SUPPLEMENT TABLE 1. Detail information of combined datasets

(A) Seven brain cancer studies

Tissue	Author	Year	Platform	Sample size	Comparison	Source
Brain	Petalidis	2008	HG-U133A	65	AA vs GBM	GSE1993
Brain	Freije	2006	HG-U133A,B	85	AA vs GBM	GSE4412
Brain	Phillips	2006	HG-U133A,B	100	AA vs GBM	GSE4271
Brain	Sun	2006	HG-U133_Plus_2	180	AA vs GBM	GSE4290
Brain	Paugh	2010	HG-U133_Plus_2	53	AA vs GBM	GSE19578
Brain	Yamanaka	2006	Agilent	29	AA vs GBM	GSE4381
Brain	Gravendeel	2009	HG-U133_Plus_2	284	AA vs GBM	GSE16011

6,005 genes remained in the combined dataset after gene matching (AA: Grade 3 Anaplastic astrocytoma; GBM: Grade 4 Glioblastoma multiforme)

(B) Nine MDD studies

Study name	Gender	Brain region	Sample size	Platform
MD1_ACC	Male	ACC	32 (16 pairs)	Affymetrix
MD3_ACC	Female	ACC	44 (22 pairs)	Illumina
C_MD2_ACC_F	Female	ACC	18 (9 pairs)	Affymetrix
C_MD2_ACC_M	Male	ACC	26 (13 pairs)	Affymetrix
MD1_AMY	Male	AMY	28 (14 pairs)	Affymetrix
MD3_AMY	Female	AMY	42 (21 pairs)	Illumina
C_MD2_DLPFC_F	Female	DLPFC	28 (14 pairs)	Affymetrix
C_MD2_DLPFC_M	Male	DLPFC	32 (16 pairs)	Affymetrix
NY_DLPFC_M	Male	DLPFC	26 (13 pairs)	Affymetrix

7,577 genes remained in the combined dataset after gene matching.

(C) 16 diabetes studies

Study	Organism	Platform	Description
1	Mouse	MG-U74Av2	Brown preadipocyte IRS knockout profiling
2	Mouse	MG-U74Av2	Comparison of Low Fat and High Fat Diet on Mice of Two Genetic Backgrounds (B6 vs. 129) - Fat
3	Mouse	MG-U74Av2	Comparison of Low Fat and High Fat Diet on Mice of Two Genetic Backgrounds (B6 vs. 129) - Liver
4	Mouse	MG-U74Av2	Comparison of Low Fat and High Fat Diet on Mice of Two Genetic Backgrounds (B6 vs. 129) - Skeletal Muscle
5	Mouse	MG-U74Av2	Isolated adipocytes from normal and fat insulin receptor knockout (FIRKO) mice sorted into small and large cells
6	Mouse	MG-U74Av2	Liver - ob/ob mice
7	Mouse	MG-U74Av2	Mouse skeletal muscle - controls, streptozotocin diabetes and insulin treated
8	Human	HG-U133A,B	Human pancreatic islets from normal and Type 2 diabetic subjects
9	Mouse	MG-U74Av2	Transcription profiling of wild type and PGC-1alpha KO liver and skeletal muscle
10	Mouse	MG-U74Av2	Effect of PGC-1alpha and PGC-1beta on gene expression in myocytes and hepatocytes
11	Mouse	MG-U74Av2	Control Insulin Receptor (IR) and IRS-1 Single and Double Heterozygous (DH) Knockouts - Comparison of Age (6 weeks vs 6 months) and Genetic Background (B6 vs. 129) - Epididymal White Fat
12	Mouse	MG-U74Av2	Control Insulin Receptor (IR) and IRS-1 Single and Double Heterozygous (DH) Knockouts - Comparison of Age (6 weeks vs 6 months) and Genetic Background (B6 vs. 129) - Liver
13	Mouse	MG-U74Av2	Control Insulin Receptor (IR) and IRS-1 Single and Double Heterozygous (DH) Knockouts $_1$ Comparison of Age (6 weeks vs 6 months) and Genetic Background (B6 vs. 129) - Skeletal Muscle
14	Mouse	MG-U74Av2	Effect of insulin infusion on skeletal muscle
15	Mouse	MG-U74Av2	Skeletal Muscle - Muscle Insulin Receptor Knockout and Control Mice - Control, Streptozotocin Diabetic and Insulin Treated
16	Human	HG-U133A	Human skeletal muscle - type 2 diabetes - Swedish males

6,645 genes remained in the combined dataset after gene matching.

SUPPLEMENT TABLE 2. Mean FDRs for different methods in HS_r with $r = 6$ by simulation analysis without correlated genes. The standard deviations of the FDRs in using 100 simulations are shown in the parentheses.

	FDR_1	FDR_2
rOP ($r = 6$)	0.0460 (± 0.0091)	0.2033 (± 0.0157)
Fisher	0.0443 (± 0.0063)	0.4691 (± 0.0165)
Stouffer	0.0442 (± 0.0071)	0.4045 (± 0.0148)
minP	0.0442 (± 0.0070)	0.4790 (± 0.0161)
maxP	0.0446 (± 0.0147)	0.0743 (± 0.0196)
Vote Counting	0.0000 (± 0.0000)	0.0031 (± 0.0016)