot
Consensus CoDing Sequence (CCDS)
Human Genome Resources
NCBI Handbook
RefSeq
Whole Genome Association (WGA)
Organism Data in GenBank
EST
Genomic
mRNA
Protein
Homo sapiens (human) genome view
Build 36.2 statistics
Switch to previous build
BLAST search the human genome
1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20 21 22 X Y MT
Lineage: Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia; Eutheria; Euarchontoglires; Primates; Haplorrhini; Catarrhini; Hominidae; Homo; Homo sapiens
September 2006: NCBI released an annotation update for the human genome (NCBI Build 36.2); this update does not change the genome assembly. The previous version of the genome assembly, NCBI Build 35.1, can still be accessed for Map Viewer display and for BLAST. For additional information about changes, statistics, and the status of the CCDS project please refer to:
Release Notes
Statistics
CCDS Project
The NCBI Map Viewer provides graphical displays of features on the human genome sequence assembly as well as



NCBI

NCBI Map Viewer

PubMed | Nucleotide | Protein | Genome | Gene | Structure | PopSet | Taxonomy | Help

Search for BRCA1 on chromosome(s) 17 assembly All Find Advanced Search

Homo sapiens (human) genome view

Build 36.2 statistics Switch to previous build

BLAST search the human genome

1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20 21 22 X Y MT not placed

Hits: 209 12

Search results for query "BRCA1": 221 hits

Hits shown: 1 - 100 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 **17** 18 19 20 21 22 X Y MT not placed

Chr	Assembly	Match	Map element	Type	Maps
17	reference	all matches			
		Neighbor of **Brca1** gene 1	Rn.94975	Rn_EST_Cl	Rn Un G
		BRCA1 interacting protein C-terminal helicase 1	Mm.186143	Mm_EST_Cl	Mm Un G
		Neighbor of **Brca1** gene 1	Mm.784	Mm_EST_Cl	Mm Un G
		Neighbor of **BRCA1** gene 2 (9 hits)	Hs.559259	Hs_EST_Cl	Hs Un G
		Neighbor of **BRCA1** gene 1 (2 hits)	Hs.546264	Hs_EST_Cl	Hs Un G
		BRCA1 interacting protein C-terminal helicase 1	Hs.532799	Hs_EST_Cl	Hs Un G
		Neighbor of **BRCA1** gene 1	Hs.373818	Hs_EST_Cl	Hs Un G
		Neighbor of **BRCA1** gene 1 (2 hits)	Hs.277721	Hs_EST_Cl	Hs Un G
		BRCA1 interacting protein C-terminal helicase 1	Gga.17801	Gga_EST_Cl	Gga Un G

Quick Filter

☑ Gene

Transcript :

☐ all

☐ RefSeq

☐ STS

☐ Unigene

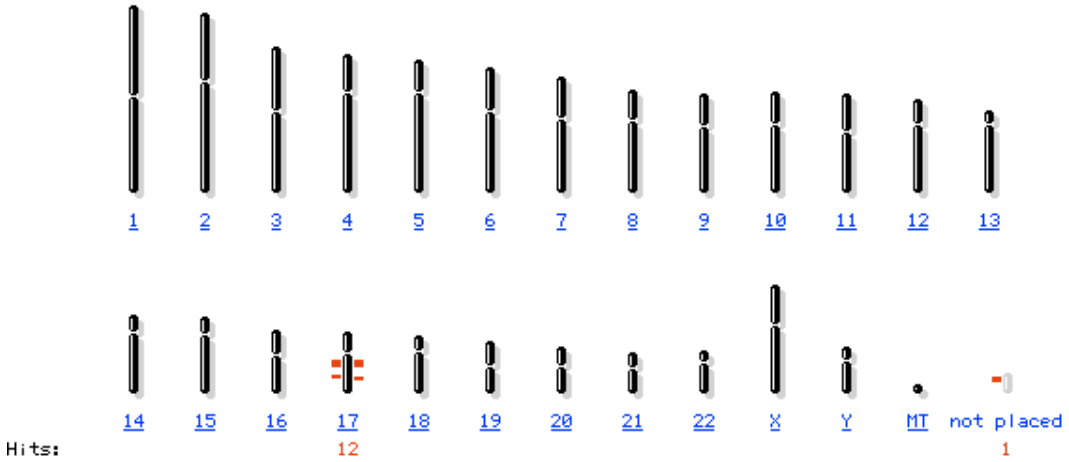
Filter

Quick Filter

✓ Gene

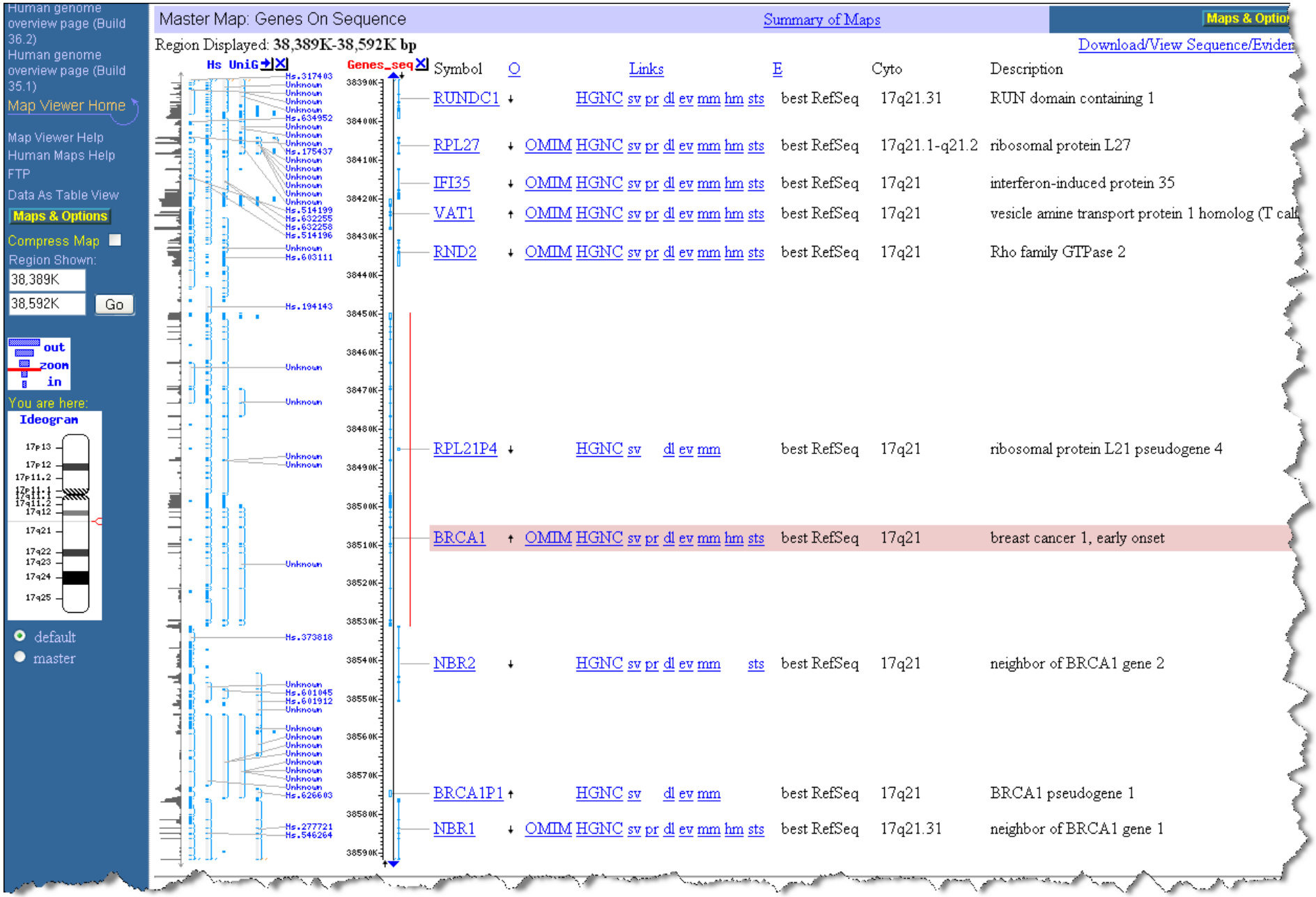
Homo sapiens (human) genome view

Build 36.2 statistics Switch to previous build



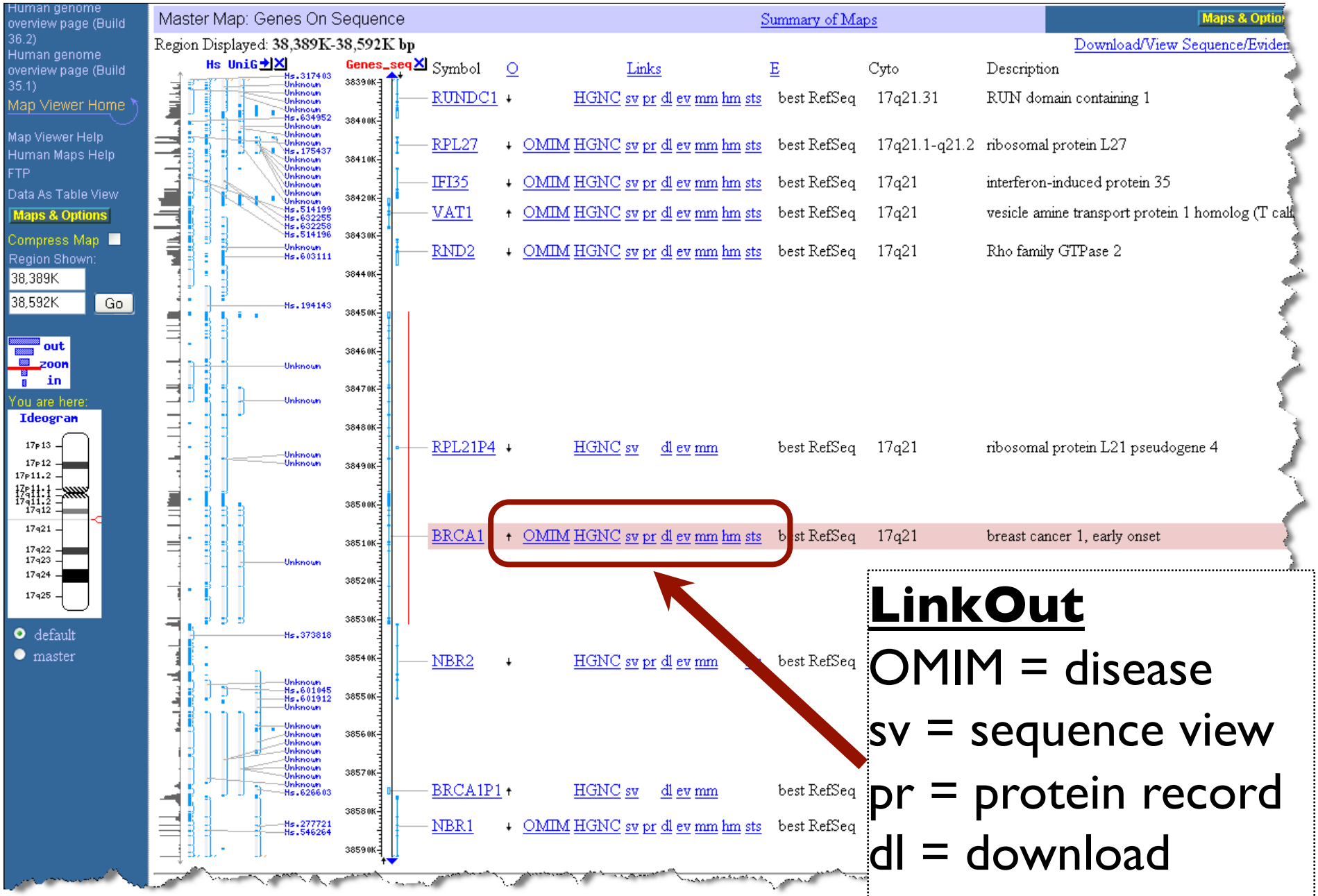
Search results for query "BRCA1 AND gene[obj_type]": 13 hits

Chr	Assembly	Match	Map element	Type	Maps
17	reference	all matches			
		similar to neighbor of **BRCA1** gene 1	LOC728560	Gene	Genes_cyto | Genes_seq
		BRCA1P1 : like BRCA1	BRCA1P1	Gene	Genes_cyto | Genes_seq
		BRCA1-interacting protein 1	BRIP1	Gene	Genes_cyto | Genes_seq
		neighbor of **BRCA1** gene 2	NBR2	Gene	Genes_cyto | Genes_seq
		neighbor of **BRCA1** gene 1	NBR1	Gene	Genes_cyto | Genes_seq
		BRCA1 : breast cancer 1, early onset	BRCA1	Gene	Genes_cyto | Genes_seq
		BRCA1 : ENSG00000012048	BRCA1	GENE	ensGenes
17	Celera	all matches			
		BRCA1P1 : like BRCA1	BRCA1P1	GENE	Genes_seq
		BRCA1-interacting protein 1	BRIP1	GENE	Genes_seq
		neighbor of **BRCA1** gene 2	NBR2	GENE	Genes_seq
		neighbor of **BRCA1** gene 1	NBR1	GENE	Genes_seq
		BRCA1 : breast cancer 1, early onset	BRCA1	GENE	Genes_seq
17:not placed	reference	similar to neighbor of **BRCA1** gene 1	LOC727732	GENE	Genes_seq


Human genome overview page (Build 36.2)
Human genome overview page (Build 35.1)
Map Viewer Home
Map Viewer Help
Human Maps Help
FTP
Data As Table View
Maps & Options
Compress Map
Region Shown:
38,389K
38,592K
Go
out
zoon
in
You are here:
Ideogram
17p13
17p12
17p11.2
17p11.1
17q11.1
17q11.2
17q12
17q21
17q22
17q23
17q24
17q25
default
master
Master Map: Genes On Sequence
Summary of Maps
Maps & Optio
Region Displayed: 38,389K-38,592K bp
Download/View Sequence/Evider
Hs UniG
Genes_seq
Symbol O Links E Cyto Description
RUNDC1 HGNC sv pr dl ev mm hm sts best RefSeq 17q21.31 RUN domain containing 1
RPL27 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21.1-q21.2 ribosomal protein L27
IFI35 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 interferon-induced protein 35
VAT1 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 vesicle amine transport protein 1 homolog (T cal
RND2 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 Rho family GTPase 2
RPL21P4 HGNC sv dl ev mm best RefSeq 17q21 ribosomal protein L21 pseudogene 4
BRCA1 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 breast cancer 1, early onset
NBR2 HGNC sv pr dl ev mm sts best RefSeq 17q21 neighbor of BRCA1 gene 2
BRCA1P1 HGNC sv dl ev mm best RefSeq 17q21 BRCA1 pseudogene 1
NBR1 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21.31 neighbor of BRCA1 gene 1

Two tasks

- Can you figure out how to LinkOut to the OMIM and/or Homologene entries for BRCA1?
- Can you figure out how to download the genomic sequence for the BRCA1 region?


Human genome overview page (Build 36.2)
Human genome overview page (Build 35.1)
Map Viewer Home
Map Viewer Help
Human Maps Help
FTP
Data As Table View
Maps & Options
Compress Map
Region Shown:
38,389K
38,592K
Go
You are here:
Ideogram
default
master
Master Map: Genes On Sequence
Summary of Maps
Region Displayed: 38,389K-38,592K bp
Download/View Sequence/Evider
Hs UniG
Genes_seq
Symbol O Links E Cyto Description
RUNDC1 HGNC sv pr dl ev mm hm sts best RefSeq 17q21.31 RUN domain containing 1
RPL27 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21.1-q21.2 ribosomal protein L27
IFI35 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 interferon-induced protein 35
VAT1 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 vesicle amine transport protein 1 homolog (T cal
RND2 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 Rho family GTPase 2
RPL21P4 HGNC sv dl ev mm best RefSeq 17q21 ribosomal protein L21 pseudogene 4
BRCA1 OMIM HGNC sv pr dl ev mm hm sts best RefSeq 17q21 breast cancer 1, early onset
NBR2 HGNC sv pr dl ev mm best RefSeq
BRCA1P1 HGNC sv dl ev mm best RefSeq
NBR1 OMIM HGNC sv pr dl ev mm hm sts best RefSeq
LinkOut
OMIM = disease
sv = sequence view
pr = protein record
dl = download
hm = Homologene