

Discover hidden relationships in your toxicological studies

Discovery Team, QIAGEN Digital Insights

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Agenda

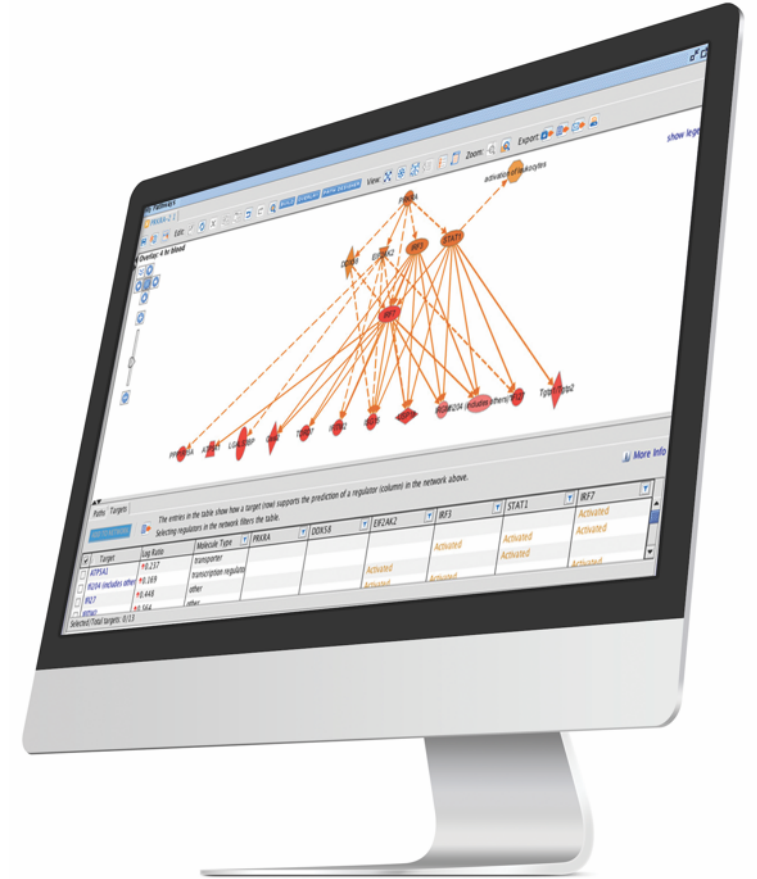
Analysis Match

What can you learn from analyses that are similar or different than yours?

Case study: Biological effects of gemfibrozil in the liver (of rat)

QIAGEN OmicSoft Land Explorer for IPA

Conclusions



Analysis Match makes it easy to find insights

Discover which analyses resemble yours, to uncover insights from mechanistic similarities and differences

Expression Analysis - Gemfibrozil vs Ctrl RNA-seq PMID 25150839 metadata - 2020-03-10 04:16 PM

Summary Graphical Summary Canonical Pathways **Upstream Analysis** Diseases & Functions Regulator Effects Networks Lists Molecules Analysis Match

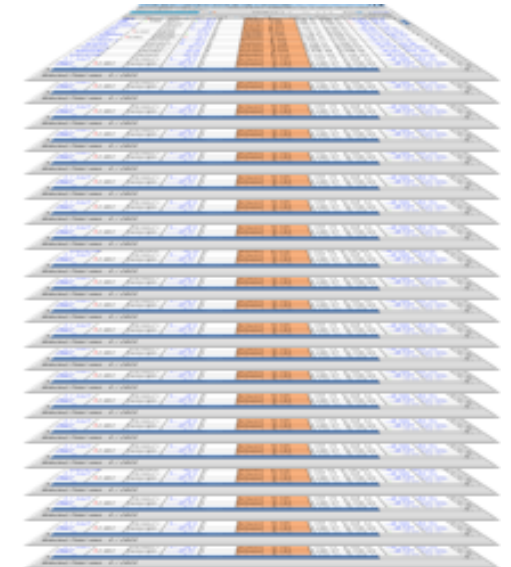
Upstream Regulators Causal Networks

Add To My Pathway Add To My List Display as Network Activity Plot Customize Table Mechanistic Networks

Upstream Reg...	Expr Fold...	Molecule Type	Predicted Activ...	Activation z-score	p-value of o...	Target Molecules in Dataset	M...
PPARA	↑1.620	ligand-dependent nuclear receptor	Activated	5.208	5.99E-61	↑ABCD3, ↑ACAA1, ↑ACAA2, ↑ACA...all 123	304 (16)
pirinixic acid		chemical toxicant	Activated	7.276	4.94E-50	↑ABCC3, ↑ABCD3, ↑ACAA1, ↑ACA...all 109	319 (15)
POR	↑2.773	enzyme	Inhibited	-3.121	6.54E-36	↑ABCC3, ↑ACADL, ↑ACADVL, ↑AC...all 60	216 (7)
ciprofibrate		chemical drug	Activated	6.015	5.90E-32	↑ABCD3, ↑ACAA1, ↑ACADL, ↑ACAD...all 51	366 (17)
ACOX1	↑3.494	enzyme	Inhibited	-5.045	5.62E-30	↑ABCD3, ↑ACAA1, ↑ACADL, ↑ACAD...all 49	226 (9)
elaidic acid		chemical - endogenous mammalian	Activated	3.554	1.78E-29	↑ACACA, ↑ACAT2, ↑ACOT1, ↑ACOX1...all 40	
fenofibrate		chemical drug	Activated	6.771	7.16E-25	↑ABCD3, ↑ACAA1, ↑ACAA2, ↑ACAC...all 59	274 (17)
HNFI1A	↓-1.414	transcription regulator	Inhibited	-4.106	8.63E-25	↑ACAT2, ↑AGT, ↓AHSG, ↑AK2, ↑AK...all 81	463 (19)
clofibrate		chemical drug	Activated	4.759	9.74E-25	↑ABCC3, ↑ABCD3, ↑ACAA1, ↑ACADL...all 37	216 (8)
SREBF2	↑1.214	transcription regulator	Activated	4.767	4.78E-24	↑ACAA2, ↑ACACA, ↑ACSL1, ↑ACSS2...all 33	447 (18)
SCAP	↑2.321	other	Activated	5.304	3.21E-23	↑ACAA2, ↑ACACA, ↑ACACB, ↑ACSL1...all 33	344 (12)
bezafibrate		chemical drug	Activated	4.309	4.76E-23	↓ABCD1, ↑ABCD3, ↑ACACB, ↑ACA...all 35	311 (15)
SREBF1	↓-1.168	transcription regulator	Activated	4.869	1.49E-20	↓AARS1, ↑ACACA, ↑ACACB, ↑ACSL1...all 52	412 (18)
rosiglitazone		chemical drug	Activated	5.071	1.56E-20	↑ACAA2, ↑ACADL, ↑ACADM, ↑ACA...all 73	423 (18)
PPARG	↑1.426	ligand-dependent nuclear receptor	Activated	4.959	5.43E-19	↑ACAA1, ↑ACAA2, ↑ACACA, ↑ACADL...all 72	416 (21)
gemfibrozil		chemical drug	Activated	4.042	1.21E-18	↑ACAA1, ↑ACADL, ↑ACADVL, ↑ACO...all 27	386 (20)
cholesterol		chemical - endogenous mammalian	Inhibited	-3.347	4.06E-18	↑ACACA, ↑ACAT1, ↑ACSL1, ↑ACSS2...all 47	338 (13)
INSR	↓-1.250	kinase	Activated	5.692	1.59E-16	↑ACAA2, ↑ACADL, ↑ACADM, ↑ACA...all 60	502 (24)
PPARD	↓-5.233	ligand-dependent nuclear receptor	Activated	3.474	2.67E-16	↑ACAA1, ↑ACAA2, ↑ACACA, ↑ACAC...all 43	273 (15)
INSIG1	↓-1.075	other	Inhibited	-4.625	7.28E-16	↑ACACA, ↑ACACB, ↑ACSS2, ↑CYP...all 29	347 (12)
lipopolysaccharide		chemical drug	Inhibited	-3.375	3.17E-15	↑ABCC3, ↓ABCC6, ↑ACADM, ↑AC...all 161	450 (20)
mono-(2-ethylhexyl)phthz		chemical toxicant	Activated	3.109	8.65E-15	↑ACACB, ↑ACADL, ↑ACADM, ↑ACA...all 35	382 (17)
SH3TC2	↑1.001	other	Activated	4.000	9.15E-15	↑ACSL1, ↑CYP51A1, ↑DHCR7, ↑FDFT1, ↑FDPS...all 12	268 (7)
(-)-norephedrine		chemical drug	Activated	3.464	2.46E-14	↑CYP51A1, ↑DHCR7, ↑FDFT1, ↑FDPS...all 12	268 (7)
CLPP	↑1.193	peptidase	Inhibited	-3.838	3.27E-14	↑ACADL, ↑ACADM, ↑ACADVL, ↑AC...all 22	
PPARGC1B	↑1.814	transcription regulator	Activated	3.903	3.55E-14	↑ACACA, ↑ACACB, ↑ACADL, ↑ACA...all 23	452 (18)

Selected 0 / 50

Match against
your own analyses and
→
>73,000 other curated
analyses



Which analyses have similar Upstream Regulators, Canonical Pathways, Diseases & Functions, etc.?

Unprecedented discovery with Analysis Match

Build confidence in your results

- Identify shared biology across disparate diseases, tissues, treatments and more

Develop greater insights

- Evaluate upstream drivers, downstream phenotypes and biological pathways

Identify key regulators/pathways

- Key in on similarly activated/inhibited entities across the groups

Easily evaluate critical hypotheses

- Leverage an extensive collection of public data

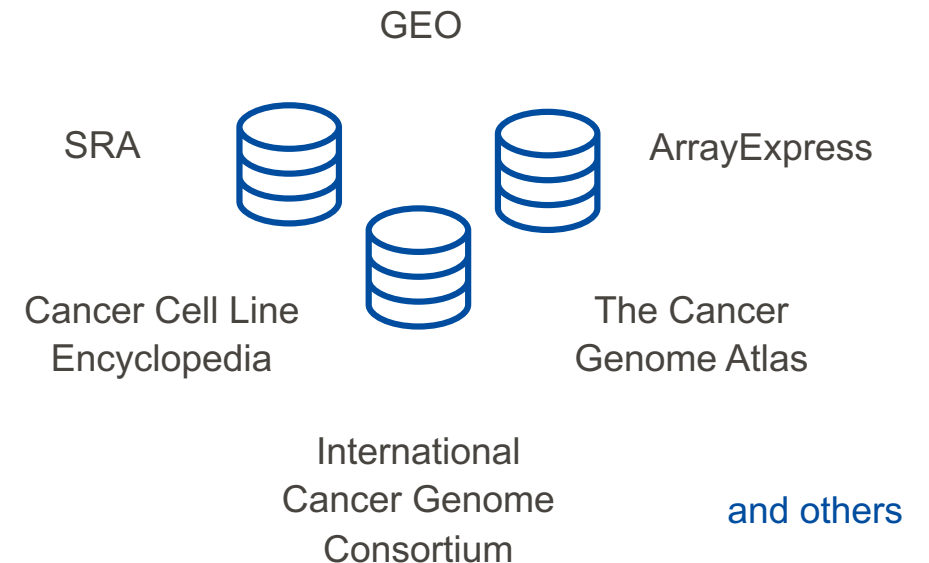
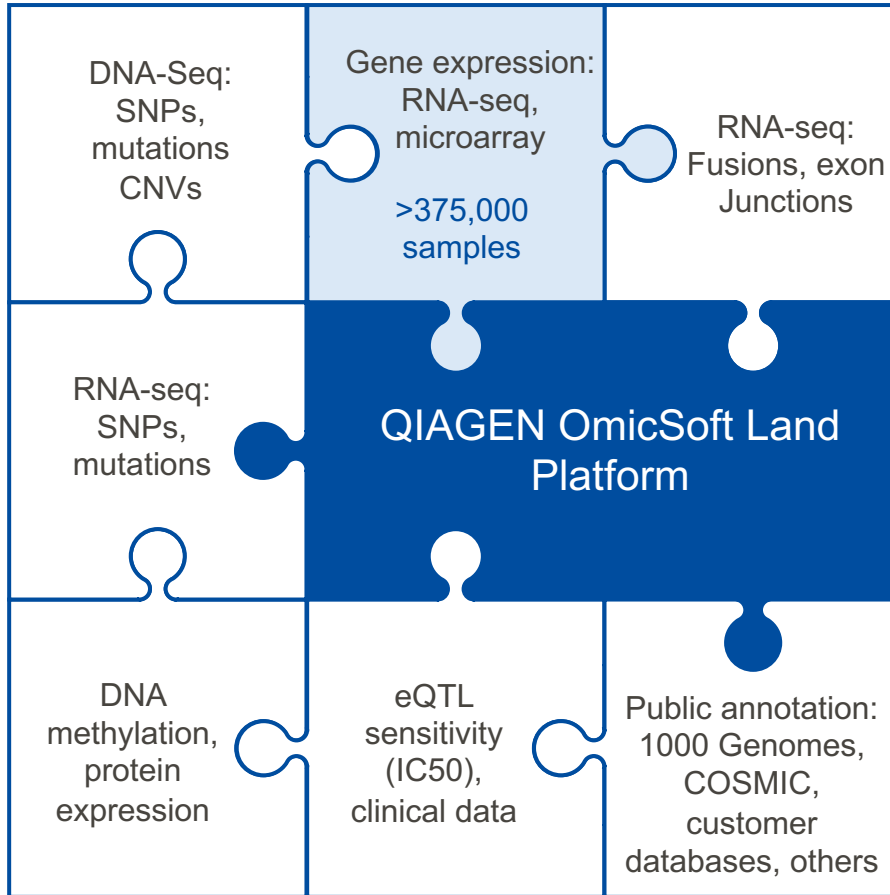
Applications

- Mechanism of action/toxicity
- Biomarker discovery through comparison analysis
- Target discovery/validation
- Drug repurposing



More than 73,000 comparison datasets from QIAGEN OmicSoft Lands in QIAGEN IPA

Lands provide expression data to QIAGEN IPA



Analysis Match combines knowledge with data

ArrayExpress, GEO, TCGA, SRA,
LINCS, etc.



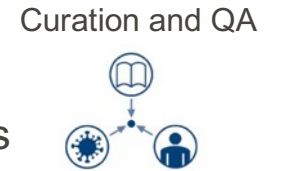
Reprocessed using the
same pipeline

QIAGEN OmicSoft Array Studio

Journal articles and databases such as
Clinical Trials, COSMIC, MGD, OMIM, etc.



>7.2 million
curated Findings



73,000+ expression comparison datasets

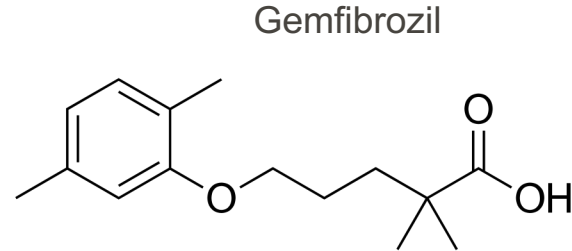
Built from >375,000 samples

QIAGEN Ingenuity Pathway Analysis



- Biological analyses of each dataset
- Compare your analysis to all QIAGEN OmicSoft analyses

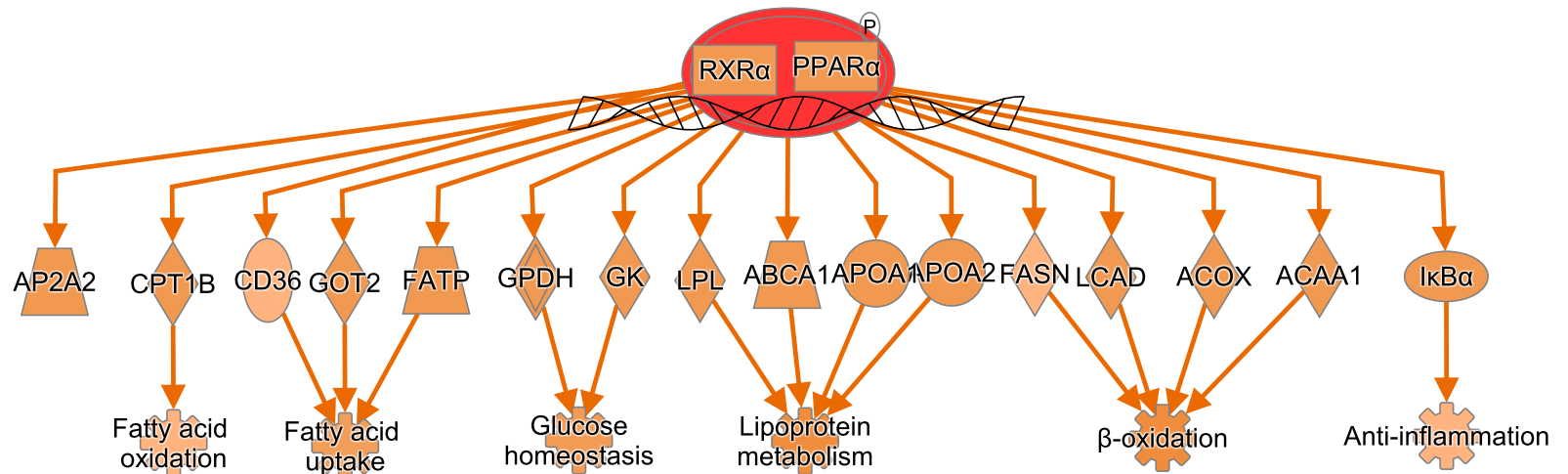
Case study: Biological effects of gemfibrozil in the liver (of rat)



Liver transcriptome

Lipid-lowering drug; Agonist of the Peroxisome Proliferator-Activated Receptor alpha (PPAR α), a ligand-dependent transcription factor

What we expect to see:



Using QIAGEN IPA to explore the biology of gemfibrozil in rat liver

Analysis of liver expression of gemfibrozil-treated rats for 7 days compared to control

Series **GSE47875**

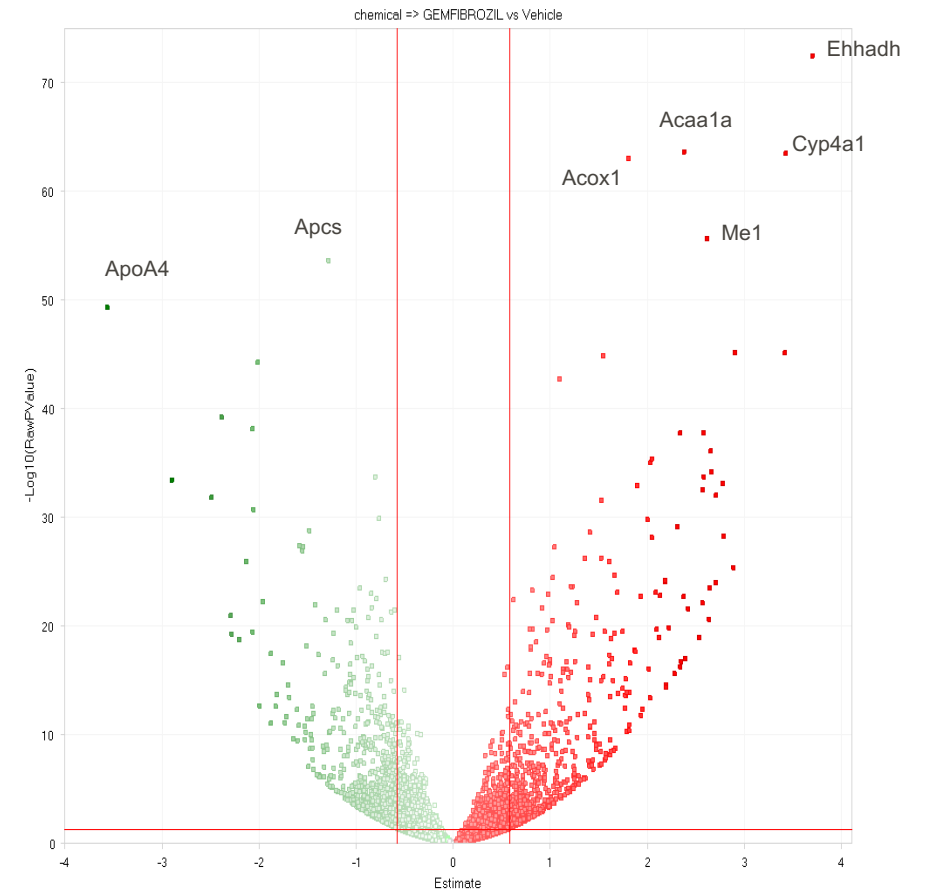
[Query DataSets for GSE47875](#)

Status Public on Aug 08, 2014
 Title SEQC Toxicogenomics Study: microarray data set
 Organism [Rattus norvegicus](#)
 Experiment type Expression profiling by array
 Summary The comparative advantages of RNA-Seq and microarrays in transcriptome profiling were evaluated in the context of a comprehensive study design. Gene expression data from Illumina RNA-Seq and Affymetrix microarrays were obtained from livers of rats exposed to 27 agents that comprised of seven modes of action (MOAs); they were split into training and test sets and verified with real time PCR.

contributor: DrugMatrix, National Toxicology program (NTP)

[GSE47875](#)

- Treatment group: 3 rats with 700 mg/kg gemfibrozil for 7 days
- Control group: 6 rats with corn oil for 7 days
- Illumina HiScanSQ FASTQ processed in QIAGEN OmicSoft Array Studio
- Analysis cutoffs in QIAGEN IPA:
 - Fold change: <-1.5 or >1.5
 - Adjusted p-value: <0.01
 - Average expression in experiment or control samples: >10 FPKM
- Analyzed 503 down-regulated and 461 up-regulated genes



Summary of IPA core analysis

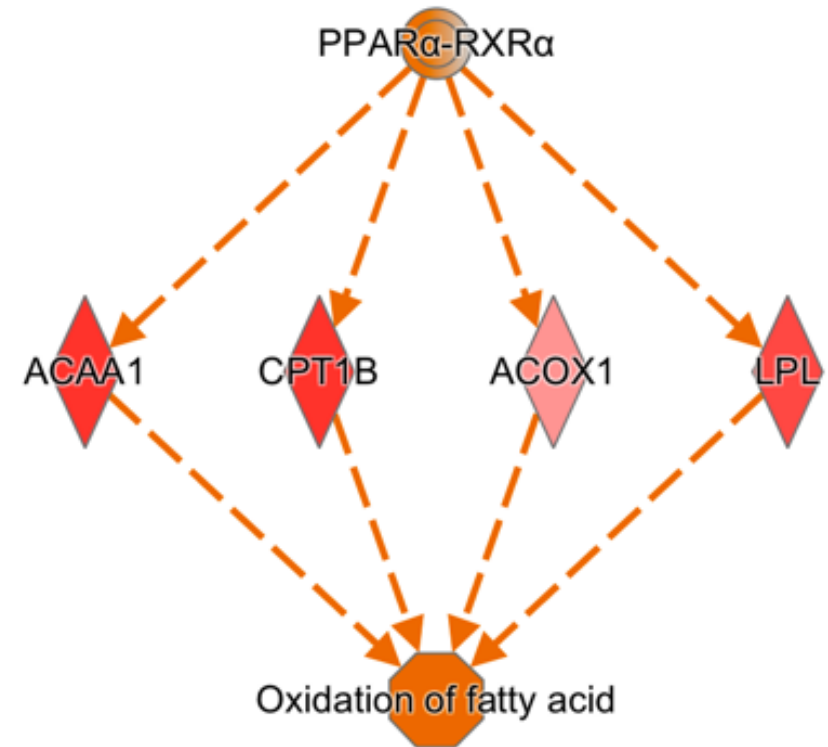
Effects on regulators and pathways (IPA Core Analysis)

Activated regulators and pathways

- PPAR α upstream regulator
- Cholesterol biosynthesis
- Fatty acid β -oxidation
- Ketogenesis

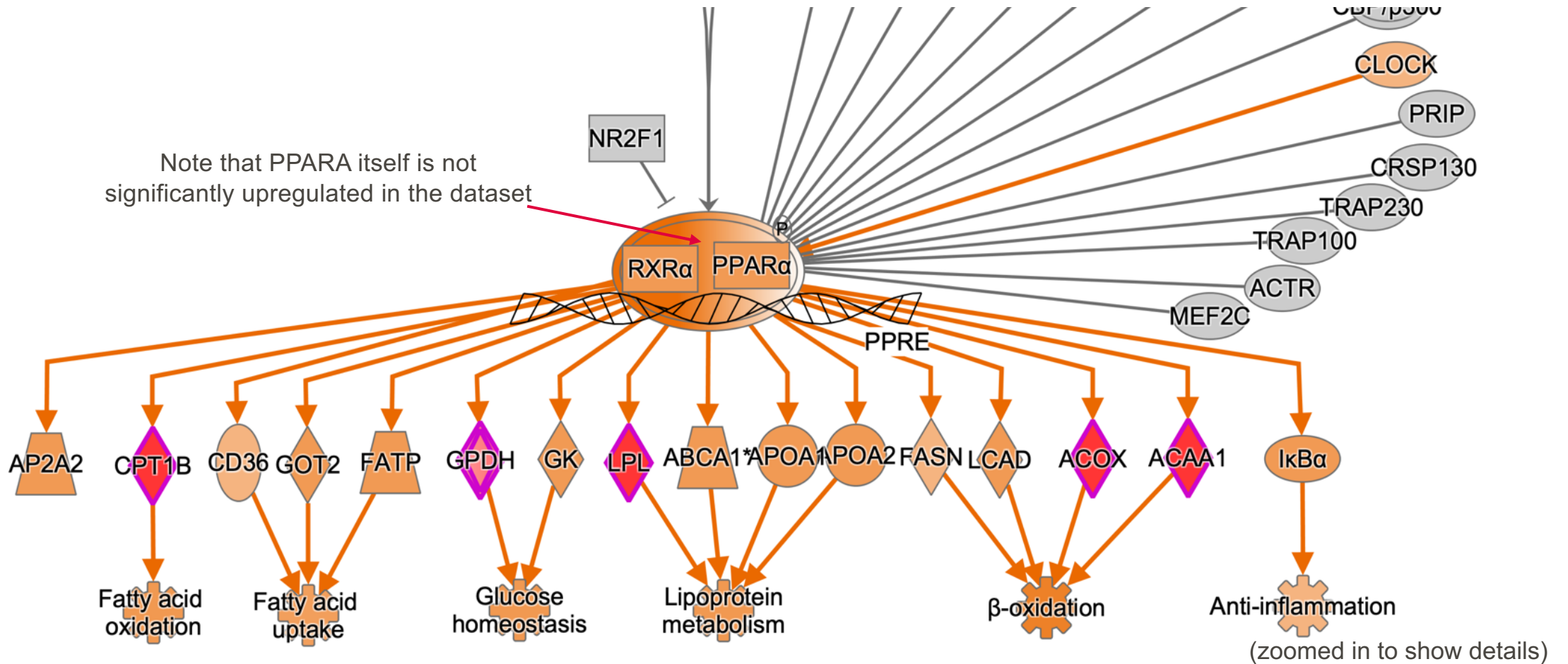
Inhibited pathways

- LXR/RXR pathway
- Cholesterol transport

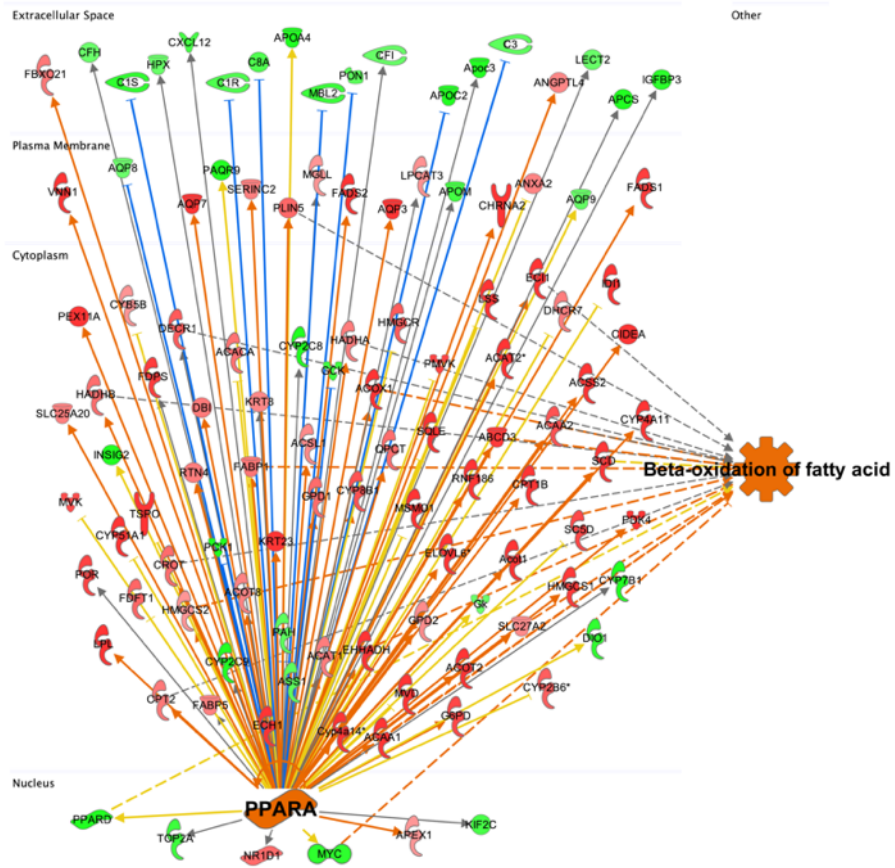


Confirm known biology – we see the expected target activation

Activation of RXR α /PPAR α by gemfibrozil (predicted from the gemfibrozil RNA-seq data)



Confirm known biology – expected drug target, pathways and functional effects



Examples of pathway impacts

Canonical pathway	B-H p-value	z-score
Super pathway of cholesterol biosynthesis	3.14E-14	4.8
Ketogenesis	7.05E-08	2.6
Acyl-coA hydrolysis	3.33E-06	2.4
Fatty acid beta oxidation I	4.84E-06	3
Isoleucine degradation I	8.01E-04	2.4
LXR/RXR activation	2.47E-11	-3.7

Examples of functional impacts

Disease or function	B-H p-value	z-score
Oxidation of fatty acid	2.30E-11	2.6
Synthesis of cholesterol	1.05E-17	2.1
Vascularization	3.50E-04	-2.1
Invasion of cells	3.43E-04	-2.2
Cholesterol transport	9.87E-05	-3.2

Activated

Inhibited

● What other conditions have predictions similar to these?

How can we find matches to other analyses?

Conceptually, create signatures of the predicted 'entities' for every analysis and compare them

Query signature

	Upstream regulator	Predicted activation
	PPARA	Activated
	ACSL3	Activated
	INSR	Activated
	RPE65	Activated
	SREBF1	Activated
	SCAP	Activated
	SREBF2	Activated
	ZNF423	Activated
	PPARG	Activated
	POR	Inhibited
	ASXL1	Inhibited
	NR1D2	Inhibited
	ST3GAL5	Inhibited
	CREB3L3	Inhibited
	ACOX1	Inhibited
	GRB14	Inhibited
	PDE8A	Inhibited

Compare

Signature from another analysis

	Does it match?	Upstream regulator	Predicted activation
	YES	PPARA	Activated
		ABDH5	Activated
		ASXL2	Activated
	YES	RPE65	Activated
	YES	SREBF1	Activated
		KLF15	Activated
	YES	SREBF2	Activated
		BTN2A2	Activated
		ACSBG1	Activated
		NR1I3	Inhibited
		CR1	Inhibited
		ASXL1	Inhibited
		DUT	Inhibited
	YES	ACOX1	Inhibited
		NR1I3	Inhibited
	YES	GRB14	Inhibited
	YES	PDE8A	Inhibited

Create and score signatures for:

- Upstream Regulators
- Causal Networks
- Canonical Pathways
- Diseases & Functions

The **sign** of the entity (activated or inhibited) is important, but not its **order** in the signature

Analysis Match results for gemfibrozil in rat liver

Filtered to show top matching (>45% match) or top anti-matching (< -45% match)

Filtered to exclude matches to own analyses

Examples of available metadata

Brief description of the comparison

Percent matching or anti-matching

Upstream Regulators

Diseases & Functions

Canonical Pathways

Master Regulators

Overall average

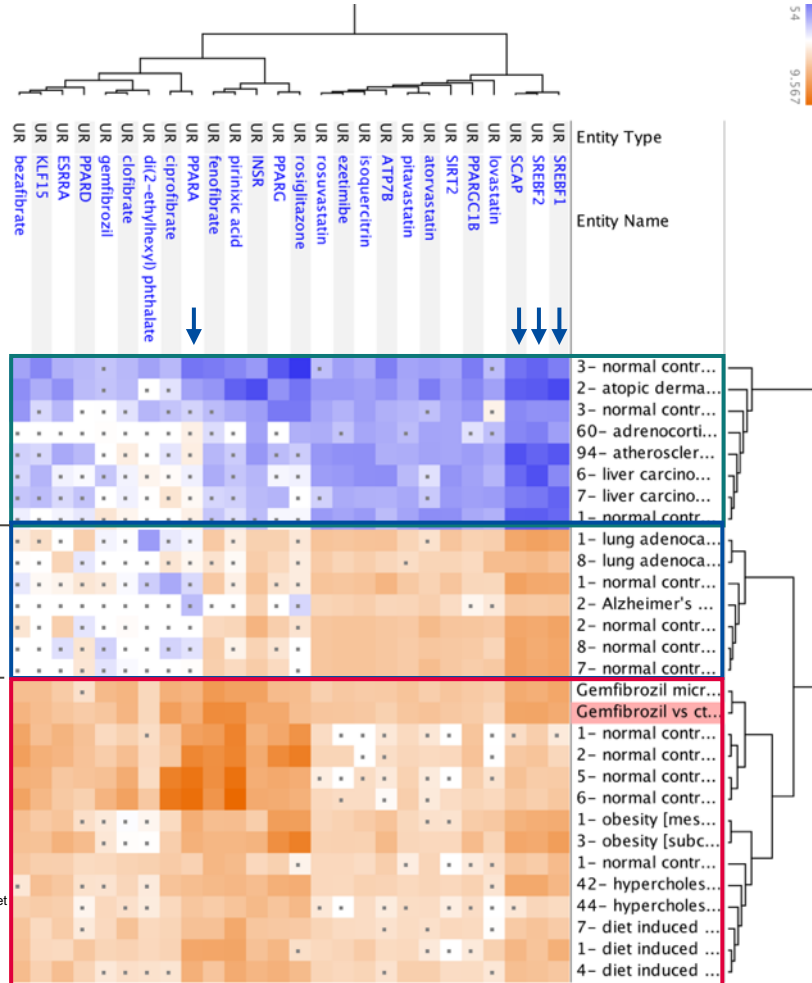
Analysis Name	Project	case.diseasestate	case.tissue	case.treatment	comparisoncate...	comparisoncontrast	CP (...)	UR (...)	CN...	DE (...)	Z...
6- normal control [liver] NA 8236	MouseDisease	normal control	liver	NA	Treatment vs. Control	Tissue:Compound => liver -> tesaglitazar vs s...	84.52	64.81	63.32	33.33	61.49
5- normal control [liver] NA 8235	MouseDisease	normal control	liver	NA	Treatment vs. Control	Tissue:Compound => liver -> fenofibrate vs sa...	70.71	64.03	64.87	33.33	58.24
4- small intestine carcinoid neuroc	OncoGEO	small intestine carcinoid neuroe...	small intestine	imatinib	Treatment vs. Control	Treatment:TreatTime[hours] => 24 -> imatinib...	65.47	63.25	40.00	33.33	50.51
672- normal control [fetal testis]	HumanDisease	normal control	fetal testis	NA	Other Comparisons	ExperimentGroup => testis 10 weeks gestation...	65.47	55.78	43.59	36.00	50.21
7- normal control [embryo] DMSC	MouseDisease	normal control	embryo	DMSO	Other Comparisons	Treatment:CultureCondition => DMSO -> N2B...	65.47	60.00	47.96	27.22	50.16
1- normal control [liver] amiodaro	MouseDisease	normal control	liver	amiodarone	Treatment vs. Control	Treatment => amiodarone vs DMSO	59.76	60.00	44.72	36.00	50.12
8- normal control [embryo] tazet	MouseDisease	normal control	embryo	tazemetostat	Other Comparisons	Treatment:CultureCondition => tazemetostat -...	65.47	58.40	45.83	30.43	50.03
3- obesity [subcutaneous adipos	HumanDisease	obesity	subcutaneous adip...	differentiation medium	Treatment1 vs. Treatment2	Tissue:Treatment => subcutaneous adipose tis...	70.71	56.57	48.99	22.68	49.74
8- lung adenocarcinoma (LUAD) [HumanDisease	lung adenocarcinoma (LUAD)	lung	adipocyte exosome	Treatment vs. Control	Dosage => 10.56 ug/ml vs 0 ug/ml	65.47	55.68	41.23	36.00	49.59
1- obesity [mesenteric adipose ti	HumanDisease	obesity	mesenteric adipose...	differentiation medium	Treatment1 vs. Treatment2	Tissue:Treatment => mesenteric adipose tissu...	65.47	64.03	67.08		49.14
2- normal control [white adipose	MouseDisease	normal control	white adipose tissue	rosiglitazone	Treatment vs. Control	Transfection:Treatment => PRDM16 shRNA -> ...	59.76	51.96	40.00	43.03	48.69
3- normal control [liver] NA 379	MouseDisease	normal control	liver	NA	Treatment1 vs. Treatment2	Genotype:CircadianTime => NOCT-/- -> Z18 v...	70.71	64.81	58.31		48.46
1- NA [epididymal white adipose	RatDisease	NA	epididymal white a...	NA	Treatment vs. Control	Tissue:SubjectTreatment => epididymal white...	53.45	51.12	44.72	43.03	48.08
42- hypercholesterolemia [visce	MouseDisease	hypercholesterolemia	visceral adipose tis...	NA	Treatment1 vs. Treatment2	Tissue:ExperimentGroup => visceral adipose ti...	70.71	59.16	61.64		47.88
8- normal control [subcutaneous	HumanDisease	normal control	subcutaneous adip...	differentiation medium	Treatment vs. Control	Treatment:TreatTime[days] => 14 -> differenti...	59.76	43.59	46.90	39.28	47.38
1- normal control [liver] NA 4109	MouseDisease	normal control	liver	NA	Treatment vs. Control	SubjectTreatment:Gender:AnimalStrain => 129...	-70.71	-44.91	-31.62	-43.03	-47.57
3- normal control [white adipose	MouseDisease	normal control	white adipose tissue	none	Treatment vs. Control	Transfection:Treatment => none -> PRDM16 s...	-65.47	-47.96	-36.06	-43.03	-48.13
2- psoriasis [skin] NA 11962	HumanDisease	psoriasis	skin	NA	Disease vs. Normal	SamplePathology => non-lesional vs normal	-80.18	-60.00	-52.92		-48.27
7- liver carcinoma [liver] phenol	OncoGEO	liver carcinoma	liver	phenol	Treatment vs. Control	Treatment => phenol vs none	-70.71	-54.77	-37.42	-33.33	-49.06
2- atopic dermatitis [skin] NA 39	HumanDisease	atopic dermatitis	skin	NA	Disease vs. Normal	DiseaseState => atopic dermatitis vs normal c...	-75.59	-69.34	-51.96		-49.22
6- normal control [epididymal wh	MouseDisease	normal control	epididymal white a...	NA	Tissue1 vs. Tissue2	Tissue:SubjectTreatment => low fat diet -> epi...	-59.76	-53.85	-48.99	-36.00	-49.65

Selected 0 / 21

But what are the details behind the matching?

Matching and anti-matching analyses fall into three distinct biological clusters

Part of upstream regulator signature:



species	case.tissue	Notes:	comparisoncontrast
mouse	white adipose	Knockdown of PPAR regulator	Transfection:Treatment => none -> PRDM16 shRNA vs control shRNA
human	skin	Disease state	DiseaseState => atopic dermatitis vs normal control
mouse	embryo		GeneticModification:Treatment => none -> knockdown IRF3 vs control
human	adrenal gland		NOTCH2_Somatic_Mutation_[DNaseq]_Status => MUT vs WT
mouse	liver		AnimalStrain[maternal] => SM/J vs C57BL/6J
human	liver		Treatment => N-nitrosodimethylamine (DMN) vs none
human	liver		Treatment => phenol vs none
mouse	fetal neostriatum		Treatment => 3-nitropropionic acid vs none
human	lung	Flu infection	SamplingTime => 24 hpi vs 0 hpi
human	lung	Adipocyte exosomes	Dosage => 10.56 ug/ml vs 0 ug/ml
mouse	liver	Caloric restriction	SubjectTreatment => calorie restriction vs normal diet
mouse	hippocampus		DiseaseState => Alzheimer's disease (AD) vs normal control
mouse	embryo	Differentiation	Treatment:TreatTime[hours] => 12 -> miconazole vs DMSO
mouse	embryo	Differentiation	Treatment:CultureCondition => tazemetostat -> N2B27 medium vs serum
mouse	embryo	Differentiation	Treatment:CultureCondition => DMSO -> N2B27 medium vs serum
rat	liver	PPAR alpha	Gemfibrozil vs corn oil (microarray)
rat	liver	PPAR alpha	Gemfibrozil vs corn oil (RNA-seq)
mouse	white adipose	PPAR gamma	Transfection:Treatment => control shRNA -> rosiglitazone vs none
mouse	white adipose	PPAR gamma	Transfection:Treatment => PRDM16 shRNA -> rosiglitazone vs none
mouse	liver	PPAR alpha	Tissue:Compound => liver -> fenofibrate vs saline
mouse	liver	PPAR gamma	Tissue:Compound => liver -> tesaglitazar vs saline
human	mesenteric adipose	Adipose differentiation	Tissue:Treatment => mesenteric adipose -> differentiation medium vs ...
human	subcutaneous adipose	Adipose differentiation	Tissue:Treatment => subcutaneous adipose -> differentiation medium ...
mouse	liver	PPAR gamma	Treatment => amiodarone vs DMSO
mouse	visceral adipose	High fat	Tissue:ExperimentGroup => visceral adipose -> high fat diet 9 weeks ...
mouse	gonadal adipose	High fat	Tissue:SubjectTreatment => gonadal adipose -> high fat diet; pioglitazone vs chow diet
mouse	inguinal adipose	High fat, PPAR gamma	SubjectTreatment => high fat diet; rosiglitazone vs low fat diet
mouse	liver	High fat	AnimalStrain[maternal] => BFM1 vs C57BL/6N
human	subcutaneous adipose	PPAR alpha	Treatment => amorfutin 4 vs DMSO

Clusters:

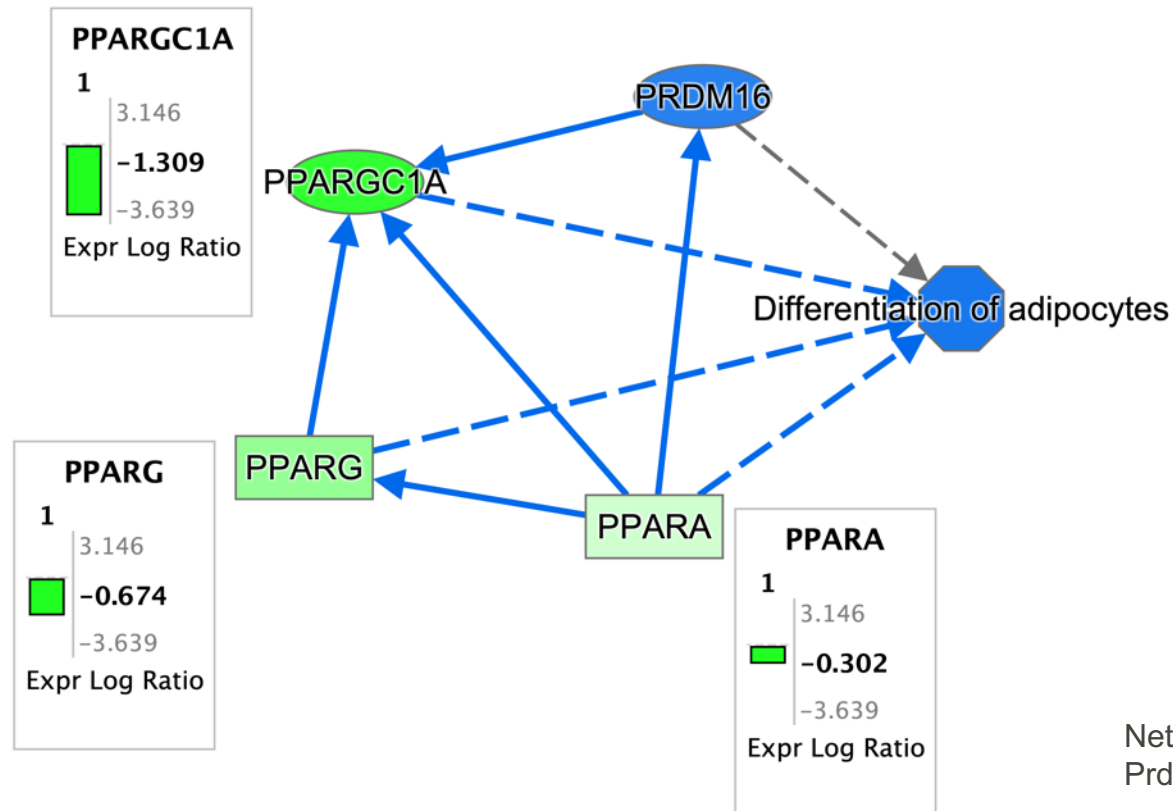
SCAP / SREBP / PPARA

SCAP / SREBP / PPARA

SCAP / SREBP / PPARA

PRDM16 knockdown leads to down-regulation of several relevant genes

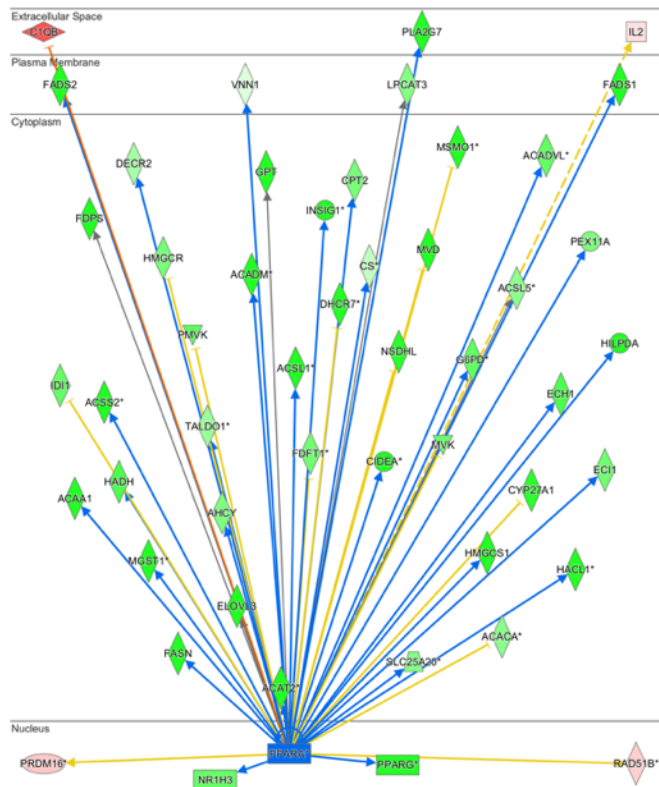
PRDM16 is a regulator of PPAR activity in adipose tissue and master transcriptional co-regulator in brown adipocytes, promoting expression of brown fat-selective genes and repression of white-selective genes



Network overlaid with expression profile of Prdm16 shRNA vs. scrambled control

Atopic dermatitis “anti-matches” the gemfibrozil treatment

PPAR α is predicted to be inhibited in this condition; Application of PPAR α agonists may treat it



PPARA inhibited



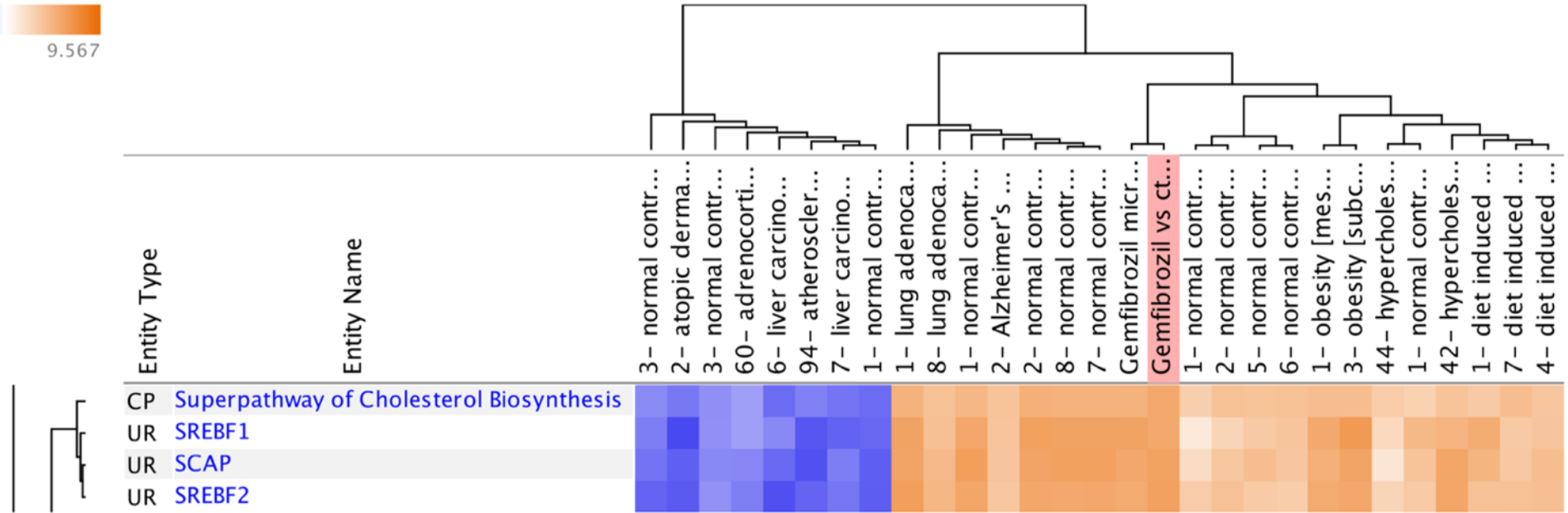
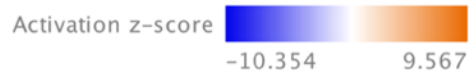
Staumont-Sallé, D. et. Al.(2008) Peroxisome proliferator-activated receptor α regulates skin inflammation and humoral response in atopic dermatitis. *Journal of Allergy and Clinical Immunology*, 121, 962–968.



Chiba, T. et. Al.(2012) Topical application of PPAR α (not β/δ or γ) suppresses atopic dermatitis in NC/Nga mice. *Allergy*, 67, 936–942.

Clustering provides insight into the signature entities as well

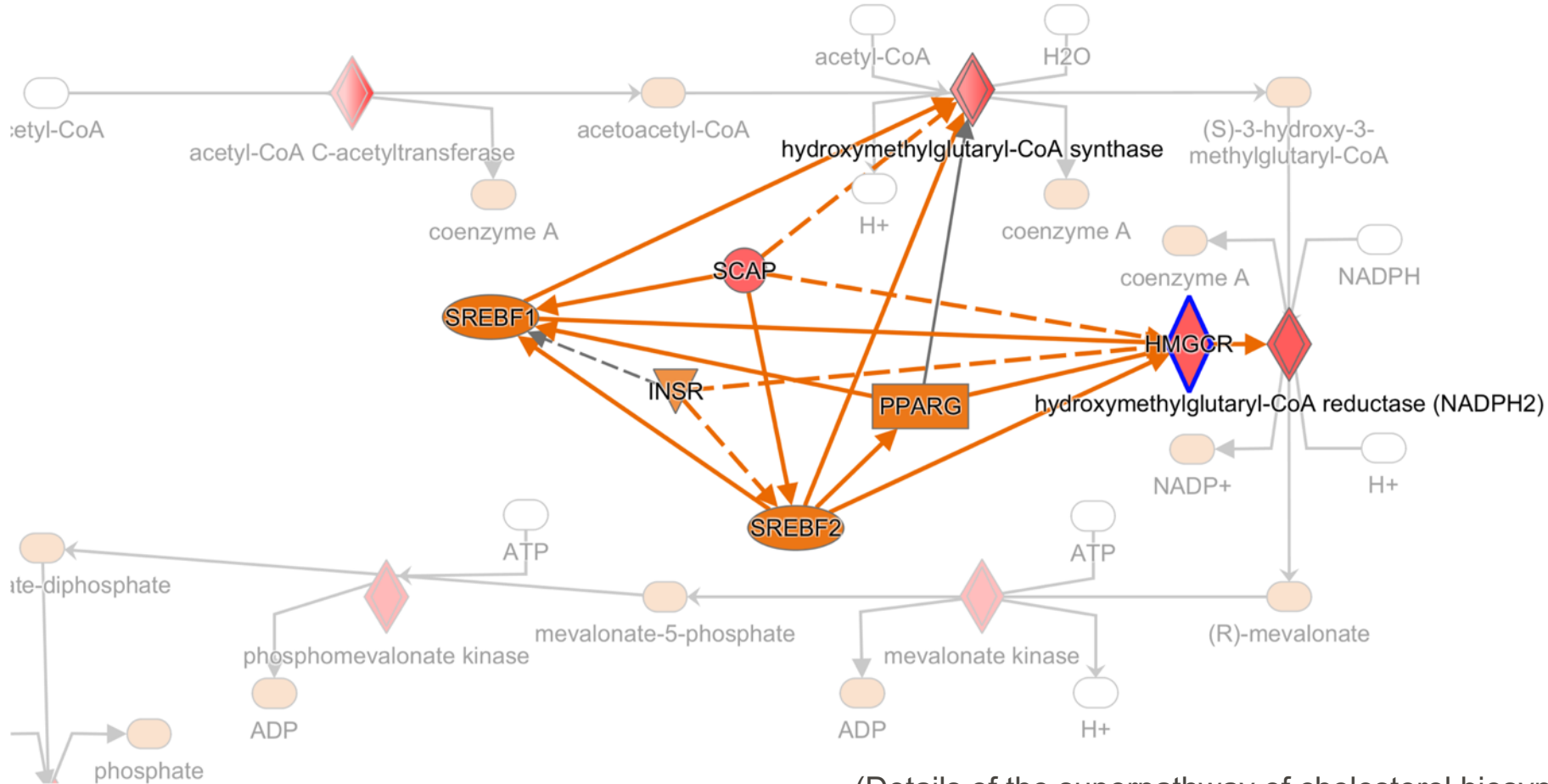
Key regulators of cholesterol biosynthesis cluster with the enzymatic pathway, but are not members of the pathway



Heatmap rotated 90° from previous views

All three regulators activate the rate-limiting step in cholesterol synthesis

HMGCR is upregulated by gemfibrozil, consistent with the activation of the other regulators



(Details of the superpathway of cholesterol biosynthesis pathway)

Visualize and explore the activity of a single IPA entity with new Activity Plot

Activity Plot - PPARA

27531 Analyses for PPARA

Significance $-\log_{10}(P\text{-value})$

Z-Score

Evaluate Metadata Customize Table

Analysis Name	Project	P-value	Z-score	case.diseasestate	case.tissue	comparisonca...	comparisoncontrast
6- normal control [liver] NA 8236	MouseDisease	3.40E-93	8.302	normal control	liver	Treatment vs. Control	Tissue:Compound => liver -> tesaglitazar vs saline
5- normal control [liver] NA 8235	MouseDisease	2.69E-79	7.931	normal control	liver	Treatment vs. Control	Tissue:Compound => liver -> fenofibrate vs saline
4- nonalcoholic fatty liver disease (NAFLD) [li	MouseDisease	1.10E-72	7.561	nonalcoholic fatty liver diseas...	liver	Disease vs. Normal	AnimalStrain:DiseaseState => C57BL/6N -> nonalcoholic fatt...
1- normal control [liver] NA 6945	MouseDisease	7.00E-24	7.118				
3- fatty liver [liver] NA 6831	MouseDisease	8.60E-62	7.102				
5- type 2 diabetes mellitus [liver] NA 3688	MouseDisease	7.54E-36	7.059				
2- normal control [white adipose tissue] rosig	MouseDisease	1.49E-41	6.973				
2- nonalcoholic fatty liver disease (NAFLD) [li	MouseDisease	6.62E-14	6.857				
4- nonalcoholic fatty liver disease (NAFLD) [li	MouseDisease	1.57E-14	6.741				
20- nonalcoholic steatohepatitis (NASH) [live	MouseDisease	4.30E-69	6.658				

Selected 1 / 221

Case/Control Differences

Key	Case	Control
dosage	150 mg/kg	NA
subjecttreatment	PPAR agonists	saline

Comparison Context

animalstrain **C57BL/6J**
comparisoncategory **Treatment vs. Control**
comparisoncontrast **Tissue:Compound => liver -> fenofibra
saline**
diseasestate **normal control**
organism **mouse**
platformname **Illumina.MouseWG-6_V2_0_R3_112785**
tissue **liver**
treatment **NA**

Z-score 8.302 - 3.794 (p1 of 2) [More Info](#)

Significant metadata in 200 selected analyses (PPARA)

Customize Table 198 repository analyses selected

Metadata field	Significant term	p-value	Selected analyses with term	Total a...	Select...	Total a...
case.celltype	bone marrow MSC	2.94E-52	23	48	71	40007
case.dosage	0.010% w/w	1.80E-35	18	40	118	38206
case.diseasestate	hypercholesterolemia	3.27E-33	20	76	198	62813
case.tissue	liver	3.60E-28	62	3739	198	62800
case.genotype	LDLR-/-	6.99E-25	24	118	77	6974
case.treatment	rosiglitazone	1.14E-23	12	27	198	62813
case.tissue	subcutaneous adipose tissue	1.41E-20	18	212	198	62800
case.subjecttreatment	high fat diet;rosiglitazone	1.80E-17	11	19	110	9636

Selected 0 / 195

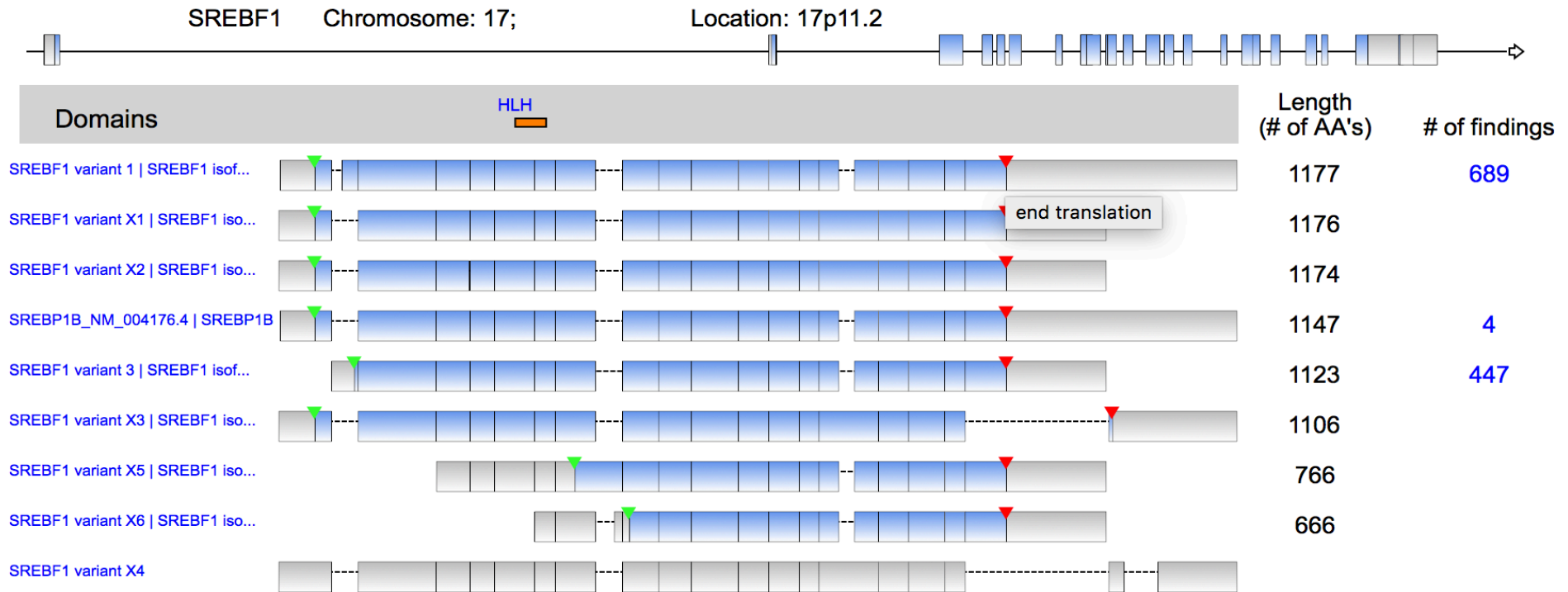
Evaluate metadata

Activity Plot requires an Analysis Match license

What is the expression of a gene in normal human tissues?

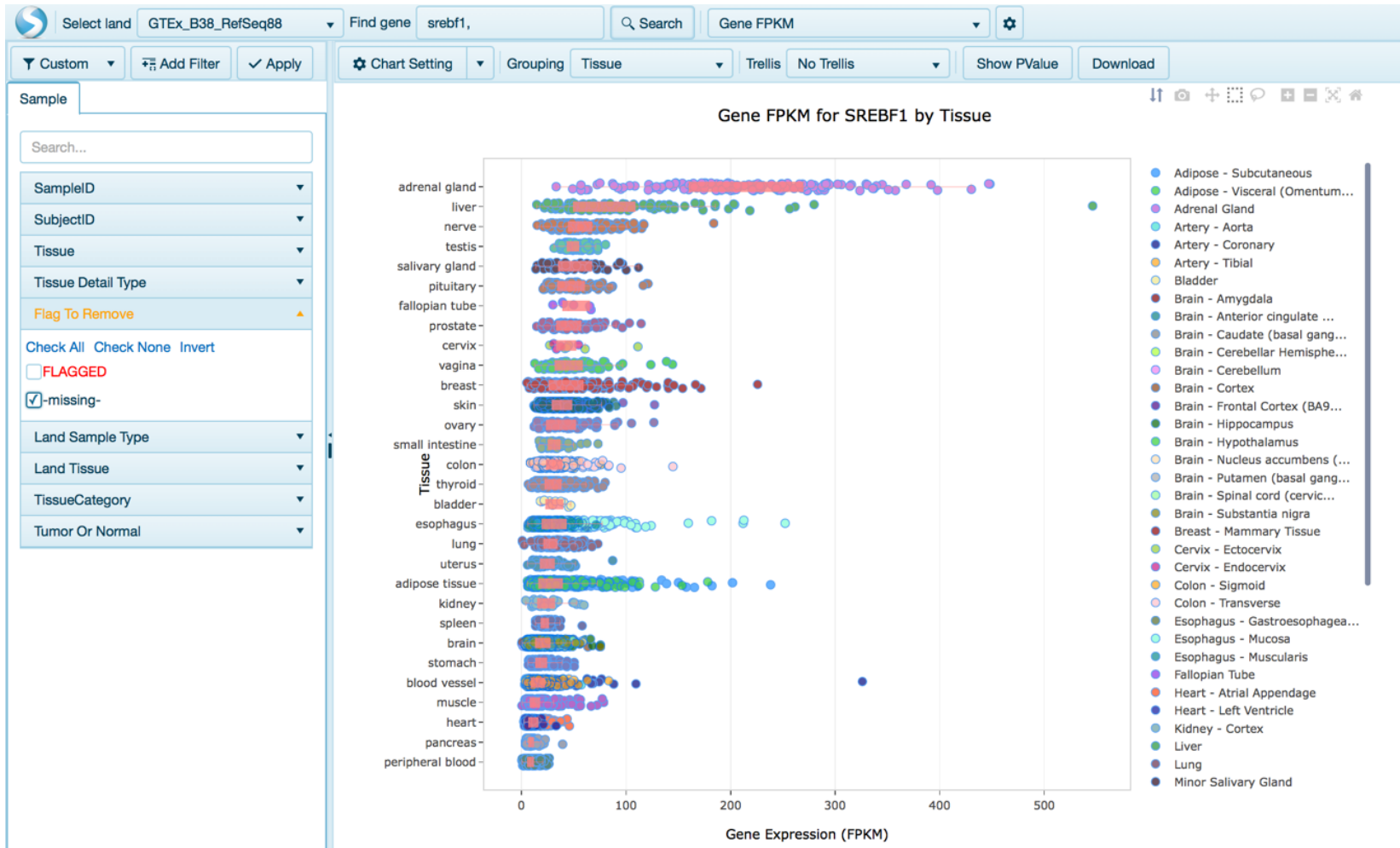
QIAGEN OmicSoft Land Explorer integration with IPA

Human ▾ Isoforms From RefSeq ▾ [View GTEx human tissue expression \(Land Explorer\)](#)



GTEx access from Isoform View free to all IPA users

QIAGEN OmicSoft Land Explorer for IPA



Display the GTEx data sample-level data for a gene or for individual splice variants in 51 human tissues

SREBF1 has highest expression in adrenal gland and liver in human subjects

GTEx access from Isoform View free to all IPA users

New quick links to Full Land Explorer in IPA

IPA Gene View: HMGCR (Mammalian)
[Contact Support](#) | [Help Documentation](#)

Review the categorized literature findings and database information for this node.

Summary
Human
Mouse
Rat

Member Of:	hydroxymethylglutaryl-CoA reductase , hydroxymethylglutaryl-CoA reductase (NADPH2)
Entrez Gene Name:	3-hydroxy-3-methylglutaryl-CoA reductase
Synonym(s):	3H3M, 3-hydroxy-3-methylglutaryl-CoA reductase, 3-hydroxy-3-methylglutaryl-Coenzyme A reductase, 3-Methylglutaryl Coenzyme A Reductase, Hmg, HMG-CoAR, HMG-CoA reductase, HMGR, HYDROXYMETHYLGLUTARYL-COENZYME A REDUCTASE, LDLCQ3, Red
NCBI CDD Domains (Superfamilies / Multi-Domains):	3-hydroxy-3-methylglutaryl-coenzyme A reductase , Hydroxymethylglutaryl-CoA reductase family , Hydroxymethylglutaryl-coenzyme A (HMG-CoA) reductase (HMGR) , Sterol-sensing domain of SREBP cleavage-activation
Protein Functions / Functional Domains:	catalytic domain, coenzyme binding, enzyme, hydroxymethylglutaryl-CoA reductase, hydroxymethylglutaryl-CoA reductase (NADPH2), identical protein binding, NADPH binding, protein binding, protein homodimerization, protein phosphatase binding, sterol sensing domain, transmembrane domain
Subcellular Location:	cellular membrane, Cytoplasm, detergent resistant lipid raft fraction, Endoplasmic Reticulum, endoplasmic reticulum membrane, endoplasmic reticulum mitochondria contact site, intracellular membrane-bounded organelle, microsome, nuclear envelope, outer nuclear membrane, peroxisome membrane, peroxisomes, plasma
Canonical Pathway:	AMPK Signaling; LXR/RXR Activation; Mevalonate Pathway I; Superpathway of Cholesterol Biosynthesis; Superpathway of Geranylgeranyldiphosphate Biosynthesis I (via Mevalonate)
OmicSoft Expression Levels:	Blueprint , CCLE , GTEx , HumanDisease , MouseDisease , OncoHuman , OncoMouse , TCGA
OmicSoft Differential Expression:	HumanDisease , LINCS , MouseDisease , OncoHuman , OncoMouse , TCGA
OmicSoft Mutations:	TCGA , TumorMutations
Targeted By miRNA Functional Cluster: (showing 50 out of 61) show all	let-7f-2-3p (and other miRNAs w/seed UAUACAG), miR-1276 (miRNAs w/seed AAAGAGC), miR-1283 (miRNAs w/seed CUACAAA), miR-144-3p (miRNAs w/seed ACAGUAU), miR-146a-3p (and other miRNAs w/seed CUCUGAA), miR-1668 (and other miRNAs w/seed AAAGGCC), miR-20b-3p (miRNAs w/seed CUGUAGU), miR-27a-3p (and other miRNAs w/seed UCACAGU), miR-27b-5p (miRNAs w/seed GAGCUUA), miR-28-3p (and other miRNAs w/seed ACUAGAU), miR-29b-3p (and other miRNAs w/seed AGCACCA), miR-3065-3p (miRNAs w/seed CAGCACC), miR-3103-5p (and other miRNAs w/seed GAGGGAG), miR-3127-3p (and other miRNAs w/seed CCCCUUC), miR-3529-3p (miRNAs w/seed ACAACAA), miR-365-3p (and other miRNAs w/seed AAUGCCC), miR-3677-3p (miRNAs w/seed UCGUGGG), miR-3682-5p (miRNAs w/seed UACUUCU), miR-3690 (miRNAs w/seed CCUGGAC), miR-376a-5p (and other miRNAs w/seed GUAGAUU), miR-3921 (and other miRNAs w/seed CUCUGAG), miR-3974 (miRNAs w/seed AAGGUCA), miR-4433a-3p (miRNAs w/seed CAGGAGU), miR-4433b-3p (miRNAs w/seed AGGAGUG), miR-4446-5p (miRNAs w/seed UUUCCCU), miR-4503 (miRNAs w/seed UUAAGCA), miR-4540 (miRNAs w/seed UAGUCCU), miR-4635 (miRNAs w/seed CUUGAAG), miR-4640-3p (miRNAs w/seed ACCCCCU), miR-4641 (miRNAs w/seed GCCCAUG), miR-4704-3p (miRNAs w/seed CAGUCAC), miR-4715-5p (miRNAs w/seed AGUUGGC), miR-4766-5p (and other miRNAs w/seed CUGAAAG), miR-4774-3p (miRNAs w/seed UUGCCUA), miR-4780 (miRNAs w/seed CCCUUGA), miR-493-3p (miRNAs w/seed GAAGGUC), miR-5100 (miRNAs w/seed UCAGAUC), miR-5196-3p (miRNAs w/seed CAUCCUC), miR-548f-3p (and other miRNAs w/seed AAAACUG), miR-548o-3p (and other miRNAs w/seed CAAAACU), miR-548v (miRNAs w/seed GCUACAG), miR-5687 (miRNAs w/seed UAGAACG), miR-5690 (miRNAs w/seed CAGCUAC), miR-578 (and other miRNAs w/seed UUCUUGU), miR-582-5p (miRNAs w/seed UACAGUU), miR-596 (miRNAs w/seed AGCCUGC), miR-623 (miRNAs w/seed UCCUUG), miR-658 (miRNAs w/seed GCGGAGG), miR-6732-3p (miRNAs w/seed AACCCUG), miR-6740-5p (miRNAs w/seed GUUUGGG)...(more)

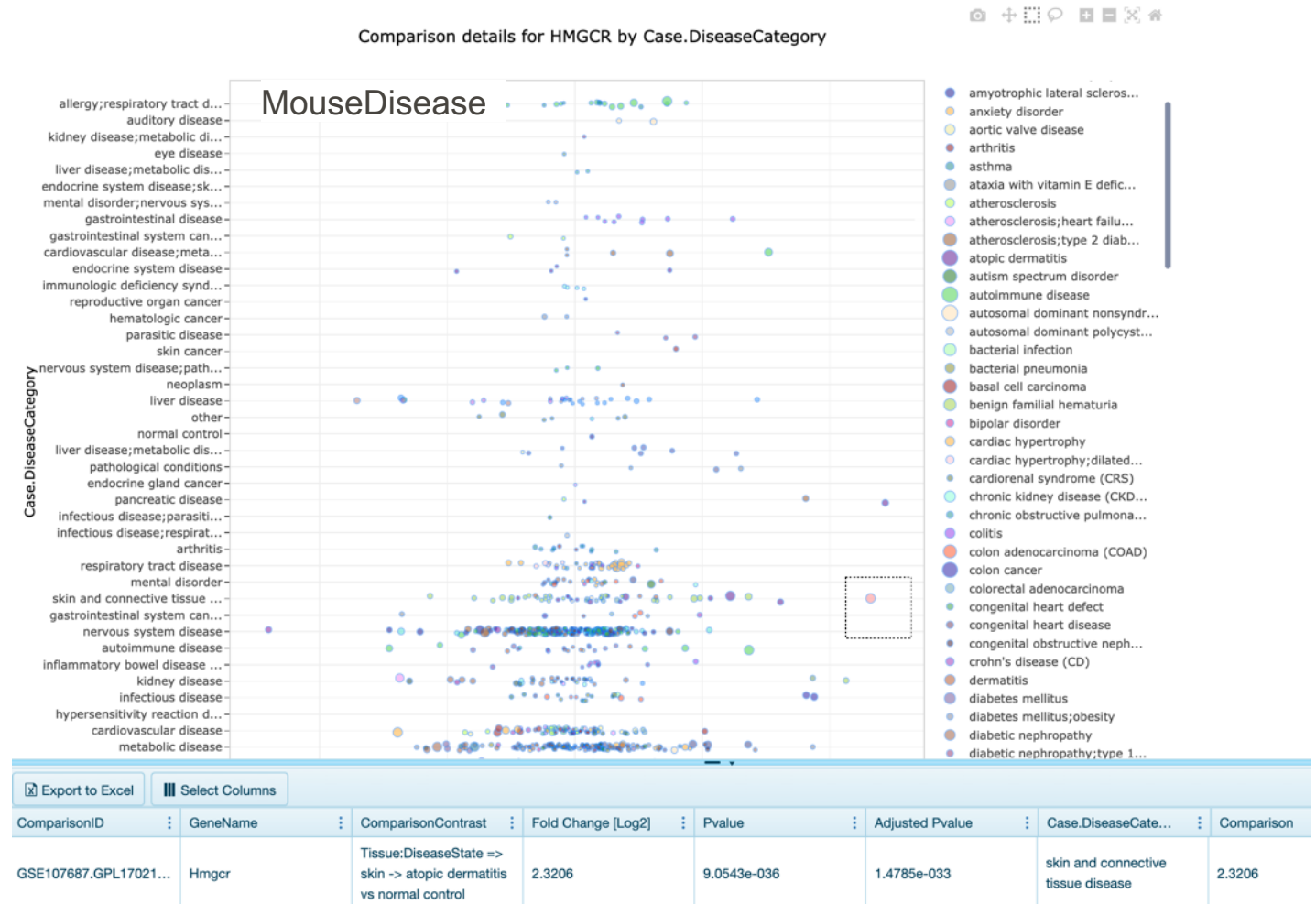
Top findings from Ingenuity Knowledge Base (show all 3710 categorized literature findings)

regulates: cholesterol, HMGCR, mevalonic acid, terpenoid, farnesyl pyrophosphate, MYC, RAS, steroid, (S)-mevalonic acid, sterol, nitric oxide, YAP1, Mapk, BIRC5, isopentenyl diphosphate

Access to OmicSoft links requires Land Explorer license

With Full Land Explorer for IPA, view gene & isoform expression data across Land samples

HMGCR is upregulated in atopic dermatitis in mouse, and psoriasis in human, as well as other conditions

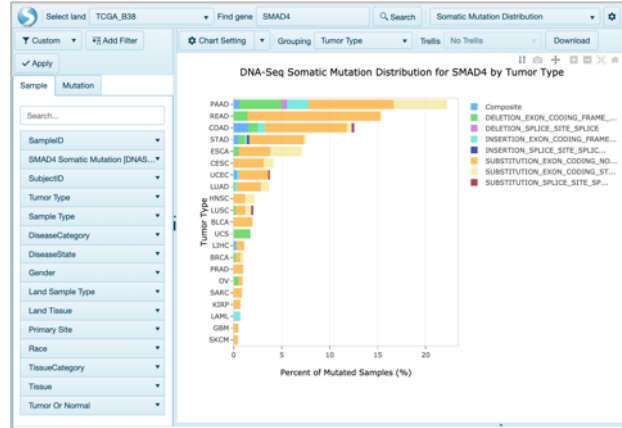


Full Land Explorer in IPA requires an additional license. Ask for a free trial!

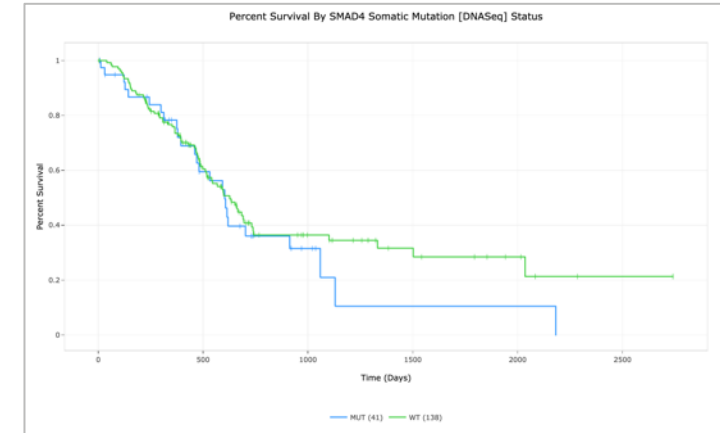
Land Explorer can provide many insights



Expression in Rat, Mouse, and Human Disease



Mutation frequency



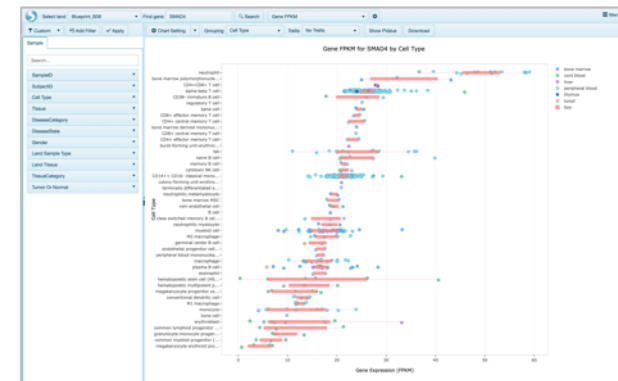
Survival plots



Cell line expression



Tumor expression



Hematopoietic expression (BluePrint)

Download the Analysis Match white paper

Literature-powered causal analytics from QIAGEN IPA combined with a massive, well-curated dataset collection provided by QIAGEN OmicSoft creates a unique opportunity for you to make biological discoveries

<https://go.qiagen.com/LP=1543>



Resources

QIAGEN IPA

- IPA product info: <https://digitalinsights.qiagen.com/products-overview/discovery-insights-portfolio/analysis-and-visualization/qiagen-ipa>
- IPA Analysis Match: <https://tv.qiagenbioinformatics.com/video/37242337/exploring-ipas-analysis-match-an>
- Land Explorer: <https://digitalinsights.qiagen.com/products-overview/discovery-insights-portfolio/content-exploration-and-databases/qiagen-omicsoft-land-explorer/>
- Coronavirus Network Explorer: <https://digitalinsights.qiagen.com/coronavirus-network-explorer/>

QIAGEN OmicSoft:

- Product Info: <https://digitalinsights.qiagen.com/products-overview/discovery-insights-portfolio/qiagen-omicsoft/>

QIAGEN CLC Genomics

- Product info: <https://digitalinsights.qiagen.com/products-overview/analysis-and-visualization/qiagen-clc-genomics-workbench/>

QIAGEN expands integrated coronavirus NGS and software solutions to accelerate COVID-19 research

- [QIAseq SARS-CoV-2 Primer Panel converts viral RNA samples into libraries ready for sequencing](#)
- [QIAGEN Digital Insights solutions support COVID-19 drug, vaccine and epidemiology research](#)
- For an overview of QIAGEN's coronavirus testing solutions, please visit <http://www.qiagen.com/coronavirus>.
- To explore QIAGEN's NGS-specific solutions for COVID-19 research, please visit <https://go.qiagen.com/CoronavirusNGS>
- For details of QIAGEN's SARS-CoV-2 Whole Genome Sequencing Service, please visit <https://www.qiagen.com/applications/genomic-services/sars-cov-2-whole-genome-sequencing-services>

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A close-up photograph of a hand with the index finger pointing upwards and to the right. The background is blurred, showing other hands in a similar gesture, suggesting a presentation or meeting setting.

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