RGD: A Tutorial for Data, Searches and Tools

http://rgd.mcw.edu

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RGD: A Tutorial for Data, Searches and Tools

Data and Searches

Search by keyword, external identifier or RGD ID

1. On any RGD web page, e.g. the RGD home page (<u>http://rgd.mcw.edu</u>), keyword searches either of the exact term or using a * as a wildcard can be made using the box at the top right corner of the page.

		RGD Search Features
		The RGD site search allows users to find objects in RGD based on keyword or position information. Ow and indexed to return Genes, QTLs, Strains, Markers, References, and Ontology terms.
	Help FTP Download Citing RGD Contact	Simply type one or more search terms into the search box and hit 'Search RGD'
		hypertension Search RGD
	Physican 1 Keyword blood	Capitalization
	NOME DATA GENOME TOOLS DISEASES PHENOTYPES & MODELS COMMUNITY	Searching on RGD is NOT case sensitive. Searching for BLOOD PRESSURE, blood pressure, or BIO result
2	Search RGD Grant Resources RGD Update Citing RGD About Us Contact Us	BIOoD PrEsSuRe Search RGD
	Search RGD	Automatic "and" queries
		RGD only returns objects that have been indexed against all search terms entered. Searching for blood have attributes containing the words blood and pressure. Objects that have been indexed against only
	You can lear Hyperte	blood pressure Search RGD
	Mcsa Examples: Lear, "blood pressure", SS BN Mcw. pbesty and blood pressure, 'mph', pmd 15232814	Searching by RGD ID
	blood Search	If an integer value alone is in the search box, RGD will assume the search is for an RGD ID. To get to the it's RGD ID (2004) in the search box.
1	Search RGD By Position	2004 Search RGD
	Examples: Chr 2: 1200000 - 13000000	Searching with external identifiers
	Chr 🛛 💌 From (bp) Io Search by Position	Over 4 million external identifiers have been indexed. Since numeric values are assumed to be RGD ID search box will tell RGD you want to run an external identifier search. If the search term is not numeric, attempted. The following escarbes will return references and genes based on PubMed and Entrez Gene
		pmid:11101853 Search RGD
	Listing of Search Features	:232345 Search RGD
		entrez gene 232345 Search RGD
		pubmed 15232614 Search RGD

- 2. RGD's Keyword search can also be accessed by clicking on the "Search RGD" menu item under the "HOME" tab. This will take you to the "Search RGD" page.
- 3. For detailed information about the RGD Keyword search click the "Listing of Search Features" on the "Search RGD" page.

	Keyword 2004	
4	Keyword :232345	5 Keyword blood
	Keyword P16599	

- 4. RGD's Keyword search includes searching by RGD ID. Any numeric value entered into these boxes will be searched for as an RGD ID. To search for a numeric external identifier such as an Entrez Gene or PubMed ID, include a colon (:) in front of the ID. If the search term is not numeric, such as a UniProtKB ID, an external identifier search is always attempted.
- 5. For the purpose of this example, enter the word "blood" in one of the keyword search boxes and click the magnifying glass icon.

					Help FTP D	ownload	Citing RGD	Contact
	~~ rd	d		PhysGen	Ke	yword		
	HOME DATA GENOME T	OOLS	DISEASES PHENOTYPES & MODELS	COMMUNITY				
	Genes QTLs Strains N	larkers	ESTs Maps Ontologies	References FT	P Download	Submit	Data	
	RGD Search Res	ult	7					
	1425 records found for s	search	term blood					
	GENES 311 Found View Genes Rattus norvegicus	for All S	pecies View Rat Genes Report		Result Rat	Matrix Mouse	Human	
	Mus musculus	24	View Mouse Genes Report	Genes		24	<u>198</u>	
	Homo sapiens	198	View Human Genes Report	QTLS:	-	_	11	
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	STRAINS 50 Found Rattus norvegicus	50	View Rat Strains Report	-				
	REFERENCES 586 Found View Referen	ices for	All Species					
	Ontologies							
	Curators at RGD make annota terms below.	tions to p	genes, QTLs and strains using standardize	d vocabularies/ontolo	gies. Your se	earch retui	med annotati	ons to the
2	Gene Ontology vasoconstriction vasodilation							

- 6. The Search Result page gives a summary of all of the RGD objects which matched the search term. In addition the search returns all of the ontology terms which matched. To see a list of the genes, QTL and/or strains that are annotated to a particular ontology term, click on the term to go to the Ontology Report page. For more information on the Ontology Report page, see below.
- 7. To see a list of all of the rat genes that matched the search term "blood", click the "View Rat Genes Report" link or the number "89" in the Result Matrix.

											He	elp FTP	Download (Citing RGD Co	ntact Us	
		R	50					I	hysGen	E C		Ke	eyword			
	HOME	ATA GENO	ME TOOLS	DISEASES	PHENO	TYPES & I	MODELS	COMMUNITY								
	Genes	QTLs Strains	Markers	ESTs Map	s Onte	ologies s	Sequences	References	FTP D	ownload	Submit Data					
10	(View Res	search resul uits for all Obje	cts and Ontol	ogies)	us			9	Refine Assem	ibly: RGS	C genome			Update		
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_ 1	Rat	Mouse	Human	All	Exp	ort This Re	port lo <u>C</u>	<u>SV TAB Pri</u>	<u>nter</u> (Senome Vie	ewer 🚽					10
8	RGD ID	Symbol	Name			Descriptio				nr Start	Stop	Species	Annotations	Match	Туре	
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	620451	Rhd	Rh blood gro	oup, D antigen			up gene; produ erythrocytes	uces antigens on	the 5	15363864	2 153672532	2 Rat	5	description , old_gene_name , name	gene	
	628609	Abol1	ABO blood g	group-like 1			d group protei ase activities	in with A- and	3	5253078	5270252	Rat	12	description , old_gene_name , name	gene	

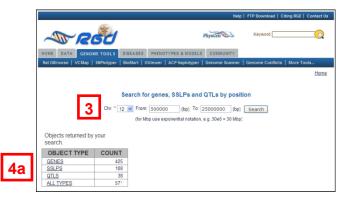
- 8. Information included in the gene result list includes the gene RGD ID, symbol, name, description and chromosomal position as well as the number of ontology annotations associated with that gene.
- 9. The box in the upper right corner of the page shows the current search term and allows the user to refine the search by changing the search term and/or selecting a particular chromosome. The genomic or genetic position information can be changed by using the drop-down box labeled "Assembly" and the results can be sorted by any of the columns simplifying the task of finding the particular result needed.
- 10. Tabs at the top of the results box allow users to easily move between results for rat, mouse, human or all three.
- 11. Results can be exported as CSV or tab-delimited text files, sent to a printer, or viewed in their genomic context using the RGD Genome Viewer. See below for more information on RGD's Genome Viewer.

Search by Position

1. On the RGD home page (<u>http://rgd.mcw.edu/</u>), under the tab which reads "HOME" click the menu item "Search RGD". This will take you to the "Search RGD" page.



2. In the "Search RGD By Position" box, select chromosome 12 and enter 500000 into the "From:" box and 25000000 into the "To:" box. Note that for simplicity mega base pair positions can be entered using exponential notation making these positions 0.5e6 and 25e6, as shown. Click the "Search by Position" button.



- 3. On the resulting page, notice that the search criteria are displayed at the top of the page. The search can be refined or expanded using these boxes.
- 4. Also notice that a summary table of the objects returned by the search is shown. Click on "QTLS" to navigate down to the table displaying all QTLs located within the search region. You can return to the top of the page using either your browser's "back" button, or the "Back to top of page" link located below each table.

Back to top o		rch region (expo	ut table to envi	adabaat	7						
RGD ID		SYMBOL	it table to spre	NAME		CHR.	START	SI	TOP		٦
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1598855	QTL	Bp294	Blood press	ure QTL 294		12	1	352	70263		<u>'</u>
1298081	QTL	Cia25		uced arthritis QTL	25	12	1	434	32656		_
1357337	QTL	Gluco3	Glucose leve	el QTL 3		12	1	122	40883		
61334	QTL	Gluco17	Glucose leve	el QTL 17		12	1	122	40883		
2303568	QTL		0	01.00		10	4		57496		
61421	QTL	Genes, QT	s and SSL	Ps found in you	r search reg	ION (<u>export t</u>	able to spread	sheet)		•	
2303575	QTL	RGD ID	TYPE	SYMBOL		NAM	E		CHR.	START	STOF
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<u>631521</u>	6	61334	QTL	Gluco17	Glucose le			-	12	1	122408
2312418	0	01421	QTL	Cia12	Collagen in	duced arthriti	is QTL 12		12	1	445214
634350	QIL	2303575	QTL	Insul14	Insulin level	QTL 14			12	1	435622
<u>1300174</u>	QTL	1357337	QTL	Gluco3	Glucose lev	vel QTL 3			12	1	122408
		1598855	QTL	Bp294	Blood press	sure QTL 294	l.		12	1	352702
		2303568	QTL	Bw88	Body weigh	nt QTL 88			12	1	254571
		1298081	QTL	Cia25	Collagen in	duced arthriti	s QTL 25		12	1	434326
		737979	QTL	Pia22	Pristane in	duced arthriti	s QTL 22		12	530865	455308
		1626034	GENE	Vom2r-ps90	vomeronas	al 2 receptor,	pseudogene 9	0	12	534145	5413
		35384	SSLP	D12Rat1	D12Rat1				12	555108	5556
		631521	QTL	Pia12	Pristane in	duced arthriti	s QTL 12		12	555108	247484
		1583708	GENE	Vom2r58	vomeronas	al 2 receptor,	58		12	600121	73279
		2312418	QTL	Kidm41	Kidney mas				12	665384	2093270
		1588806	GENE	Vom2r-ps91	vomeronas	al 2 receptor,	pseudogene 9	1	12	736334	8205
		<u>1588795</u>	GENE	Vom2r-ps93	vomeronasa	al 2 receptor,	pseudogene 9	3	12	933091	93536

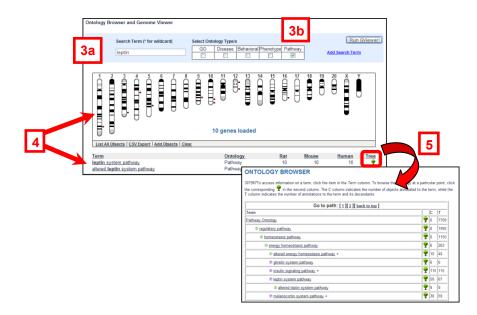
- 5. From the QTLS table, scroll down to the table which displays all of the objects located within the search region. Notice that the results are ordered by base pair position.
- 6. Click one of the RGD ID links to navigate to the report page for that gene, QTL or SSLP.
- 7. Returning to the results page, click the "export table to spreadsheet" link to download the results as a comma-separated text file which can then be opened in Excel for ease of analysis.

Ontology Search and RGD's Gene Pages

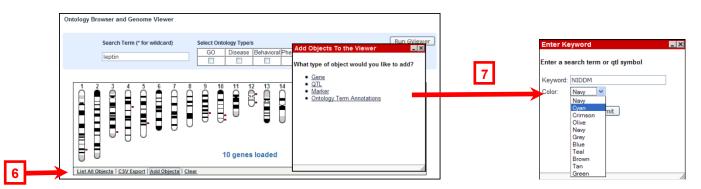
RGD is using several controlled vocabularies for the annotation of genes, QTL and strains. These include the three vocabularies of the Gene Ontology (GO function, process and component) along with Disease (DO), Phenotype (MP) and Pathway (PW) Ontologies. For rat genes all these vocabularies are used, for human genes DO, MP and PW and for mouse genes DO and PW are being used, respectively. DO and MP are also used for the annotations of rat and human QTL and of rat strains.



- 1. The **Ontology Browser** and **GViewer** can be used to search one or several vocabularies for terms of interest and to find what objects have been annotated to them. Click the "DATA" tab to access a page listing all of the data types in RGD. Click "Ontologies" in the list of data types or in the menu at the top to access a simple Ontology Browser.
- 2. Click the "GENOME TOOLS" tab to access a page listing all RGD's tools. Click "GViewer" in the menu at the top or "Genome Viewer" in the list of tools to access the Ontology Search/GViewer.



- 3. As an example, enter "leptin" into the search box. The default is for all of the ontologies to be selected. Click all of the check boxes except "pathway" to search only RGD's Pathway Ontology. Click "Run GViewer".
- 4. The search returns a screen with a GViewer image of all of the genes annotated to PW terms that include the word "leptin". In addition a box contains a list of all of the ontology terms which match the search criteria with counts of the number of annotations to each term for rat, mouse and human.
- 5. Note that clicking on the tree icon in the entry for the ontology term will bring up a diagram of the placement of that term in the ontology.



- 6. Looking at the GViewer tool, you can see a line of options along the bottom of the image which allow you to view or download a list of all of the objects displayed, add more objects to the display or clear the display and start over.
- 7. If you click the "Add Objects" link a box will open giving you the option of searching for objects such as genes, QTL or SSLP Markers, or for another ontology term to view where objects annotated to that term overlap with the results you are already viewing. For this example, click the link for "QTL" and enter "NIDDM" in the search box. Select "Cyan" from the drop down list of colors and click "Submit".

Search Term (* for wildcard) Select Ontology Type/s NIDDM Ieptin GO Disease Behavioral Phenot 68 objects found for term "NIDDM". (Hover over the symbol to show the objects location) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 16 1 2 3 4 5 6 7 8 9 10 11 12 13 14 16 1 0	ntology Browser and Genome Viewer	8	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 11 Niddm35 Niddm44 Niddm66 Niddm64 Niddm63 Niddm63 Niddm63 Niddm63 Niddm64 Niddm64 Niddm64 Niddm64		GO Disease Behavioral Phenot 68 objects found for term "NIDDM". (Hover over the symbol to show the objects	_ >
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10 genes and 68 qtls loaded <u>Niddm3</u>		10 reported 68 attaileaded • Niddm2	

8. All of RGD's rat Niddm QTL are now displayed as cyan bars and a list of the QTL is displayed.

	Ontology Browser and Genome Viewer	
	Search Term (* for wildcand) Select Ontology Type's OO Desses Behavioral Phenotype Pathway leptin Ø I Ø	Run Gvewer 2 Add Jeach Term
9	Chromosome 10 (82067669 112142857)	hbly Send to Strover 1 are Zeon Pere
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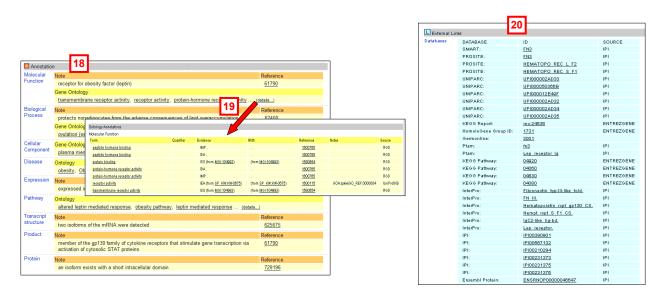
- 9. To zoom into an area of a chromosome, click on the chromosome at the position you would like to see more closely. A zoom pane showing the selected area with its genes and QTL appears below the main display pane. The area can be moved by sliding the selected area along the chromosome in the main display. You can double click the slider to lock it into place.
- 10. To see the area you have zoomed into in its broader genomic context, click the "Send to GBrowse" button. RGD's rat Genome Browser will open up with the GViewer results displayed as a separate track. For more information on RGD's GBrowse tool, see below.

Leptin system pathway (PW:0000363) Leptin acts on two populations of hypothalamic neurons that express oresignic (feeding inducing) and ancesigned geneses from the openes fro	Leptin system pathway (PW:0000363) Leptin acts on two populations of hypothalamic neurons that express or exigenci (feeding inducing and anorexigenic genes, respectively, Leptin reduces the expression of genes from the former and anorexigenic genes, respectively, Leptin reduces the expression of genes from the former and and a lab-degenetic meta databation of STAT. There are 2 <u>path(s)</u> and 58 annotation(s) to this term. Annotations to this term and its descendants total 67. 1 <th>Leptin system pathway (PW:000363) Leptin acts on two populations of hypothalamic neurons that express or exigenic (feeding inducing) and ancersion of genes between the later neurons. Leptin mediated response acts primarily via Jak-dependent actuation of STAT. There are 2 <u>path(s)</u> and 58 annotation(s) to this term. Annotations to this term and its descendants total 67. <u>View Interactive Pathway Diagram</u></th> <th>in system pathway conception system pathway ONTOLOGY REPO</th> <th><u>Ontology</u> Pathway Pathway</th> <th><u>Rat</u> 10 3</th> <th>Mouse 10 1</th> <th><u>Human</u> 10 2</th> <th>Tree Tree</th> <th></th>	Leptin system pathway (PW:000363) Leptin acts on two populations of hypothalamic neurons that express or exigenic (feeding inducing) and ancersion of genes between the later neurons. Leptin mediated response acts primarily via Jak-dependent actuation of STAT. There are 2 <u>path(s)</u> and 58 annotation(s) to this term. Annotations to this term and its descendants total 67. <u>View Interactive Pathway Diagram</u>	in system pathway conception system pathway ONTOLOGY REPO	<u>Ontology</u> Pathway Pathway	<u>Rat</u> 10 3	Mouse 10 1	<u>Human</u> 10 2	Tree Tree	
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- 11. Going back to the Genome Viewer results page, click the "leptin system pathway" term in the list below the GViewer to access the corresponding Ontology Report page.
- 12. Note that the report page includes a GViewer image of the rat genes annotated to this term as well as the definition of the term. In addition, when RGD has an interactive pathway diagram associated with the term, an icon linking to that diagram is included on the report page.
- 13. The Ontology Report page also includes a list of genes annotated to this GO term. Clicking on any of the annotated genes brings up the report page for that gene. As an example, scroll down and click on Lepr the receptor for leptin. This will bring up the gene report for the rat leptin receptor.

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							-				
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- 14. The top of the gene report page for the rat Lepr gene includes information such as current and previous nomenclature, information on splice variants and a notation that this gene is a candidate gene for the Bss4 QTL.
- 15. The "Homologs" section gives links to the RGD gene pages for the mouse and human orthologous genes. Clicking on "UCSC" or "NCBI MapViewer" will take you to the corresponding genome browser image for that gene.
- 16. Mapping information for the rat gene and its orthologs, including map positions for genomic, genetic and RH maps, is included in the "Comparative Map Data section".
- 17. Scroll down to the "Genome" section of the report to see an intron-exon diagram of the gene. Also included is a selection of browsers for genomic viewing.



- 18. Scroll down to the "Annotations" section of the page to view the manually curated annotations for this gene. These include both free text notes and ontology annotations.
- 19. Only a partial list of terms is included on the gene page. Click "(details...)" to access the full list of ontology annotations for the Lepr gene.
- 20. Returning to the gene page, scroll down again to the "External Links" section. This section provides links to external gene-specific records such as Entrez Gene and Ensembl gene pages, and to protein-specific data. Links to databases such as UniProtKB, IPI and Ensembl protein provide information on

the whole protein, while links such as those for InterPro, Pfam and SMART give information on domains, families and protein structure.

QTL Search and QTL Reports

 From the RGD home page (http://rgd.mcw.edu), or any internal page, click on the Data tab at the top of the page. The submenu in the blue bar lists the various types of biological data stored in RGD (A). Click on "QTLs" to open the QTL query page.

		Help FTP Download Citing RGD Contact Us		
	A Receil Physics	Keyword C	Help FTP Download Citing RG0 Contact Us	-
	HOM DATA ENOME TOOLS DISEASES PHENOTYPES & MODELS COMMUNITY		neip FTP Download Citing RGD Contact US	-
1	TOT DATA ENGLETOLES DISENSES PRENDITIES ANDEES COMBINITY Gen a GTLs 3 rains Markers ESTS Maps Ontologies Sequences Beferences FTP Down	~~~RGd	Physician Keyword	
	QTL Search	HOME DATA GENOME TOOLS DISEASES PHENOTYPES & MODELS CO	риминтү	
	QTE Search	Genes QTLs Strains Markers ESTs Maps Ontologies Sequences F	References FTP Download Submit Data	
	QTL reports provide phenotype and disease descriptions, mapping, and strain information as well as link			
	Example searches: Mcs. "blood pressure", renal function, blood -pressure	QTLs search result for Rattus norvegicus (View Results for all Objects and Ontologies)	Refine Term: blood pressure Update	
5			Assembly: RGSC genome assembly v3.4 V Chr 5 V	
4	Keyword blood pressure Search QTLs 5	17 records found for search term blood pressure	Sort By: Relevance V Descending V	
	Limit Results (optional)	Rat Mouse Human Al 8 Export This Report To CSV	V TAB Printer Genome Viewer	
		RGD ID Symbol Name LOD Trait Sub Trait	Chr Start Stop Species Annotations Match Type	4
3	Chr 5 Start (bp) Stop (bp) Assembly RGSC genome assembly v3.4 V Include Unmapped Objects V	Value		Τ
_	Rat	G 1393 Bp/ Blood pressure CIL 7 4.5 .0001 pressure sal-loaded sy	ystolic 5 62555131 166174140 Rat 2 name di	
	Mouse	61386 Bp49 Blood pressure QTL 16.6 Blood pressure	5 62555131 103059258 Rat 4 trait, qti name	
4	Species: Human O	631498 Bp100 Blood pressure GTL 4.9 .001 Blood systolic systolic	5 165063650 165074526 Rat 2 trait, qti	
	Ali	Blood pressure QTL and Blood evaluate	5 130600001 171801967 Det 2 trait, of	
	Search QTLs	Disad annual (CT) Disad	name	
	Switch to classic QTL search	131 pressure	5 1650/4526 1/3096209 Rat 2 name di	
	View all search features	631686 Bp119 Blood pressure CTL 3.8 Blood pressure systolic systolic	5 1 40017184 Rat 2 trait, qti	
		634349 Bp139 Blood pressure QTL .001 Blood pressure systolic pressure	5 135877124 173096209 Rat 2 trait, qti	
		724626 Bo147 Blood pressure QTL 4.2 0001 Blood sustain	5 132950559 173095200 Bat 2 trait, of	
		pressure	traž	
		1290077 DD107 157 pressure sat-loaded sy	ystolic 5 121964552 126366030 Rat 3 name di	
		1298086 Bp156 Blood pressure CTL Blood pressure salt-loaded sy pressure	ystolic 5 90916908 135916908 Rat 2 trait , qtl	

- 2. In the keyword search box, enter "blood pressure".
- 3. The QTL search gives you several additional options that you can use to narrow your search. These include chromosomal position and species. For the genomic position you can select a chromosome number or both a chromosome and base pair position. You also have the option to change the genomic assembly that the position information refers to and/or choose to include or exclude objects that do not map to the selected genome assembly. For this example, select chromosome 5.
- 4. You can also select a species. Notice that RGD also stores information on mouse and human quantitative trait loci and you can search for QTLs from any or all of these species. For this example, leave the default selection, Rat.
- 5. Click on the "Search QTLs" button to run the search.
- 6. Examine the QTL results page. The QTL search result page contains a list of all rat QTLs in RGD which match the search criteria. For each QTL, in addition to the RGD ID, symbol and name, the list gives the LOD score, the p value if available, trait and subtrait, and the base pair position on the chromosome.
- 7. Options in the box at the top of the form allow you to refine your search term, change the genome assembly which positions are given for and sort the results by any of the available columns.
- 8. Search results can be exported as a CSV or tab-delimited text file, sent to a printer, or viewed in the Genome Viewer by clicking on the appropriate link.
- 9. Click on the symbol for Bp7 to go to the RGD report page for that QTL.

	Help FTP Dow	nload Citing R	GD Contact Us			
A RED	Keywor	rd * for wildcar	d Q			
HOME DATA TOOLS DISEASES GENOME COMMUNITY	Map Data:	Marker	Symbol	Map Name	Chr.	Position
		Flank 1	D5Mit9	Other Maps	<u>5</u>	
Genes QTLs Strains SSLPs ESTs Maps Ontologies Sequences References FTP Download	5			RH 3.4	5	384.6
QTL Report for <u>Rat</u> : <i>Bp</i> 7				genome assembly 3.1 RGSC genome assembly v3.4	<u>5</u>	
Name		Peak	Edn2	genome assembly 3.1	5	
Symbol: Bp7				Other Maps	<u>5</u>	<u>q36</u>
Name: Blood pressure QTL 7				RGSC genome assembly v3.4	<u>5</u>	
Description				Rat Celera Assembly	5	
Trait: Blood pressure 11		Flank 2	D5Mco10	Other Maps	5	
Subtrait: salt-loaded systolic				genome assembly 3.1	5	
Method: indirect systolic blood pressure measured by tail cuff method on rats for diet cont. Associated Disease: hypertension	aini			RGSC genome assembly v3.4	<u>5</u>	
Associated Disease: hypertension Phenotypes: increased blood pressure	Annotations			10.4		
Statistics: LOD: 4.5 P value: .0001	Annotations	s Note				Reference
Map Summary: Chr.: 5 Peak Marker: Edn2 Flanking Markers: D5Mit9, D5Mco10	Other: 1	-	tenic to mouse salt-induced hyperte	ension QTI Boo3 (at mouse chro	mosome 4)	619653
Strains: SS/Jr LEW	- Ľ		allele associated with increased blo		,	61059
G Genome	Related Obj	jects				
View: Bp7 0rl 10rl 20rl 30rl 40rl 50rl 60rl 70r	Candidate Ge		14			
01 101 2011 3011 4011 5011 6011 701	Other datab			45		
	References		s RatMap Entrez Gene	15	-	
Browsers: Select a browser to view Assembly: 3.4 Coordinates: 5: 62555131-168174140	Kelerences		s) about Bp7 (3 curated references	16		
	Database In				4	
	RGD ID:	61393				
	History:	Nomen	clature and modification history			
				and the second second		

- 10. RGD QTL Report pages supply manually curated, detailed information about quantitative trait loci. In the Description section of the page, notice the trait and subtrait which are linked to this chromosomal locus. The "Method" line gives detailed information on the experimental methods used to measure the trait. Ontology annotations for associated disease and phenotype terms are shown. Click on "hypertension" or on "increased blood pressure" to go to the Disease or Mammalian Phenotype ontology report pages for the respective terms. RGD curates statistical measurements from QTL papers and supplies them in a searchable format. Notice that for this QTL both LOD score and P value are given.
- 11. RGD links QTL reports to the reports for the strains that were used to generate each QTL. Click on "SS/Jr" to navigate to the Strain Report page for that rat strain.
- 12. QTLs are defined by corresponding marker positions used to establish linkage. Notice that on the Map Summary line both peak and flanking markers are given. Scroll down to the Map Data section to view the map positions of the three markers. RGD uses genomic, genetic and RH maps to localize markers for QTLs.
- 13. Just above the Map Data section is a view of the Bp7 QTL on chromosome 5. Use the dropdown list labeled "Select a browser to view" to choose one of the genome browsers within RGD or on other websites such as UCSC or NCBI to view the Bp7 QTL in its genomic context.
- 14. Scroll down to the "Annotations" section. This section of the page gives free text notes which supply extra information about the QTL. Each note is linked to the reference from which that information was curated. Click on "61059" to read the abstract for the paper from which the note "SS allele associated with increased blood pressure" was derived.
- 15. The Related Objects section of the page lists any related QTLs and/or candidate genes. Click on "Edn2" to view the gene report page for the candidate gene "endothelin 2". Note that the gene report page also supplies the information that Edn2 is a candidate gene for Bp7 and contains a link to the QTL.
- 16. "Other database links" provides links to information on Bp7 in external databases. Click "RatMap" to view the RatMap report or "Entrez Gene" to view the information from NCBI's Entrez Gene database. The data at Entrez Gene is derived from RGD's QTL data.
- 17. The References section links to a page which lists all of the references associated with Bp7. Click "Article(s) about Bp7 (3 curated references)" to view the citations for the three papers associated with Bp7. Links are provided to the abstracts at RGD and at PubMed.

Strain Search and Strain Reports

1. From the RGD home page (http://rgd.mcw.edu), or any internal page, click on the Data tab at the top of the page. The submenu in the blue bar lists the various types of biological data stored in RGD (A). Click on "Strains" to open the Strain query page.

			Help F	TP Download	d Citing RGD Contact Us				
	A ROU Physi	ien	,	Keyword [
1	HOME DATA GENOME TOOLS DISEASES PHENOTYPES & MODELS COMMUNITY Genes QTLs Strains Markers ESTs Maps Ontologies Sequences References	~	- Red	1	p	ysGen	p FTP Do		ting RGD Contact Us
	Strain Search				PHENOTYPES & MODELS COMMUNITY os Ontologies Sequences References	FTP Download Submit Data			
	Strain reports include a comprehensive description of strain origin, disease, phenotype, gene sub-strains, and strain sources. (Search Help) Example searches: th. "blood pressure". SS BN Mow. dtGrat/	(View Re:	search result for Rat sults for all Objects and On rds found for search t Export This Repor	tologies) erm cop		Refine Term: Cop Sort By: RGD ID	Ascending	v	Update
	Keyword cop Search Strains		Symbol COP/OlaHsd	Name	Origin These are derived from the original colony which w developed by Dr. W.F. Dunning.	Source ¹³ Harlan	Type	Annotation:	s Match 4
2	Switch to classic strain search	60997	DA	DA	Developed from stock of unstated origin by Dr. T.T. Jr. at Oak Ridge National Laboratory, Tennessee to then by Dr. Derov Wilson at He Witstar instatute, wh named it DA because it expressed the 'd' blood gro allele of Joy Pairn, and it is 'a' agout in colour (Wilso 1965), inbreeding(more)	r11,	inbred	11	origin
	View all search features	609	<u>o</u> 5		Curtiss 1921 at Columbia University Institute for Can Research. As Cohen Rosenthal Diabetic Hypertensive, from a between strains CDR and SHR followed by selectio	ross	inbred	4	symbol
		68019	CRDH	Cohen Rosenthal Diabetic Hypertensive	between strains CDR and SHR followed by selecte high blood pressure and blood glucose levels follow two-moths of feeding a copper-poor, high (74%) sucrose diet. Selected animals were brother x sl (more)		inbred	11	origin

- 2. The RGD Strain Search works in the same way as the general Keyword search at the top of the page except that it only searches for strains. For this example, enter "cop" in the "Keyword" search box under "Strain Search".
- 3. Click the "Search Strains" button to navigate to the Strains Search results page.
- 4. Notice that the search returns the list of all strains where "COP" occurs anywhere in the indexed fields of the strain record. In addition to the obvious options of symbol and name, these include previous nomenclature and origin. Note in the results list you will see substrains and congenic strains in addition to the parental COP strain.
- 5. Click the link for "COP" to go to the Strain Report page for the parental strain.

		r		
1	01	4	Strain Report	
	Strain Repo	ort		
			Symbol: COP/Crl	
	Symbol: COP		Strain: COP	
	Strain: COP		Substrain: Crl	
	Type: inbred		Name: Copenhagen	
	See Also: COP/Crl COP/Ola		Source: Charles River Laboratories	
		laHsd	Type: inbred	Ontology (7)
			See Also: COP	
	Basic details		COP/OlaHsd	Term Qualifier Evidence With Reference Notes Source
	Basic details			Disease
	Genetic markers:	COPLAN	Basic details	Hupenplania ED 1358963 RGD
		COP/Crl: Hooded	Basic details	Phenotype 10
	Coat Color:	COP: Black hooded.	Genetic markers: Hooded	mammary alwedar hypeplasia IED 1358963 RGD
		COP/Crl: White	Coat Color: White	
6	# Inbred	COP: F49 (Pcr1988).	#Inbred	
_	Generations:		Generations:	Strain SSLP data (?)
	Origin:	COP: Curtiss 1921 at Columbia University Ins COP/Crl: Inbred strain is from Curtis in 1921	Origin: Inbred strain is from Curtis in 1921 at Columbia University Institute for Cancer Research. T	ro
		Program (Cr). To Charles River from the Natio	Charles River from the National Cancer Institute in 1998.	
		COP/OlaHsd: These are derived from the orig		Strain OTL data
				COPICI On Sendo Name Tait Subtrait
			Annotations: 0	Eat10 strongen-induced plustary tumorigenesis QTL 10 Gland mass pitulary
	Annotations:		Note Reference	1 Lasts Estrogen-induced pitutary tumorigenesis QTL 13 Gland mass pituitary
			Note Reference	3 Ept5 Estrogen-induced pluitary tumorigenesis QTL 6 Gland mass pituliary 3 Ent2 Estrogen-induced pluitary tumorigenesis QTL 2 Gland mass pituliary
	Note		Lifespan and Spontaneous Disease	5 Enca1 Estrogen-induced partary tumorgenesis Q1, 2 Gand mass pitutary 6 Enca1 Estrogen-induced mammary cancer QTL 1 Mammary tumor susceptibility estadiol-induced
	Lifernan and Sno	ontaneous Disease	F1, F2 and backcross progeny of these rats with ACI show significantly prolonged latency for 1358956	6 Egt1 Estrogen-induced pituitary tumorigenesis QTL 1 Gland mass pituitary
		0.2 months (but this figure is probably unrelia	E2 induced mammary cancer.	10 Estrogen-induced pituitary tumorigenesis QTL 9 Gland mass pituitary
		ours of the thymus (Dunning and Curtis 1946, I	17beta-estradiol stimulates mammary cell proliferation and lobuloalveolar hyperplasia. 1358963	18 Emca2 Estrogen-induced mammary cancer QTL 2 Mammary tumor susceptibility estradiol-induced
	<u></u>		E2 induced atypical epithelial hyperplasia is not present in COP rats which is observed in 1358963	
	Small pitutaries (Dunning et al 1947). Resistant to Cysticercus. tumours IRS 4337 and R3327 prostate adenocarcinoma, which i cancer (Lubaroff et al 1977).		ACI rats.	
			Drugs and Chemicals	Associated References (?)
			Strain has decreased sensitivity to DES-induced pituitary growth.	
			Synthetic estrogen diethylstilbestrol (DES) induces pituitary growth in ACI and COP rats and 1358974	1: Shull JD, etal., Endocrinology 2001 Dec;142(12):5124-30.
			their F1, F2 and backcross progeny.	2: Harvell DM. etal., Endocrine 2003 Jul 21(2):175-83.
		of diethylstilboestrol leading to death from bladd	DES induces an increase in the circulating PRL in ACI males as compared to COP males. 1358974	Gould KA, etal., Genetics 2014 Dec;160(4):2113-25. Harrell DM, etal., Proc Natl Acad Sci U S A 2000 Mar 14 97(5):2779-84.
		tis 1946, Dunning et al 1947). Resistant to man	DES treatment on males for 12 weeks induced the development of PRL-producing pituitary 1358975	5: Spady TJ, etal., Endocrinology 1919 Jun; 140(6) 2828-35.
	by/, i2-dimethylbenz[ajanthracene at doses which in strains Ow tumors compris		tumors comprising of enlarged pituitary glands displaying lactotroph hyperplasia and	
	property of the mar	immary gland rather than a systemic effect (Isa	associated hyperprolactinemia.	
		duction of mammary cancer following exposure	These females are relatively resistant to 17beta-estradiol induced mammary tumorigenesis. 1358956	
	7,12-dimethylbenz	z(a)-anthracene powder applied directly to expo (Takahashi et al. 1992). Subtractive hybridizatio	an uning COP and WE	

- 6. RGD's Strain Report pages display a wealth of valuable information on individual rat strains. In the "Basic Details" section, notice the information on Genetic markers, Coat Color and number of inbred Generations. In the Origin section, parent strain pages give information on the origins of not only the parental strain, but also all of the corresponding substrains.
- 7. In the section above "Basic Details" click the link for "COP/Crl" to go to the page for this substrain. Notice that this Strain Report only gives information for the substrain, but includes a link to both the parent strain and the COP/OlaHsd substrain.
- 8. Scroll down to the "Annotations" section.
- 9. Detailed notes on topics such as "Lifespan and Spontaneous Disease" and "Drugs and Chemicals" have been written by RGD curators. Click the "1334449" link in the "Reference" column beside the first note under "Drugs and Chemicals" to read the abstract for the paper from which the note "*Strain has decreased sensitivity to DES-induced pituitary growth*" was curated. Notice that the Reference report page shows a link to the PubMed page which includes a link to the free full text of this article.

- 10. Returning to the Strain Report, scroll down to the Ontology section to view the Disease and Phenotype Ontology annotations that have been assigned to this strain. Click on the link for "mammary alveolar hyperplasia" to review the information for this Mammalian Phenotype term.
- 11. Returning once again to the strain page, scroll down to view the list of RGD QTLs which were generated using this strain. Click on the link for Ept10 to navigate to the QTL report page for Estrogeninduced pituitary tumorigenesis QTL 10. (See information on the QTL report pages elsewhere in this handout for details on using RGD QTL reports.)

Term	Qualifier Evidence With	Referen	ce N	éotes .	Source					
Disease			000	VOIaHsd						
Drymus Neoplasma	TAS	1004					Trait			
prostatic neoplasms	TA8	1004		Symbol Na						Subtrait
Phenotype					robic running ca			running capacit		
hyperplastic prostate pland	TAS	1004	16	Arunc2 Ae	robic running ca	pacity QTL 2	Aerobic	running capacit	у	
thymus hyperplasia	TAS	1004	16	Arunc1 Ae	robic running ca	pacity QTL 1	Aerobic	running capacit	у	
Strain SSLP data (?) COP/OlaHsd. 4134 SSLP markers have been typed in this :	_{train} 12		Ass	ociated F	References (?)				
train QTL data										
COP			COP							
Chr Symbol Name	Trait	Subtrait	1:					HK, Lindsey JR	Weisbroth SH, 5	5-72, Academic Press
1 Mcs3 Mammary carcinoma susceptibility QTL 3	Mammary tumor susceptibility		2:	Festing.	MFW, Personal	Communication U	pdate, Feb-2000			
1 Hcas5 Hepatocarcinoma susceptibility QTL 6	Liver tumor susceptibility	nodule number	3:	Hou LC.	etal., Cancer Re	es 1994 May 15,54	(10) 2765-70			
2 Lnn:3 Uver neoplastic nodule remodeling QTL 3 2 Most Mammary carcinoma susceptibility QTL 1	Liver neoplastic nodule remodeling freque Mammary tumor susceptibility	ency	4:	Shepel L	A. etal., Geneti	s 1998 May: 149(1	1:289-99			
<u>Most1</u> Manimary carcinoma susceptionity QIL 1 Hcar12 Hepatocarcinoma resistance QTL 13	Liver tumor existance	nodule number	5:	M Eesti	ng Rat Strain Lis	d			_	_
7 Mos2 Mammary carcinoma susceptibility QTL 2	Mammary tumor susceptibility				a characteristics				1.10	
8 Mos4 Mammary carcinoma susceptibility QTL 4	Mammary tumor susceptibility		COP/						113	
13 Leves Liver neoplastic nodule remodeling QTL 5	Liver neoplastic nodule remodeling frequ		1:	Shull JD	etal, Endocrin	ology 2001 Dec;14	2(12) 5124-30		110	·
13 Lnm6 Liver neoplastic nodule remodeling QTL 6	Liver neoplastic nodule remodeling frequ		2:	Harvell D	M, etal., Endoc	rine 2003 Jul;21(2):	175-83.			
	Liver neoplastic nodule remodeling freque Liver tumor susceptibility	ency autola number	3:	Gould Ke	A. etal., Genetic	s 2004 Dec:168(4)	2113-25.			
			4:	Hanel D	M etal Proc M	atl Acad Sci U S A	A 2000 Mar 14:97(6):2	779-84		
14 Hcas6 Hepatocarcinoma susceptibility QTL 6	Liver tumor susceptibility	nodule number								
14 Hcan5 Hepatocarcinoma susceptibility QTL 6 15 Hcan7 Hepatocarcinoma susceptibility QTL 7		nodule number nodule number	5:		Letal Endocris		10(6) 2828-35			
14 Hcas6 Hepatocarcinoma susceptibility QTL 6 15 Hcas7 Hepatocarcinoma susceptibility QTL 7	Liver tumor susceptibility		5:	Spady T.		tology 1999 Jun;14				
14 Hcas5 Hepatocarcinoma susceptibility QTL 6 15 Hcas7 Hepatocarcinoma susceptibility QTL 7	Liver tumor susceptibility		5: 6:	Spady T. Spady T.	J. etal. Cancer	tology 1999 Jun; 14 Lett 1998 Feb 13: 1				
14 Hcas6 Hepatocarcinoma susceptibility QTL 6 15 Hcas7 Hepatocarcinoma susceptibility QTL 7	Liver tumor susceptibility		5: 6: 7:	Spady T. Spady T. Strecker	J. etal. Cancer	tology 1999 Jun;14				
14 Hcas5 Hepatocarcinoma susceptibility QTL 6 15 Hcas7 Hepatocarcinoma susceptibility QTL 7	Liver tumor susceptibility		5: 6: 7: COP/	Spady T. Spady T. Strecker	J etal. Cancer TE, etal., Gene	tology 1999 Jun;14 Lett 1998 Feb 13:1 tics 2005 Jan 31;	24(1):95-103.			
 Limit Low resplacit reader remoting OIL 4 Hand Hepatocineme susceptible OIL 6 15 Hand Hepatocineme susceptible OIL 7 Hand Hepatocineme sesistance OIL 54 	Liver tumor susceptibility		5: 6: 7:	Spady T. Spady T. Strecker OlaHsd Festing	J. etal., Cancer TE, etal., Gene , MFW, Inbred S	tology 1999 Jun;14 Lett 1998 Feb 13:1 tics 2005 Jan 31;	24(1):95-103.	HK, Lindsey J	R. Weisbroth SH.	55-72, Academic Pres

- 12. Returning to the COP/Crl strain page, either click the link at the top of the page or use your browser's "Back" button to navigate back to the COP parental strain page. Scroll down to the Strain SSLP data section. Notice that information on the markers typed in the COP/OlaHsd substrain is listed there. Directly beneath this section you will see that QTL data for the parental strain and both substrains is listed in the Strain QTL data segment. The QTLs listed for the COP/Crl substrain here are the same as those listed on that substrain's strain report.
- 13. Finally, scroll down to the "Associated References" section. This section lists all of the references associated with the COP strain and its substrains. Click on the last link in the list for COP/Crl, "7: Strecker TE et al..." to view the same Reference Report that you accessed from the COP/Crl report page.

Reference/Author Search and Reference Reports

1. From the RGD home page (http://rgd.mcw.edu), or any internal page, click on the Data tab at the top of the page. The submenu in the blue bar lists the various types of biological data stored in RGD (A). Click on "References" to open the Reference query page.

1				
	Help FT	P Download Citing RGD Contact Us		
	MRED Physics			
4	HOME DATA GENOME TOOLS DISEASES PHENOTYPES & MODELS COMMUNITY			
Ш	Genes QTLs Strains Markers ESTs Maps Ontologies Sequences References F	'P Download Submit Data		
	Reference Search Reference reports provide full citations, abstracts, and links to Pubmed. (<u>Search Help)</u> Example searches: <u>iscobsen 2004</u> , pmid:15232614, <u>obesity smith nat cenel</u>	References search result for Rattus norvegicus (View Results for all Objects and Ontologies) 2 2 records found for search term blood pressure rapp 1998 All Export This Report To CSY TAB Printer	Refine Term: blood pressure rapp 1998 Update Sort By: Relevance ♥ Descending ♥ ♥	
2	Keyword blood pressure rapp 1998 Search References Switch to classic reference search View all search features	Image: Piconal state of the state	Abstract PubMed PubMed 0.00 = 5.0 on rat chromosome 9 using a large F2 population (t+ 233) derived from Dahi sat-sensitive (5) and Dahi sat-resistant (R) rats. The F2 rats were fed 5% Nac1 d(more)	12-01
		Construction of a double congenic strain to prove an epistatic e19940 interaction on blood pressure between rat chromosomes 2 and 10. Rapp JP, etal., J Clin Invest 1998 Apr 15;101(8):1591-5.	Previously we presented suggestive evidence from an F2 seyregating population for an interaction on blood pressure (BP) between quantitative trait loci (OTL) on rat chromosomes (Chr) 2 and 10. To prove the existence of such <u>(more)</u>	08-01

2. Multiple search terms can be entered into the strain keyword search box. So for instance, enter "blood pressure rapp 1998" and the tool will automatically search for articles in RGD that meet all of the search criteria. Click "Search References" to locate the relevant references.

- 3. On the results page, note once again that the search can be refined or the results sorted using the options in the box at the top of the form. The search results can be exported as a CSV or tab-delimited text file or sent to a printer. Results include the RGD ID, title and citation of the reference. The full abstract can be viewed directly on the search results page by clicking "...(more)". The result in this list also gives one-click access to the abstract in PubMed via the link in the "PubMed" column.
- 4. Click the link for the article by Rapp et al ("Linkage analysis and construction...") to view the abstract for that article.

Reference Report	
Linkage analysis and construction of a congenic strain for chromosome 9.	or a blood pressure QTL on rat
5 Rapp JP, Garrett MR, Dene H, Meng H, Hoebee B, Lathrop GM,	Related Objects Report
Citation: Rapp JP, etal., Genomics 1998 Jul 15;51(2):191-6	There are 7 entries in RGD covered by this refe
Status: COMPLETED	
Abstract (?)	GENES
Abstract(1)	Symbol Name
A blood pressure quantitative trait locus was found (LOD = 5.0) on rat chro derived from Dahl salt-sensitive (S) and Dahl salt-resistant (R) rats. The F2	
strain introgressing the R low-blood-pressure QTL allele on chromosome 9	STRAINS
designated S.R(chr 9), had a lower blood pressure (19 mm Herring 0.0001 rats (2% NaCl diet for 24 days), proving the existence of the ord pressure of	Symbol Name
	SR/Jr Salt Resistant
Show data curated from this reference 7	SS/Jr Salt Sensitive
	SS.SR-InhalJr -na-
External Database Links	QTLS
	Symbol Name
PubMed Rapp JP, etal., Genomics 1998 Jul 15;51(2):191-6 (9722941)	Bp34 Blood pressure QTL 34
- 6	SSLPS
	Symbol Name
	D9Uia6 -na-
	D9Uia9 -na-

- 5. On the Reference report page, note that each author's name is a link. Click a name to view all of the articles in RGD by that author.
- 6. The reference report page also includes a link to the abstract record in PubMed. Click the citation under "External Database Links" to view the abstract at PubMed.
- 7. Finally, on the reference report page click the link labeled "Show data..." to view all of the data objects that have been curated from this reference.
- 8. The Related Objects report shows that 7 objects have annotations derived from the Rapp et all reference. These include one gene, three strains, one QTL and two SSLPs. Click on the symbol for any of these objects to view the report page for that object.

Pathway Annotations and Visualization

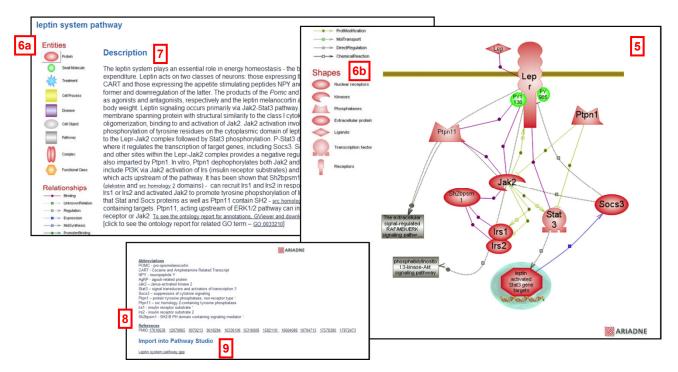
1. Similar to a search for GO, a search using the keyword 'leptin' within the Pathway Ontology brings up "leptin system pathway" and "altered leptin system pathway" – the two terms in the vocabulary that contain the word "leptin".

Term leptin system pathway altered leptin system pathw	аұ	<u>Ontology</u> Pathway Pathway	<u>Rat</u> 103	<u>Mouse</u> 10 1	<u>Human</u> 10 2	Tree •	
lepti and a via Jai 2 There	tin system pathway acts on two populations of hyp noresignic genes, respectively, cost the expression of genes for te-dependent activation of STAT. are 2 path(s) and 58 annotati indants total 67.	y (PW:000036 othalamic neurons that : Leptin reduces the ex om the latter neurons. I	t express or exigenic (fee pression of genes from 1 Leptin mediated respons unnotations to this term	and its	Interactive Pathware 8 19 20 X 0 0 0	ay Diagram	
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List	All Objects CSV Export Add	<u>Objects Clear</u>	Irs1 insulin recepto Irs1 insulin recepto Irs2 insulin recepto	r substrate 1		ISS (from RGD:10816)	RGD:230 RGD:230 RGD:230

- 2. Click on the term "leptin system pathway" to view all the objects annotated to that term. The ontology report shows a GViewer image of the rat genes annotated to that term, as well as a list of rat, human and mouse genes annotated to the term and the paths to the term. Unlike GO annotations which are done on a gene-by-gene basis, annotations to pathway terms aim at capturing the network information, i.e., the identification of all genes which according to published reviews are components of a particular pathway and the subsequent annotation of these genes to the term.
- 3. In addition to the annotation of genes to pathway terms, RGD builds interactive pathway diagrams using the Pathway Studio 5.0 from Ariadne Genomics. A growing list of classic metabolic, signaling, regulatory and disease pathway diagrams have already been incorporated into RGD. These diagrams are accessible from the Ontology report page by clicking on the pathway diagram icon at the top right side of the page.



4. Alternatively, the entire list of pathway diagrams can be viewed by clicking on the "Pathways" button on the RGD home page. From the list, click on the name of a pathway to explore its diagram.



5. The leptin system pathway diagram is shown here. Icons for individual genes link to the RGD records for those genes. Those for related pathways link to the diagrams for the respective pathways. Where a single icon represents multiple objects, such as target genes, a link is provided to a separate page with the complete list to simplify the diagram structure.

- 6. Along with the diagram itself, all diagram pages provide a legend for entities, relationships and shapes as designed by Ariadne Genomics.
- 7. Note the detailed description of the pathway
- 8. A list of abbreviations and a list of references that are hyperlinked to PubMed are provided.
- 9. In addition to viewing the diagram, users can import the diagram.gpp file into their own Pathway Studio tool. The Ariadne Genomics logo is displayed on all diagram pages.

RGD Tools

Disease Portals

RGD is providing disease and disease related information for rat, human and mouse genes, rat and human QTL and rat strains. In an effort to offer better ways for organizing and presenting these data, RGD has begun implementing the Disease Portals project. Portals so far offered are for the cardiovascular, neurological and obesity/metabolic syndrome disorders.

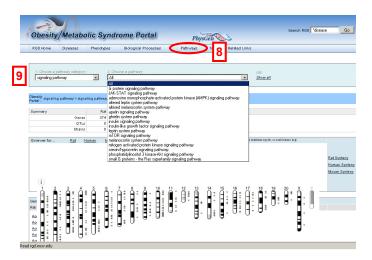
He	Ip FTP Download Citing RGD Contact Us
Physica D	RGD Disease Portals RGD disease portals are designed to be entry points for researchers to access data and tools related to their area of interest.
HOME DATA TOOLS DISEASES GENOME COMMUNITY Cardiovascular Disease Portal Neurological Disease Portal Obesity/Metabolic Syndrome Portal	Cardiovascular Disease Portal RGD has released its <u>Cardiovascular Disease Portal</u> to provide researchers with easy access to data on genes, OTLs, strain models, biological processes and pathways instead to cardiovascular diseases. This resource finded by MHLB also includes dynamic data analysis thost to mide the operation of the disease and the diseases and the disease and the diseases. All other diseases and pathways fields to cardiovascular diseases and the diseases and the diseases and the diseases. The section as disease caregory to get a publicher of the diseases. All other diseases and the disea
	provide a list of related genes, OLLs, and strains as well as a genome wide view of these across the genome via GVeever and access to GBrowse results showing the genes and OLLs within the genomic cortex. Additional pages for <u>Fological Processes</u> , <u>Pathwary</u> and <u>Phenotypes</u> provide one-cick access to data of interest. A <u>Tools</u> section and a Links section provide additional resources. <u>Phone Strain St</u>

- 1. From the main RGD webpage click on the **DISEASES** tab to access a list of available portals
- 2. Select "Obesity / Metabolic Syndrome Portal" either in the menu bar at the top or in the portals list.

Obesity Metabolic Syndrome Portal ROD Home Diseases Phenotypes Biological Processes P	Pathways Tools Related Links	
Image: Choose a disease One Al Image: Choose a disease One Place relect a cologoy firt in Stour at Density Obesity Pedal Stour at Summary End 667 OF TLG 713 667 Stoale 123 100		
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- 3. The default view for all portals is a display of all objects (genes, QTL and strains) annotated to disease terms within the portal. Note that a summary of the number of objects of each species is included at the top of the page.
- 4. A rat GViewer image shows a genome-wide view of annotated genes and QTLs. Click on "Human Synteny" to view an image with the human syntenic regions denoted by color.
- 5. Mouse over one of the objects in the diagram to see the symbol and position information for that object.

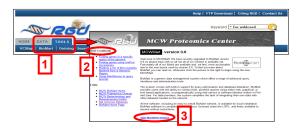
- 6. Click "View annotation Data" to download a list of the annotated objects with their genomic positions.
- 7. Lists of annotated objects are located beneath the GViewer image. You can scroll up and down the list. Also, each object is hyperlinked to its report page, i.e., clicking on it one gets to the gene, QTL or strain report page.



- 8. In addition to this default display, you can choose a disease category and a specific disease within the category or make such selections for phenotypes, biological processes or pathways within the portal to see the annotated objects. All annotations are based on controlled vocabularies: the Disease Ontology (DO), the Mammalian Phenotype Ontology (MP), GO Process Ontology (one of the three vocabularies of GO), and the Pathway Ontology (PW). Click on the "Pathway link" to access this section of the portal.
- 9. In the drop down lists at the top of the page, select "signaling pathway". Notice that the items in the second list change according to what you choose for the first term. Also note that the lists of objects and the GViewer image change according to the ontology and the terms selected.

BioMart

1. RGD's BioMart tool allows the user to query RGD for specific data based on both input and output criteria. Once a dataset is selected, that data is filtered based on the input criteria and the data retrieved is determined by the output criteria. From the RGD home page (http://rgd.mcw.edu), or any internal page, click the **TOOLS** tab at the top of the page and select **BioMart** on the menu bar to access the MCWMart home page.



- 2. Notice the **RGD Cookbook** links in the left margin. These pages walk you through some common problems.
- 3. To access the RGD BioMart tool, click **Start MartView session**.



4. There are several datasets to choose from. Select RGD Mart.

Dataset	Please restrict your query using criteria be	low		
20080212	B Gene Information			
Filters [None selected]	Gene Symbol			
Attributes	Gene Name	New Count Results		XML Peri
[None selected]	B Genome Map v3.4	Dataset	Please restrict yo	our query using criteria below
	Map Locations	20080212	a Gene Information	
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			Disease Ontology	Abetalipoproteinemia

- 5. Click Filters to access a form which will allow you to limit the genes for which you get information. A subset of the RGD genes can be selected based on a single symbol and/or name, map position, a list or file containing gene, sequence or ontology identifiers, and/or a variety of ontology terms.
- 6. For this example, click the plus sign (+) next to "External Database Identifiers", click the check box for "Limit to Genes with" and type "2004" into the text box under "RGD ID(s)". If you wanted to upload a file of IDs you would click the "Browse..." button to locate and upload your file.

20080212		,			
Filters	I GENE AND FUNCTION O DATABASE ACCESSIONS				
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	© ONTOLOGY ANNOTATIONS		[None selected]	Symbol	Entrez Gene ID
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	Disease Ontology DB Reference DO ID DO Lerm Aspect	Evidence Qualifier With From			
	Mammalian Physiology Annotation				
	MP Term	With From			
	DB Reference	Evidence Qualifier With From	v		

- 7. Select "Attributes" in the menu on the left. Choose the type of data that you wish to obtain for the genes you have selected, either "GENE AND FUNCTION" data or "DATABASE ACCESSIONS".
- 8. For this example, keep the default selection of gene and function. This includes gene IDs and nomenclature, map data and annotations for any or all of the four ontologies that RGD uses—Gene, Disease, Phenotype and Pathway.
- 9. Click the check boxes for Symbol, RGD ID, Entrez Gene ID, Chromosome and Start and Stop positions.



- 10. Click the Results button at the top of the page to view the selected data for RGD ID 2004.
- 11. Results can be viewed on the website or downloaded to a file as HTML, Comma or Tab separated Values or Excel spreadsheet. For both the download function and viewing on the website, you can choose "Unique results only" to avoid redundant annotations.

GBrowse

 You can access the RGD Rat Genome Browser, or GBrowse, from the RGD home page (<u>http://rgd.mcw.edu</u>) by clicking on the button labeled "Rat Genome", or from any RGD page, by clicking on the "GENOME TOOLS" tab at the top of the page. On the Genome Tools page, click the Rat Genome Browser link to access GBrowse.



2. Notice at the top of the page there is a section with instructions for using GBrowse including examples of possible searches. Below this section, type "chr11:27240000..28240000" into the "Landmark or Region" box under Search. Note that you can also enter symbols or keywords into this box. Directly under this, the default for "Data Source" is Rat Genome V3.4 Assembly. Keep this as the source, but notice that other data sources are available including the Human genome. Click the Search button to display the region entered.

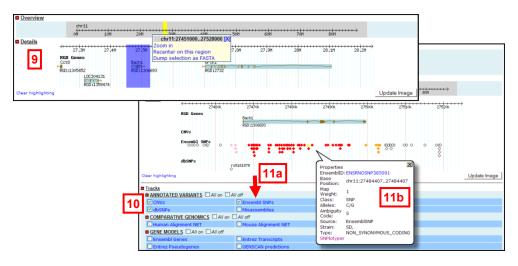
	Showing 1 Mbp from chr11,	positions 27,240,000 to	28,240,000								
	Instructions										
	National Search using genomic object symbols or use an Ontology term. Navigation: Click one of the rulers to center on a location, or click and drag to select a region. Use the Scroll/Zoom buttons to change magnification and position.										
	Examples: Chr1:108056701109056700, Padi4, anglogenesis, c)p1*, Chr11:27130000.29820000, proteinuna, Grik1, RGD620956.										
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	GENE MODELS All on All off										
	Ensembl Genes	Entrez Transcripts	RGD Genes 6								
	Entrez Pseudogenes	GENSCAN predictions									

- 3. The Overview section shows a diagram of the entire chromosome 11 with a yellow box/line showing the section which is displayed in the Details section. Clicking on the overview diagram will move the Details display to the location where you clicked. The number of base pairs displayed remains the same. Use your browser's "Back" button to return to the original position.
- 4. You can also use the arrows to scroll up or down the chromosome, and the dropdown box or plus/minus buttons to increase or decrease the number of base pairs displayed. Use your browser's "Back" button to return to the original size and/or position.
- 5. In the Details section, if you have used GBrowse before the tool will use your previous settings. To clear these settings, use the "Reset" button at the top of the page. If you have not used the tool before or if you have cleared the settings, the default view is only the RGD Genes track.

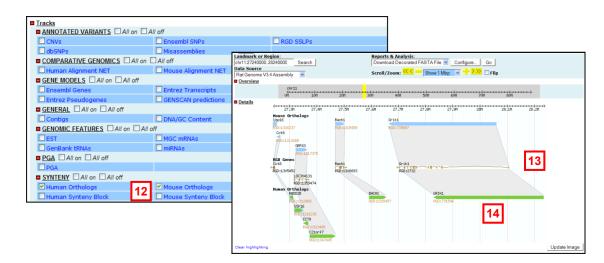
6. If you scroll down to the "Tracks" section of the page you can see the variety of different data types that GBrowse can display. Because only RGD genes are presently being displayed, only that box is checked.

Overview				
	chr11 crtr11 off 10ff	20M 30M	40rt 50rt 20rt 80rt	
Details	27,3H 27,4H RGD Genes Octil	27.5H 27.6H Bachi 80011306693	Properties 8 2017 20.111 20.21	
	R60:1305452 L0C304131 R60:1359474	850:1306693	Name: Non-Instant dependent ROD ID: 63434 Bab D: 63434 Postbor: fw1122214205.43156819	
	RGD QTLs		Position: Mapping Positioned by flanking	
	RGD:1641927		Method: markers	
	R50:1300147		LOD: 3.5	
	R5D:1596611		Class: QTL Source: RGD	
	RSD:1590042			
	RGD:724554			
	RSD:1598841			
	RGD:634341			
	R5D:1581565			
	R50:2290451			
	R0D:1558659			
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EST		MGC mRNAs		
GenBank t	NAc.	miRNAs		

- 7. To see all of the QTL that overlap your region, scroll down to the GENOMIC FEATURES segment of the Tracks section. Check the box for RGD QTLs and click the "Update Image" button.
- 8. Note that when you mouse over any object in GBrowse, such as a QTL or gene, a balloon pops up with detailed information about that object. What information is displayed depends on the object. In this case, the QTL nomenclature, RGD ID, base pair position, mapping method and LOD score are shown. Notice that the RGD ID is a link that will take you to the corresponding QTL report.



- 9. RGD's GBrowse has tracks for a number of annotated variants including SSLPs, copy number variants and SNPs from both dbSNP and Ensembl. To see the SNPs for the gene Bach1, click and drag your mouse along the scale line in the Details section to select the portion that contains just that gene. A popup box gives you the option to Zoom in, Recenter the image or download the selection as a FASTA file. Select "Zoom in". The image is automatically updated.
- 10. Scrolling down to the Tracks section, uncheck the box for RGD QTLs, check the one for Ensembl SNPs and click "Update Image".
- 11. The diamond shapes that represent SNPs in GBrowse are color coded to show the type of SNP each is. For a list of the colors and their meaning, click the text (not the check box) for "Ensembl SNPs". A new window will open up which gives more information about the various tracks. Mousing over a SNP will open a popup balloon that displays more information about that SNP, including what type of SNP it is. If you mouse over the yellow SNP in the second exon of the Bach1 gene you will see that it is a "Nonsynonymous coding" SNP.



- 12. RGD's rat GBrowse now includes information on rat-mouse-human synteny. Using your browser's "Back" button, go back to the original image of the rat genes within chr11:27240000..28240000, or alternatively, click the "Reset" button and re-enter the genomic position of interest. Notice that the rat genes that are displayed have blue shading behind them. This indicates that those genes have mouse and or human orthologous genes that are currently not being displayed. Scrolling down to the bottom of the Tracks section, select the tracks for "Human Orthologs" and "Mouse Orthologs" and click "Update Image".
- 13. The display now shows a number of orthologous mouse and human genes with grey shaded areas linking the rat genes to their orthologs. Hover over a mouse gene to open a popup balloon that displays more information about that gene including its symbol, name, RGD, MGI and Entrez Gene IDs, and its genomic position in mouse. The RGD, MGI and Entrez Gene IDs are links to that gene's record on the corresponding website.
- 14. Note that the sizes of the genes in the different species have not been adjusted. If the rat gene is longer or shorter than the orthologous mouse or human gene, this is reflected in the sizes of the bars representing those genes.

FTP Downloads

1. Data can be downloaded in bulk from our ftp site. Click "Download Data via FTP" above the Keyword search box in the top right corner of each RGD page.

			Index of ftp://rgd.mcw.edu/pub/data_relea			
			Up to higher level directory	4a		
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About Us Yearly Report Citing RGD Contact Us	NAR-00425-web-S-2005.R1	4/20/2005 12	GENES MUS	14703 KB	4/23/2007 12:00:00 AM	
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			STRAINS	362	rattus gtis mp.obo	170 KB 2/28/2008 10:10:00 PM
						49 KB 2/28/2008 10:10:00 PM
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- 2. Another link to "FTP Download" appears in the menu bar at the very top of each RGD page.
- 3. On the FTP site, select the "data release" directory.
- 4. The data release directory contains a variety of files containing data compiled from the RGD database for rat, mouse and human genes, rat and human QTLs and rat strains. In addition, a subdirectory holds individual files with annotations of various objects to particular ontologies.