

SUPPLEMENTARY TABLES & FIGURES

Integrating genetics and transcriptomics to characterize shared mechanisms in digestive diseases and psychiatric disorders

Huanxin Ding [#], Yue Jiang [#], Qing Sun [#], Yingchao Song, Shuohui Dong, Qian Xu, Linzehao Li, Chuxuan Liu, Bingjun Li, Hengxuan Jiang, Bichen Peng, Shi Peng, Chumeng Zhang, Jiankang Zhu, Mingwei Zhong, Guangyong Zhang ^{*}, Xiao Chang ^{*}

Correspondence should be addressed to X.C. (changxiao@sdfmu.edu.cn) G.Y.Z. (guangyongzhang@hotmail.com)

Supplementary Table 1. SNP based heritability estimated by LDSC.

Supplementary Table 2. Genetic correlations between psychiatric disorders and digestive diseases.

Supplementary Table 3. Genetic correlation among psychiatric disorders pairwise.

Supplementary Table 4. Genetic correlation among digestive diseases pairwise.

Supplementary Table 5. Tissue-specific contributions to 14 digestive diseases/traits (brain-specific).

Supplementary Table 6. Multi-trait meta-analysis between psychiatric disorders and irritable bowel syndrome in Europeans.

Supplementary Table 7. Multi-trait meta-analysis between digestive diseases and irritable bowel syndrome in Europeans.

Supplementary Table 8. Multi-trait meta-analysis between psychiatric disorders and gastroesophageal reflux disease in Europeans.

Supplementary Table 9. Multi-trait meta-analysis between digestive diseases and gastroesophageal reflux disease in Europeans.

Supplementary Table 10. Multi-trait meta-analysis between psychiatric disorders and gastritis-duodenitis in Europeans.

Supplementary Table 11. Multi-trait meta-analysis between digestive diseases and gastritis-duodenitis in Europeans.

Supplementary Table 12. Multi-trait meta-analysis between psychiatric disorders and peptic ulcer in Europeans.

Supplementary Table 13. Multi-trait meta-analysis between digestive diseases and peptic ulcer in Europeans.

Supplementary Table 14. Multi-trait meta-analysis between psychiatric disorders and colorectal cancer in Europeans.

Supplementary Table 15. Multi-trait meta-analysis between digestive diseases and colorectal cancer in Europeans.

Supplementary Table 16. Multi-trait meta-analysis between psychiatric disorders and stool frequency in Europeans.

Supplementary Table 17. Multi-trait meta-analysis between digestive diseases and stool frequency in Europeans.

Supplementary Table 18. Multi-trait meta-analysis between psychiatric disorders and diverticular disease in Europeans.

Supplementary Table 19. Multi-trait meta-analysis between digestive diseases and diverticular disease in Europeans.

Supplementary Table 20. Multi-trait meta-analysis between psychiatric disorders and cholelithiasis and cholecystitis in Europeans.

Supplementary Table 21. Multi-trait meta-analysis between digestive diseases and cholelithiasis and cholecystitis in Europeans.

Supplementary Table 22. Multi-trait meta-analysis between psychiatric disorders and non-alcoholic fatty liver disease in Europeans.

Supplementary Table 23. Multi-trait meta-analysis between digestive diseases and non-alcoholic fatty liver disease in Europeans.

Supplementary Table 24. Multi-trait meta-analysis between psychiatric disorders and crohn's disease in Europeans.

Supplementary Table 25. Multi-trait meta-analysis between digestive diseases and crohn's disease in Europeans.

Supplementary Table 26. Multi-trait meta-analysis between psychiatric disorders and ulcerative colitis in Europeans.

Supplementary Table 27. Multi-trait meta-analysis between digestive diseases and ulcerative colitis in Europeans.

Supplementary Table 28. Multi-trait meta-analysis between psychiatric disorders and inflammatory bowel disease in Europeans.

Supplementary Table 29. Multi-trait meta-analysis between digestive diseases and inflammatory bowel disease in Europeans.

Supplementary Table 30. Multi-trait meta-analysis between psychiatric disorders and appendicitis in Europeans.

Supplementary Table 31. Multi-trait meta-analysis between digestive diseases and appendicitis in Europeans.

Supplementary Table 32. Number of genes ($P < 0.01$) identified by MAGMA.

Supplementary Table 33. Details of gene co-expression networks constructed using GTEx RNAseq data.

Supplementary Table 34. Co-expression modules associated neurological pathways in six highly correlated diseases.

Supplementary Table 35. Percentile rank of selected hub genes from each tissue.

Supplementary Table 36. Details on the characteristics of GWAS datasets in this study.

Supplementary Figure 1. The overview of the study.

Supplementary Figure 2. Local genetic correlations among psychiatric disorders and digestive conditions.

Supplementary Figure 3-8. Cell-type-specific enrichment of SNP heritability.

Supplementary Figure 9. The regional plots near rs2111530 (A) and rs8106322 (B) for IBS and DEP using LocusZoom.

Supplementary Figure 10. The regional plots near rs2111530 (A) and rs8106322 (B) for IBS and MDD using LocusZoom.

Supplementary Figure 11. Gene set enrichment analysis of the overlapping genes detected by MAGMA between ten psychiatric disorders and 14 Digestive Diseases.

Supplementary Figure 12. Topological overlap matrix (TOM) plots for seven brain tissues and seven digestive tract tissues.

Supplementary Table 1. SNP based heritability estimated by LDSC

Phenotype	Heritability(h²)	Heritability SE
Irritable bowel syndrome	0.0249	0.0015
Gastroesophageal reflux disease	0.0676	0.0027
Peptic ulcer	0.0106	0.0013
Acute pancreatitis	0.0034	0.0006
Non-alcoholic fatty liver disease	0.0015	0.0006
Appendicitis	0.0022	0.001
Colorectal cancer	0.1011	0.0094
Inflammatory bowel disease	0.3114	0.0306
Crohn's disease	0.181	0.0201
Ulcerative colitis	0.4442	0.051
Stool frequency	0.0685	0.0047
Diverticular disease	0.0347	0.002
Gastritis-duodenitis	0.0155	0.0014
Cholelithiasis and cholecystitis	0.0182	0.002
Anxiety, panic disorder	0.0065	0.001
Neuroticism	0.0927	0.0039
Major depressive disorder	0.0377	0.0015
Schizophrenia	0.3697	0.0129
Attention-deficit hyperactivity disorder	0.0945	0.0045
Autism spectrum disorder	0.2016	0.0151
Bipolar disorder	0.6376	0.0246
Post traumatic stress disorder	0.063	0.0115
Anorexia nervosa	0.1716	0.0112
Depression	0.0453	0.0016

Supplementary Table 2. Genetic correlations between psychiatric disorders and digestive diseases.

Psychiatric conditions	Digestive conditions	rg	SE	Z	P	FDR q-value
Anorexia nervosa	Acute pancreatitis	-0.0892	0.0708	-1.2586	0.2082	0.26025
	Appendicitis	-0.0243	0.1024	-0.2369	0.8127	0.855473684
	Cholelithiasis and cholecystitis	-0.0969	0.0457	-2.1184	0.0341	0.057518072
	Crohn's disease	0.0902	0.0487	1.8514	0.0641	0.096795699
	Diverticular disease	-0.0316	0.0357	-0.8847	0.3763	0.428308943
	Gastritis and duodenitis	-0.0543	0.0685	0.9045	0.2917	0.34904274
	Gastroesophageal reflux disease	-0.0037	0.0326	-0.1136	0.9096	0.936352941
	Inflammatory bowel disease	0.0421	0.0403	1.0455	0.2958	0.350949153
	Irritable bowel syndrome	0.1355	0.0364	3.7251	0.0002	0.000482759
	Non-alcoholic fatty liver disease	-0.2358	0.1238	-1.9047	0.0568	0.087384615
	Peptic ulcer	0.0277	0.0522	0.5297	0.5963	0.652203125
	Stool frequency	0.0532	0.0404	1.3182	0.1874	0.238509091
	Ulcerative colitis	9.00E-04	0.0377	0.0228	0.9818	0.988863309
	Colorectal cancer	-0.0418	0.0356	-1.1743	0.2403	0.290017241
Anxiety, panic disorder	Acute pancreatitis	0.2403	0.1249	1.9246	0.0543	0.086177778
	Appendicitis	-0.0707	0.1839	-0.3842	0.7008	0.752793893
	Cholelithiasis and cholecystitis	0.1196	0.0761	1.571	0.1162	0.156423077
	Crohn's disease	0.1907	0.0698	2.7322	0.0063	0.011454545
	Diverticular disease	0.1893	0.0638	2.9651	0.003	0.006
	Gastritis and duodenitis	0.2785	0.1036	3.7791	0.0013	0.00284375
	Gastroesophageal reflux disease	0.2873	0.0517	5.5561	2.76E-08	1.04E-07
	Inflammatory bowel disease	0.1483	0.0575	2.5783	0.0099	0.017544304
	Irritable bowel syndrome	0.5437	0.0672	8.0916	5.89E-16	3.59E-15
	Non-alcoholic fatty liver disease	-0.002	0.1741	-0.0117	0.9907	0.9907
	Peptic ulcer	0.2769	0.0983	2.8168	0.0049	0.009146667
	Stool frequency	0.0378	0.0676	0.5598	0.5756	0.639555556
	Ulcerative colitis	0.0744	0.0568	1.3101	0.1902	0.239891892
	Colorectal cancer	-0.0034	0.0603	-0.0568	0.9547	0.975605839
Attention-deficit hyperactivity disorder	Acute pancreatitis	0.5238	0.0635	8.2469	1.63E-16	1.14E-15
	Appendicitis	0.0394	0.0897	0.4395	0.6603	0.716604651
	Cholelithiasis and cholecystitis	0.2828	0.0455	6.2201	4.97E-10	2.40E-09
	Crohn's disease	-0.0246	0.0365	-0.6731	0.5009	0.561008
	Diverticular disease	0.2482	0.0271	9.1633	5.03E-20	4.14E-19
	Gastritis and duodenitis	0.6112	0.0529	10.4382	3.54E-45	5.51E-44
	Gastroesophageal reflux disease	0.5348	0.0258	20.72	2.29E-95	5.34E-94
	Inflammatory bowel disease	0.0284	0.0306	0.9303	0.3522	0.404163934
	Irritable bowel syndrome	0.2627	0.0369	7.1106	1.16E-12	6.25E-12
	Non-alcoholic fatty liver disease	0.5654	0.1135	4.9805	6.34E-07	2.06E-06
	Peptic ulcer	0.516	0.0529	9.7457	1.92E-22	1.68E-21
	Stool frequency	0.1234	0.0334	3.6914	0.0002	0.000482759
	Ulcerative colitis	0.0525	0.03	1.7513	0.0799	0.116520833
	Colorectal cancer	0.1322	0.0297	4.4557	8.36E-06	2.29E-05
Autism spectrum disorder	Acute pancreatitis	0.2269	0.0723	3.1398	0.0017	0.003661538
	Appendicitis	0.2096	0.1268	1.6526	0.0984	0.13776
	Cholelithiasis and cholecystitis	0.0866	0.0636	1.3626	0.173	0.222201835
	Crohn's disease	-0.0711	0.047	-1.5123	0.1305	0.170747664
	Diverticular disease	0.0625	0.0345	1.8152	0.0695	0.103510638
	Gastritis and duodenitis	0.0973	0.0603	1.7263	0.0643	0.096795699
	Gastroesophageal reflux disease	0.0821	0.0367	2.2362	0.0253	0.043728395
	Inflammatory bowel disease	-0.0619	0.0386	-1.6051	0.1085	0.147475728
	Irritable bowel syndrome	0.2475	0.0481	5.14	2.75E-07	9.63E-07
	Non-alcoholic fatty liver disease	0.1336	0.1125	1.1876	0.235	0.286086957
	Peptic ulcer	0.0026	0.066	0.0394	0.9686	0.982637681
	Stool frequency	0.0745	0.0461	1.6165	0.106	0.145490196
	Ulcerative colitis	-0.0394	0.0416	-0.946	0.3441	0.40145
	Colorectal cancer	-0.0091	0.0352	-0.2576	0.7967	0.844984848
Bipolar disorder	Acute pancreatitis	0.0519	0.0554	0.9374	0.3486	0.403338843
	Appendicitis	0.1785	0.0861	2.0732	0.0381	0.0635
	Cholelithiasis and cholecystitis	-0.0087	0.0398	-0.2192	0.8265	0.863507463
	Crohn's disease	0.0917	0.0302	3.0378	0.0024	0.004941176
	Diverticular disease	0.0863	0.0255	3.3857	0.0007	0.001555556
	Gastritis and duodenitis	0.0701	0.0511	1.3401	0.0853	0.121857143
	Gastroesophageal reflux disease	0.0707	0.0245	2.8838	0.0039	0.007479452
Inflammatory bowel disease	0.0968	0.0279	3.4717	0.0005	0.001147541	
Irritable bowel syndrome	0.1236	0.0305	4.0542	5.03E-05	0.000135423	

	Non-alcoholic fatty liver disease	0.1011	0.085	1.1888	0.2345	0.286086957
	Peptic ulcer	0.0709	0.0432	1.6428	0.1004	0.139168317
	Stool frequency	0.1811	0.0291	6.2317	4.61E-10	2.31E-09
	Ulcerative colitis	0.0822	0.029	2.8323	0.0046	0.008702703
	Colorectal cancer	0.004	0.0262	0.1529	0.8785	0.911037037
Major depressive disorder	Acute pancreatitis	0.3991	0.0558	7.1498	8.69E-13	4.87E-12
	Appendicitis	0.2331	0.0808	2.886	0.0039	0.007479452
	Cholelithiasis and cholecystitis	0.2503	0.0317	7.8822	3.22E-15	1.88E-14
	Crohn's disease	0.0941	0.0311	3.0255	0.0025	0.005072464
	Diverticular disease	0.3026	0.0253	11.9509	6.43E-33	6.92E-32
	Gastritis and duodenitis	0.4557	0.0487	10.1268	2.25E-35	2.86E-34
	Gastroesophageal reflux disease	0.521	0.0203	25.68	1.96E-145	1.37E-143
	Inflammatory bowel disease	0.1208	0.0246	4.9123	9.00E-07	2.80E-06
	Irritable bowel syndrome	0.5736	0.0252	22.7698	9.14E-115	3.20E-113
	Non-alcoholic fatty liver disease	0.4585	0.1016	4.5112	6.45E-06	1.81E-05
	Peptic ulcer	0.4442	0.0437	10.1554	3.14E-24	3.14E-23
	Stool frequency	0.191	0.0318	5.9988	1.99E-09	8.99E-09
	Ulcerative colitis	0.1237	0.0231	5.3557	8.52E-08	3.06E-07
	Colorectal cancer	0.0178	0.0213	0.8362	0.4031	0.455112903
Neuroticism	Acute pancreatitis	0.3321	0.0579	5.7348	9.77E-09	3.91E-08
	Appendicitis	0.1015	0.0666	1.5235	0.1276	0.168528302
	Cholelithiasis and cholecystitis	0.2084	0.0421	4.9519	7.35E-07	2.34E-06
	Crohn's disease	0.0972	0.0318	3.0555	0.0022	0.004597015
	Diverticular disease	0.2261	0.0278	8.1224	4.57E-16	2.91E-15
	Gastritis and duodenitis	0.3894	0.0527	8.5771	4.05E-19	3.15E-18
	Gastroesophageal reflux disease	0.4113	0.0237	17.3477	2.05E-67	4.10E-66
	Inflammatory bowel disease	0.119	0.0251	4.7448	2.09E-06	6.23E-06
	Irritable bowel syndrome	0.5881	0.0259	22.6839	6.45E-114	1.81E-112
	Non-alcoholic fatty liver disease	0.3497	0.1032	3.3869	0.0007	0.001555556
	Peptic ulcer	0.3397	0.059	5.7576	8.53E-09	3.51E-08
	Stool frequency	0.133	0.0337	3.9511	7.78E-05	0.000201704
	Ulcerative colitis	0.1088	0.0273	3.9816	6.84E-05	0.000180679
	Colorectal cancer	0.0527	0.0258	2.0441	0.0409	0.067364706
Post traumatic stress disorder	Acute pancreatitis	0.4534	0.1252	3.6212	0.0003	0.000711864
	Appendicitis	0.3592	0.1876	1.9153	0.0554	0.086177778
	Cholelithiasis and cholecystitis	0.2466	0.0851	2.8976	0.0038	0.007479452
	Crohn's disease	0.0274	0.0724	0.3793	0.7044	0.752793893
	Diverticular disease	0.2526	0.0655	3.8552	0.0001	0.00025
	Gastritis and duodenitis	0.4757	0.1136	4.5375	6.05E-07	2.02E-06
	Gastroesophageal reflux disease	0.5293	0.0638	8.2946	1.09E-16	8.03E-16
	Inflammatory bowel disease	0.1051	0.059	1.7797	0.0751	0.110673684
	Irritable bowel syndrome	0.4683	0.08	5.855	4.77E-09	2.09E-08
	Non-alcoholic fatty liver disease	0.4358	0.2208	1.9736	0.0484	0.077885057
	Peptic ulcer	0.5285	0.1105	4.7842	1.72E-06	5.23E-06
	Stool frequency	0.2727	0.0766	3.5597	0.0004	0.000933333
	Ulcerative colitis	0.1229	0.0569	2.1601	0.0308	0.052585366
	Colorectal cancer	0.0975	0.0562	1.7335	0.083	0.119793814
Schizophrenia	Acute pancreatitis	0.027	0.0503	0.5369	0.5913	0.651826772
	Appendicitis	-0.1272	0.0819	-1.554	0.1202	0.160266667
	Cholelithiasis and cholecystitis	-0.0336	0.0346	-0.9714	0.3314	0.389882353
	Crohn's disease	0.1496	0.0279	5.356	8.51E-08	3.06E-07
	Diverticular disease	0.0333	0.0241	1.383	0.1667	0.216092593
	Gastritis and duodenitis	0.084	0.0457	1.297	0.0125	0.021875
	Gastroesophageal reflux disease	0.0284	0.0227	1.2505	0.2111	0.261539823
	Inflammatory bowel disease	0.1431	0.0247	5.7975	6.73E-09	2.86E-08
	Irritable bowel syndrome	0.1715	0.0278	6.1738	6.67E-10	3.11E-09
	Non-alcoholic fatty liver disease	0.1305	0.0767	1.7003	0.0891	0.126
	Peptic ulcer	0.1074	0.0404	2.6603	0.0078	0.014
	Stool frequency	0.0518	0.027	1.9209	0.0548	0.086177778
	Ulcerative colitis	0.1191	0.0254	4.6963	2.65E-06	7.73E-06
	Colorectal cancer	0.0874	0.0229	3.8125	0.0001	0.00025
Depression	Acute pancreatitis	0.4482	0.0551	8.1388	3.99E-16	2.66E-15
	Appendicitis	0.2512	0.082	3.0618	0.0022	0.004597015
	Cholelithiasis and cholecystitis	0.2964	0.0297	9.9712	2.04E-23	1.90E-22
	Crohn's disease	0.0843	0.0305	2.7591	0.0058	0.010684211
	Diverticular disease	0.3157	0.0246	12.8521	8.37E-38	1.17E-36
	Gastritis and duodenitis	0.5217	0.034	15.3645	2.83E-53	4.95E-52
Gastroesophageal reflux disease	0.5652	0.0184	30.6579	2.07E-206	2.90E-204	

Depression

Inflammatory bowel disease	0.1289	0.0255	5.0632	4.12E-07	1.41E-06
Irritable bowel syndrome	0.5588	0.0229	24.3675	3.79E-131	1.77E-129
Non-alcoholic fatty liver disease	0.534	0.1144	4.6671	3.05E-06	8.71E-06
Peptic ulcer	0.5165	0.0422	12.2435	1.82E-34	2.12E-33
Stool frequency	0.1806	0.0284	6.3642	1.96E-10	1.02E-09
Ulcerative colitis	0.1362	0.0243	5.6115	2.01E-08	7.80E-08
Colorectal cancer	0.0403	0.0199	2.0214	4.32E-02	0.070325581

Supplementary Table 3. Genetic correlation among psychiatric disorders pairwise.

Trait1	Trait2	rg	SE	Z	P	FDR q-value
Depression	Attention-deficit hyperactivity disorder	0.6036	0.0222	27.1829	1.03E-162	3.88E-161
Depression	Anorexia nervosa	0.2783	0.0304	9.1395	6.27E-20	3.04E-19
Depression	Anxiety, panic disorder	0.5926	0.052	11.3892	4.73E-30	2.91E-29
Depression	Autism spectrum disorder	0.327	0.0274	11.9277	8.49E-33	5.68E-32
Depression	Bipolar disorder	0.4518	0.0203	22.2357	1.55E-109	3.11E-108
Depression	Major depressive disorder	0.9579	0.004	237.356	0	0
Depression	Neuroticism	0.8409	0.0122	68.8242	0	0
Depression	Post traumatic stress disorder	0.8255	0.0783	10.5376	5.80E-26	3.42E-25
Depression	Schizophrenia	0.3495	0.0186	18.8079	6.50E-79	8.89E-78
Anorexia nervosa	Anxiety, panic disorder	0.3527	0.0706	4.9951	5.88E-07	1.58E-06
Anorexia nervosa	Autism spectrum disorder	0.215	0.0505	4.2572	2.07E-05	4.72E-05
Anorexia nervosa	Bipolar disorder	0.2306	0.0294	7.8526	4.08E-15	1.55E-14
Anorexia nervosa	Major depressive disorder	0.287	0.0317	9.0493	1.44E-19	6.88E-19
Anorexia nervosa	Neuroticism	0.293	0.0303	9.6773	3.77E-22	1.92E-21
Anorexia nervosa	Post traumatic stress disorder	0.17	0.0665	2.5551	0.0106	0.016704712
Anorexia nervosa	Schizophrenia	0.2309	0.0259	8.9124	5.00E-19	2.25E-18
Anxiety, panic disorder	Autism spectrum disorder	0.1562	0.0734	2.1292	0.0332	0.050726904
Anxiety, panic disorder	Bipolar disorder	0.3018	0.0538	5.6133	1.98E-08	5.79E-08
Anxiety, panic disorder	Major depressive disorder	0.6427	0.0538	11.9429	7.07E-33	4.84E-32
Anxiety, panic disorder	Neuroticism	0.6527	0.0637	10.2409	1.30E-24	7.53E-24
Anxiety, panic disorder	Post traumatic stress disorder	0.3396	0.1168	2.9069	0.0037	0.006221788
Anxiety, panic disorder	Schizophrenia	0.3066	0.0445	6.8887	5.63E-12	1.88E-11
Attention-deficit hyperactivity disorder	Anxiety, panic disorder	0.1063	0.0595	1.7879	0.0738	0.100971818
Attention-deficit hyperactivity disorder	Anorexia nervosa	0.0969	0.0316	3.0678	0.0022	0.003872515
Attention-deficit hyperactivity disorder	Autism spectrum disorder	0.5347	0.0412	12.9874	1.44E-38	1.27E-37
Attention-deficit hyperactivity disorder	Bipolar disorder	0.2314	0.028	8.2652	1.39E-16	5.73E-16
Attention-deficit hyperactivity disorder	Major depressive disorder	0.5244	0.0251	20.8941	6.06E-97	1.01E-95
Attention-deficit hyperactivity disorder	Neuroticism	0.3808	0.0315	12.1085	9.53E-34	7.17E-33
Attention-deficit hyperactivity disorder	Post traumatic stress disorder	0.7158	0.0795	9.0024	2.21E-19	1.02E-18
Attention-deficit hyperactivity disorder	Schizophrenia	0.2015	0.0237	8.5133	1.69E-17	7.27E-17
Autism spectrum disorder	Bipolar disorder	0.219	0.0411	5.3328	9.67E-08	2.67E-07
Autism spectrum disorder	Major depressive disorder	0.3677	0.029	12.6642	9.34E-37	7.81E-36
Autism spectrum disorder	Neuroticism	0.3378	0.0374	9.0248	1.80E-19	8.47E-19
Autism spectrum disorder	Post traumatic stress disorder	0.3535	0.0786	4.4963	6.91E-06	1.61E-05
Autism spectrum disorder	Schizophrenia	0.2591	0.0347	7.4704	8.00E-14	3.01E-13
Bipolar disorder	Major depressive disorder	0.4499	0.0221	20.3512	4.53E-92	6.82E-91
Bipolar disorder	Neuroticism	0.3522	0.03	11.7595	6.31E-32	3.96E-31
Bipolar disorder	Post traumatic stress disorder	0.3947	0.0547	7.2168	5.32E-13	1.88E-12
Bipolar disorder	Schizophrenia	0.6993	0.0153	45.7962	0	0
Major depressive disorder	Neuroticism	0.851	0.0116	73.0889	0	0
Major depressive disorder	Post traumatic stress disorder	0.7159	0.0675	10.6132	2.59E-26	1.56E-25
Major depressive disorder	Schizophrenia	0.3426	0.0203	16.8479	1.09E-63	1.37E-62
Neuroticism	Post traumatic stress disorder	0.7232	0.0733	9.8599	6.21E-23	3.28E-22
Neuroticism	Schizophrenia	0.3293	0.0233	14.1513	1.83E-45	1.84E-44
Post Traumatic Stress Disorder	Schizophrenia	0.3145	0.0496	6.3368	2.35E-10	7.53E-10

Supplementary Table 4. Genetic correlation among digestive diseases pairwise.

Trait1	Trait2	rg	SE	Z	P	FDR q-value
Gastritis-duodenitis	Acute pancreatitis	0.5142	0.0936	5.4924	3.97E-08	1.25E-07
Gastroesophageal reflux disease	Acute pancreatitis	0.5518	0.0636	8.6712	4.28E-18	2.19E-17
Irritable bowel syndrome	Acute pancreatitis	0.2776	0.0661	4.2009	2.66E-05	6.50E-05
Acute pancreatitis	Appendicitis	0.2386	0.2004	1.1903	0.2339	0.283412017
Gastritis-duodenitis	Appendicitis	0.416	0.1376	3.0234	0.0025	0.004503205
Gastroesophageal reflux disease	Appendicitis	0.1728	0.0904	1.9128	0.0558	0.081665625
Irritable bowel syndrome	Appendicitis	0.1622	0.0976	1.6612	0.0967	0.130637981
Acute pancreatitis	Cholelithiasis and cholecystitis	0.8024	0.0846	9.4865	2.39E-21	1.43E-20
Appendicitis	Cholelithiasis and cholecystitis	0.2642	0.1277	2.0683	0.0386	0.059596703
Gastritis-duodenitis	Cholelithiasis and cholecystitis	0.4246	0.0586	7.2405	4.47E-13	1.82E-12
Gastroesophageal reflux disease	Cholelithiasis and cholecystitis	0.4938	0.037	13.3487	1.21E-40	1.36E-39
Irritable bowel syndrome	Cholelithiasis and cholecystitis	0.2427	0.0539	4.5063	6.60E-06	1.70E-05
Acute pancreatitis	Crohn's disease	0.0561	0.0756	0.7414	0.4584	0.5152416
Appendicitis	Crohn's disease	-0.3446	0.1289	-2.6739	0.0075	0.012544643
Cholelithiasis and cholecystitis	Crohn's disease	0.0034	0.0528	0.0638	0.9492	0.969909818
Gastritis-duodenitis	Crohn's disease	0.0786	0.0535	1.4694	0.1417	0.181500455
Gastroesophageal reflux disease	Crohn's disease	0.0737	0.0373	1.9794	4.78E-02	7.26E-02
Irritable bowel syndrome	Crohn's disease	0.1454	0.0383	3.796	0.0001	0.000223016
Acute pancreatitis	Colorectal cancer	0.0084	0.0565	0.1493	0.8813	0.910460662
Appendicitis	Colorectal cancer	-0.1624	0.1106	-1.4679	0.1421	0.181500455
Cholelithiasis and cholecystitis	Colorectal cancer	0.0587	0.0459	1.2786	0.2011	0.24784693
Crohn's disease	Colorectal cancer	0.0314	0.0471	0.6672	0.5046	0.558238583
Gastritis-duodenitis	Colorectal cancer	0.0037	0.0435	0.0859	0.9316	0.9554
Gastroesophageal reflux disease	Colorectal cancer	0.0955	0.0288	3.3143	0.0009	0.001744138
Irritable bowel syndrome	Colorectal cancer	-0.0015	0.0351	-0.0439	0.965	0.975413669
Acute pancreatitis	Diverticular disease	0.2604	0.0634	4.1058	4.03E-05	9.76E-05
Appendicitis	Diverticular disease	-0.0762	0.1105	-0.6903	0.49	0.546388889
Cholelithiasis and cholecystitis	Diverticular disease	0.3207	0.043	7.4527	9.15E-14	3.90E-13
Crohn's disease	Diverticular disease	0.0094	0.037	0.2548	0.7988	0.840684644
Colorectal cancer	Diverticular disease	0.115	0.0344	3.3441	0.0008	0.001594326
Gastritis-duodenitis	Diverticular disease	0.4389	0.0433	10.1436	3.54E-24	2.37E-23
Gastroesophageal reflux disease	Diverticular disease	0.4504	0.0277	16.2392	2.66E-59	3.93E-58
Irritable bowel syndrome	Diverticular disease	0.3849	0.0325	11.8553	2.02E-32	1.58E-31
Gastroesophageal reflux disease	Gastritis-duodenitis	0.882	0.0337	26.1656	6.55E-151	3.07E-149
Irritable bowel syndrome	Gastritis-duodenitis	0.5326	0.0443	12.0214	2.74E-33	2.41E-32
Acute pancreatitis	Inflammatory bowel disease	0.113	0.0634	1.7814	0.0748	0.104990547
Appendicitis	Inflammatory bowel disease	-0.3783	0.1251	-3.0249	0.0025	0.004503205
Cholelithiasis and cholecystitis	Inflammatory bowel disease	0.0459	0.0452	1.0154	0.3099	0.36284125
Crohn's disease	Inflammatory bowel disease	0.8981	0.0121	74.4996	0	0
Colorectal cancer	Inflammatory bowel disease	-0.0304	0.0368	-0.8252	0.4093	0.461900803
Diverticular disease	Inflammatory bowel disease	0.0425	0.0308	1.3819	0.167	0.211382883
Gastritis-duodenitis	Inflammatory bowel disease	0.1385	0.0451	3.0694	0.0021	0.003934
Gastroesophageal reflux disease	Inflammatory bowel disease	0.1027	0.0309	3.3267	0.0009	0.001744138
Irritable bowel syndrome	Inflammatory bowel disease	0.1692	0.0343	4.9293	8.25E-07	2.32E-06
Gastroesophageal reflux disease	Irritable bowel syndrome	0.6043	0.0273	22.1706	6.61E-109	1.69E-107
Acute pancreatitis	Non-alcoholic fatty liver disease	0.9115	0.2541	3.588	0.0003	0.000633835
Appendicitis	Non-alcoholic fatty liver disease	0.3676	0.3158	1.1639	0.2445	0.292359574
Cholelithiasis and cholecystitis	Non-alcoholic fatty liver disease	0.793	0.1947	4.0731	4.64E-05	1.11E-04
Crohn's disease	Non-alcoholic fatty liver disease	0.0492	0.1209	0.4069	0.6841	0.730920532
Colorectal cancer	Non-alcoholic fatty liver disease	0.0564	0.0997	0.5659	0.5715	0.627310547
Diverticular disease	Non-alcoholic fatty liver disease	0.4408	0.1266	3.4829	0.0005	0.001018116
Gastritis-duodenitis	Non-alcoholic fatty liver disease	0.5151	0.1676	3.0727	0.0021	0.003934
Gastroesophageal reflux disease	Non-alcoholic fatty liver disease	0.7101	0.1504	4.7215	2.34E-06	6.26E-06
Inflammatory bowel disease	Non-alcoholic fatty liver disease	0.2008	0.1091	1.8399	0.0658	0.094335714
Irritable bowel syndrome	Non-alcoholic fatty liver disease	0.3443	0.1145	3.0079	0.0026	0.004624051
Acute pancreatitis	Peptic ulcer	0.4783	0.0964	4.9602	7.04E-07	2.04E-06
Appendicitis	Peptic ulcer	0.1182	0.1608	0.7351	0.4623	0.51755498
Cholelithiasis and cholecystitis	Peptic ulcer	0.3222	0.0747	4.3122	1.62E-05	4.06E-05
Crohn's disease	Peptic ulcer	0.0288	0.0566	0.5092	0.6106	0.657389272
Colorectal cancer	Peptic ulcer	0.0711	0.0547	1.3007	0.1934	0.240466372
Diverticular disease	Peptic ulcer	0.3964	0.0478	8.2904	1.13E-16	5.47E-16
Gastritis-duodenitis	Peptic ulcer	0.8734	0.0694	12.5805	2.70E-36	2.71E-35

Gastroesophageal reflux disease	Peptic ulcer	0.6879	0.0435	15.8218	2.20E-56	2.94E-55
Inflammatory bowel disease	Peptic ulcer	0.0737	0.0482	1.5273	0.1267	0.164827315
Irritable bowel syndrome	Peptic ulcer	0.4221	0.0642	6.5801	4.70E-11	1.72E-10
Non-alcoholic fatty liver disease	Peptic ulcer	0.4583	0.1471	3.1158	0.0018	0.003417568
Acute pancreatitis	Stool frequency	-0.0164	0.0703	-0.2327	0.816	0.852401487
Appendicitis	Stool frequency	0.2293	0.1102	2.081	0.0374	0.058711732
Cholelithiasis and cholecystitis	Stool frequency	0.0607	0.0539	1.1259	0.2602	0.309814407
Crohn's disease	Stool frequency	0.0518	0.0405	1.2808	0.2002	0.24782467
Colorectal cancer	Stool frequency	-0.0207	0.039	-0.5307	0.5956	0.644462692
Diverticular disease	Stool frequency	0.3729	0.0376	9.908	3.84E-23	2.51E-22
Gastritis-duodenitis	Stool frequency	0.1001	0.0511	1.9581	0.0502	0.075434225
Gastroesophageal reflux disease	Stool frequency	0.2224	0.031	7.1721	7.38E-13	2.88E-12
Inflammatory bowel disease	Stool frequency	0.0381	0.0363	1.0497	0.2939	0.34699958
Irritable bowel syndrome	Stool frequency	0.2751	0.0379	7.2589	3.90E-13	1.61E-12
Non-alcoholic fatty liver disease	Stool frequency	-0.072	0.1127	-0.639	0.5229	0.576215294
Peptic ulcer	Stool frequency	0.2011	0.0573	3.5088	0.0005	0.001018116
Acute pancreatitis	Ulcerative colitis	0.1171	0.0645	1.8155	0.0694	0.098633838
Appendicitis	Ulcerative colitis	-0.3872	0.1356	-2.8565	0.0043	0.007367683
Cholelithiasis and cholecystitis	Ulcerative colitis	0.0774	0.0481	1.6077	0.1079	0.143018396
Crohn's disease	Ulcerative colitis	0.6272	0.0332	18.8722	1.93E-79	3.62E-78
Colorectal cancer	Ulcerative colitis	-0.0549	0.0324	-1.694	0.0903	0.123176214
Diverticular disease	Ulcerative colitis	0.0655	0.0315	2.0779	0.0377	0.058853889
Gastritis-duodenitis	Ulcerative colitis	0.1547	0.0437	3.5362	0.0004	0.000832593
Gastroesophageal reflux disease	Ulcerative colitis	0.1108	0.0298	3.7183	0.0002	0.000429008
Inflammatory bowel disease	Ulcerative colitis	0.9234	0.0105	87.6681	0	0
Irritable bowel syndrome	Ulcerative colitis	0.1481	0.0366	4.0416	5.31E-05	1.24E-04
Non-alcoholic fatty liver disease	Ulcerative colitis	0.2781	0.1099	2.53	0.0114	0.018624419
Peptic ulcer	Ulcerative colitis	0.1152	0.0537	2.1454	0.0319	0.05093125
Stool frequency	Ulcerative colitis	0.0282	0.0338	0.8338	0.4044	0.45821129

Supplementary Table 5. Tissue-specific contributions to 14 digestive diseases/traits (brain-specific)

Trait Nickname	Tissue	prop_h2g (π' , heritability)	prop_h2g_se
Acute pancreatitis	Brain Amygdala	0.039445846	0.060078027
Acute pancreatitis	Brain Anterior cingulate cortex BA24	0.075723848	0.073365672
Acute pancreatitis	Brain Caudate basal ganglia	0.116887803	0.090937072
Acute pancreatitis	Brain Cerebellar Hemisphere	-0.06647903	0.067625273
Acute pancreatitis	Brain Cerebellum	0.074999508	0.097364208
Acute pancreatitis	Brain Cortex	0.08326188	0.069686205
Acute pancreatitis	Brain Frontal Cortex BA9	-0.025528472	0.068242908
Acute pancreatitis	Brain Hippocampus	-0.052670634	0.057014457
Acute pancreatitis	Brain Hypothalamus	-0.00993265	0.061105755
Acute pancreatitis	Brain Nucleus accumbens basal ganglia	-0.194043292	0.05603175
Acute pancreatitis	Brain Putamen basal ganglia	-0.00416267	0.068074055
Acute pancreatitis	Brain Spinal cord cervical c-1	0.086707522	0.053564994
Acute pancreatitis	Brain Substantia nigra	-0.043649483	0.036645103
Acute pancreatitis	AllTissues	0.080560176	0.072300495
Appendicitis	Brain Amygdala	-0.159416171	0.101971258
Appendicitis	Brain Anterior cingulate cortex BA24	0.012874613	0.128116121
Appendicitis	Brain Caudate basal ganglia	-0.008431243	0.173477551
Appendicitis	Brain Cerebellar Hemisphere	0.082224395	0.179216089
Appendicitis	Brain Cerebellum	-0.123740869	0.221328327
Appendicitis	Brain Cortex	-0.076122416	0.164076458
Appendicitis	Brain Frontal Cortex BA9	0.267460749	0.175122281
Appendicitis	Brain Hippocampus	0.116326091	0.176836801
Appendicitis	Brain Hypothalamus	-0.153881739	0.129575558
Appendicitis	Brain Nucleus accumbens basal ganglia	-0.023971988	0.162903785
Appendicitis	Brain Putamen basal ganglia	0.042035474	0.194721872
Appendicitis	Brain Spinal cord cervical c-1	0.168404065	0.131117533
Appendicitis	Brain Substantia nigra	-0.038641902	0.100168786
Appendicitis	AllTissues	0.105119059	0.145330802
Crohn's disease	Brain Amygdala	-0.045207633	0.04430597
Crohn's disease	Brain Anterior cingulate cortex BA24	0.044614316	0.043898497
Crohn's disease	Brain Caudate basal ganglia	0.071374538	0.07425187
Crohn's disease	Brain Cerebellar Hemisphere	0.079061764	0.0682527
Crohn's disease	Brain Cerebellum	0.101801181	0.079803004
Crohn's disease	Brain Cortex	0.086174189	0.066422085
Crohn's disease	Brain Frontal Cortex BA9	-0.003969159	0.063415364
Crohn's disease	Brain Hippocampus	0.00498361	0.04949325
Crohn's disease	Brain Hypothalamus	0.043151592	0.052353647
Crohn's disease	Brain Nucleus accumbens basal ganglia	0.042570665	0.066720723
Crohn's disease	Brain Putamen basal ganglia	-0.02266138	0.064065129
Crohn's disease	Brain Spinal cord cervical c-1	0.007559686	0.039937892
Crohn's disease	Brain Substantia nigra	0.036495536	0.043474603
Crohn's disease	AllTissues	0.445948905	0.083964498
Cholelithiasis and cholecystitis	Brain Amygdala	-0.017636869	0.035029483
Cholelithiasis and cholecystitis	Brain Anterior cingulate cortex BA24	-0.025583254	0.031040797
Cholelithiasis and cholecystitis	Brain Caudate basal ganglia	0.067283959	0.045148221
Cholelithiasis and cholecystitis	Brain Cerebellar Hemisphere	0.014577662	0.043080171
Cholelithiasis and cholecystitis	Brain Cerebellum	0.051882869	0.048102366
Cholelithiasis and cholecystitis	Brain Cortex	-0.032079703	0.040072207
Cholelithiasis and cholecystitis	Brain Frontal Cortex BA9	0.027277648	0.038657148
Cholelithiasis and cholecystitis	Brain Hippocampus	0.000192292	0.038932695
Cholelithiasis and cholecystitis	Brain Hypothalamus	0.016518763	0.044313431
Cholelithiasis and cholecystitis	Brain Nucleus accumbens basal ganglia	-0.011415768	0.042490423
Cholelithiasis and cholecystitis	Brain Putamen basal ganglia	0.055120186	0.04475545
Cholelithiasis and cholecystitis	Brain Spinal cord cervical c-1	0.020702761	0.033036327
Cholelithiasis and cholecystitis	Brain Substantia nigra	0.004205681	0.032205403
Cholelithiasis and cholecystitis	AllTissues	0.171046228	0.054042675
Colorectal cancer	Brain Amygdala	-0.010628755	0.020668538
Colorectal cancer	Brain Anterior cingulate cortex BA24	-0.017974495	0.021028001
Colorectal cancer	Brain Caudate basal ganglia	0.079958175	0.030499402
Colorectal cancer	Brain Cerebellar Hemisphere	-0.0175495	0.032407542
Colorectal cancer	Brain Cerebellum	0.110341912	0.032959377
Colorectal cancer	Brain Cortex	0.078277145	0.046610593
Colorectal cancer	Brain Frontal Cortex BA9	-0.014337075	0.028188414
Colorectal cancer	Brain Hippocampus	0.013992666	0.023593138
Colorectal cancer	Brain Hypothalamus	-0.015037678	0.024235901
Colorectal cancer	Brain Nucleus accumbens basal ganglia	-0.031919439	0.029469622
Colorectal cancer	Brain Putamen basal ganglia	-0.003350553	0.027534203
Colorectal cancer	Brain Spinal cord cervical c-1	0.002298997	0.020467171
Colorectal cancer	Brain Substantia nigra	-0.006388394	0.022354759
Colorectal cancer	AllTissues	0.167683006	0.037082489
Diverticular disease	Brain Amygdala	-2.54E-05	0.017122443
Diverticular disease	Brain Anterior cingulate cortex BA24	-0.015038921	0.018583534

Diverticular disease	Brain Caudate basal ganglia	0.013491804	0.024133831
Diverticular disease	Brain Cerebellar Hemisphere	-0.022635916	0.023214866
Diverticular disease	Brain Cerebellum	0.066981965	0.026712927
Diverticular disease	Brain Cortex	0.008523978	0.027671338
Diverticular disease	Brain Frontal Cortex BA9	0.00894942	0.023499115
Diverticular disease	Brain Hippocampus	0.050028558	0.02481178
Diverticular disease	Brain Hypothalamus	0.016892406	0.025025659
Diverticular disease	Brain Nucleus accumbens basal ganglia	0.020488555	0.028582806
Diverticular disease	Brain Putamen basal ganglia	0.025463095	0.026139311
Diverticular disease	Brain Spinal cord cervical c-1	-0.02288309	0.016727104
Diverticular disease	Brain Substantia nigra	-0.01501569	0.012495696
Diverticular disease	AllTissues	0.135220804	0.025196487
Gastritis-duodenitis	Brain Amygdala	-0.006162965	0.027380977
Gastritis-duodenitis	Brain Anterior cingulate cortex BA24	-0.02077658	0.031056352
Gastritis-duodenitis	Brain Caudate basal ganglia	0.076183654	0.042308008
Gastritis-duodenitis	Brain Cerebellar Hemisphere	0.049159952	0.039588018
Gastritis-duodenitis	Brain Cerebellum	-0.048821809	0.043808963
Gastritis-duodenitis	Brain Cortex	0.030020271	0.034717591
Gastritis-duodenitis	Brain Frontal Cortex BA9	0.008380123	0.033678063
Gastritis-duodenitis	Brain Hippocampus	-0.029827356	0.026931225
Gastritis-duodenitis	Brain Hypothalamus	-0.018664332	0.029018054
Gastritis-duodenitis	Brain Nucleus accumbens basal ganglia	0.006067902	0.038608206
Gastritis-duodenitis	Brain Putamen basal ganglia	0.009319203	0.033892166
Gastritis-duodenitis	Brain Spinal cord cervical c-1	0.010237613	0.033304557
Gastritis-duodenitis	Brain Substantia nigra	0.006903278	0.025586565
Gastritis-duodenitis	AllTissues	0.072018956	0.033556699
Gastroesophageal reflux disease	Brain Amygdala	-0.003015599	0.012698176
Gastroesophageal reflux disease	Brain Anterior cingulate cortex BA24	-0.013100124	0.012932565
Gastroesophageal reflux disease	Brain Caudate basal ganglia	0.016651851	0.02173431
Gastroesophageal reflux disease	Brain Cerebellar Hemisphere	-0.02020637	0.018815076
Gastroesophageal reflux disease	Brain Cerebellum	0.063289791	0.020691767
Gastroesophageal reflux disease	Brain Cortex	0.03816784	0.018657736
Gastroesophageal reflux disease	Brain Frontal Cortex BA9	0.01623882	0.016814836
Gastroesophageal reflux disease	Brain Hippocampus	0.00543857	0.018331796
Gastroesophageal reflux disease	Brain Hypothalamus	-0.017142433	0.013442517
Gastroesophageal reflux disease	Brain Nucleus accumbens basal ganglia	-0.030640388	0.016663213
Gastroesophageal reflux disease	Brain Putamen basal ganglia	-0.001062295	0.021177913
Gastroesophageal reflux disease	Brain Spinal cord cervical c-1	0.016186749	0.013534731
Gastroesophageal reflux disease	Brain Substantia nigra	-0.00153562	0.010518144
Gastroesophageal reflux disease	AllTissues	0.069270792	0.019282871
Inflammatory bowel disease	Brain Amygdala	-0.019369341	0.023227865
Inflammatory bowel disease	Brain Anterior cingulate cortex BA24	-0.0016183	0.023199756
Inflammatory bowel disease	Brain Caudate basal ganglia	0.046076712	0.042680538
Inflammatory bowel disease	Brain Cerebellar Hemisphere	0.057530567	0.038372586
Inflammatory bowel disease	Brain Cerebellum	0.072411943	0.038518157
Inflammatory bowel disease	Brain Cortex	0.084636466	0.036003493
Inflammatory bowel disease	Brain Frontal Cortex BA9	-0.018599062	0.030645704
Inflammatory bowel disease	Brain Hippocampus	-0.027615075	0.028489134
Inflammatory bowel disease	Brain Hypothalamus	0.045158033	0.033388679
Inflammatory bowel disease	Brain Nucleus accumbens basal ganglia	-0.006508173	0.033388408
Inflammatory bowel disease	Brain Putamen basal ganglia	0.030235769	0.037865093
Inflammatory bowel disease	Brain Spinal cord cervical c-1	-0.002555337	0.019926886
Inflammatory bowel disease	Brain Substantia nigra	0.002575317	0.023613342
Inflammatory bowel disease	AllTissues	0.262359519	0.045970295
Irritable bowel syndrome	Brain Amygdala	-0.023536635	0.01562157
Irritable bowel syndrome	Brain Anterior cingulate cortex BA24	0.009897123	0.01663143
Irritable bowel syndrome	Brain Caudate basal ganglia	0.00970656	0.024033306
Irritable bowel syndrome	Brain Cerebellar Hemisphere	0.003966527	0.021637173
Irritable bowel syndrome	Brain Cerebellum	0.019367328	0.02594878
Irritable bowel syndrome	Brain Cortex	0.031061573	0.027459987
Irritable bowel syndrome	Brain Frontal Cortex BA9	0.012709857	0.023760574
Irritable bowel syndrome	Brain Hippocampus	0.008484032	0.023298194
Irritable bowel syndrome	Brain Hypothalamus	-0.015141852	0.018939603
Irritable bowel syndrome	Brain Nucleus accumbens basal ganglia	0.00976334	0.023960261
Irritable bowel syndrome	Brain Putamen basal ganglia	-0.001362871	0.019313949
Irritable bowel syndrome	Brain Spinal cord cervical c-1	0.032484412	0.019664529
Irritable bowel syndrome	Brain Substantia nigra	-0.003984114	0.013170768
Irritable bowel syndrome	AllTissues	0.093415281	0.023851618
Non-alcoholic fatty liver disease	Brain Amygdala	0.043095569	0.112317982
Non-alcoholic fatty liver disease	Brain Anterior cingulate cortex BA24	0.187053069	0.141757681
Non-alcoholic fatty liver disease	Brain Caudate basal ganglia	0.156511254	0.185481802
Non-alcoholic fatty liver disease	Brain Cerebellar Hemisphere	0.080359904	0.172712625
Non-alcoholic fatty liver disease	Brain Cerebellum	0.082968888	0.203980472
Non-alcoholic fatty liver disease	Brain Cortex	0.05941244	0.191022169
Non-alcoholic fatty liver disease	Brain Frontal Cortex BA9	-0.332774893	0.146305174

Non-alcoholic fatty liver disease	Brain Hippocampus	-0.230623335	0.122371357
Non-alcoholic fatty liver disease	Brain Hypothalamus	0.139256426	0.140522924
Non-alcoholic fatty liver disease	Brain Nucleus accumbens basal ganglia	-0.00544705	0.170875388
Non-alcoholic fatty liver disease	Brain Putamen basal ganglia	0.036202917	0.173701533
Non-alcoholic fatty liver disease	Brain Spinal cord cervical c-1	0.098253976	0.108090668
Non-alcoholic fatty liver disease	Brain Substantia nigra	-0.062480754	0.099157759
Non-alcoholic fatty liver disease	AllTissues	0.251788411	0.148210394
Peptic ulcer	Brain Amygdala	-0.048961056	0.034729355
Peptic ulcer	Brain Anterior cingulate cortex BA24	-0.018035992	0.042370119
Peptic ulcer	Brain Caudate basal ganglia	0.057678509	0.046962283
Peptic ulcer	Brain Cerebellar Hemisphere	-0.051915313	0.05001471
Peptic ulcer	Brain Cerebellum	0.074432795	0.054466007
Peptic ulcer	Brain Cortex	0.037797857	0.051909202
Peptic ulcer	Brain Frontal Cortex BA9	0.020446834	0.047027748
Peptic ulcer	Brain Hippocampus	0.009166435	0.039847025
Peptic ulcer	Brain Hypothalamus	-0.061611795	0.031437971
Peptic ulcer	Brain Nucleus accumbens basal ganglia	0.094325797	0.052438544
Peptic ulcer	Brain Putamen basal ganglia	-0.014814926	0.040433567
Peptic ulcer	Brain Spinal cord cervical c-1	0.039612592	0.031707184
Peptic ulcer	Brain Substantia nigra	0.014165414	0.02715103
Peptic ulcer	AllTissues	0.152287151	0.052364332
Stool frequency	Brain Amygdala	-0.028517196	0.018410303
Stool frequency	Brain Anterior cingulate cortex BA24	0.007997274	0.020554375
Stool frequency	Brain Caudate basal ganglia	0.007604632	0.029328249
Stool frequency	Brain Cerebellar Hemisphere	-0.002390698	0.027763586
Stool frequency	Brain Cerebellum	0.057718573	0.032081666
Stool frequency	Brain Cortex	0.041294443	0.029342455
Stool frequency	Brain Frontal Cortex BA9	0.006252501	0.025186542
Stool frequency	Brain Hippocampus	-0.010613365	0.023555113
Stool frequency	Brain Hypothalamus	0.01177113	0.020873998
Stool frequency	Brain Nucleus accumbens basal ganglia	-0.004939901	0.023762502
Stool frequency	Brain Putamen basal ganglia	0.024354184	0.028997253
Stool frequency	Brain Spinal cord cervical c-1	0.02268599	0.019471798
Stool frequency	Brain Substantia nigra	0.010812246	0.014459021
Stool frequency	AllTissues	0.14402981	0.02943598
Ulcerative colitis	Brain Amygdala	0.004774711	0.018743986
Ulcerative colitis	Brain Anterior cingulate cortex BA24	-0.00044807	0.021288174
Ulcerative colitis	Brain Caudate basal ganglia	0.02595494	0.038131851
Ulcerative colitis	Brain Cerebellar Hemisphere	0.04302271	0.035680105
Ulcerative colitis	Brain Cerebellum	0.04207878	0.034066215
Ulcerative colitis	Brain Cortex	0.102126039	0.037304015
Ulcerative colitis	Brain Frontal Cortex BA9	-0.031432733	0.026621453
Ulcerative colitis	Brain Hippocampus	-0.032969424	0.025035202
Ulcerative colitis	Brain Hypothalamus	0.034447225	0.026339256
Ulcerative colitis	Brain Nucleus accumbens basal ganglia	-0.037650506	0.030504453
Ulcerative colitis	Brain Putamen basal ganglia	0.041584384	0.034709377
Ulcerative colitis	Brain Spinal cord cervical c-1	0.005464139	0.016922447
Ulcerative colitis	Brain Substantia nigra	-0.018308504	0.017632265
Ulcerative colitis	AllTissues	0.178643691	0.038017989

Supplementary Table 7. Multi-trait meta-analysis between digestive diseases and irritable bowel syndrome in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Irritable bowel syndrome		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Gastroesophageal reflux disease	rs2357977	2	161010370	T	C	-0.0283	0.00002809	-0.0414	2.124E-06	-0.010786	9.1E-09	TANK	2q24.2	known
	rs35975336	3	58465907	A	G	0.0415	2.834E-07	0.0361	0.000132	0.012851	3.7E-08	KCTD6	3p14.3	known
	rs1248825	3	84944260	A	C	0.0169	0.007426	0.0444	1.204E-09	0.010906	1.4E-09	CADM2	3p12.1	known
	rs2308604	6	31271074	T	C	-0.0343	7.193E-08	-0.0455	8.552E-08	-0.012154	1.1E-11	MHC region		known
	rs10992729	9	93418793	T	C	-0.0184	0.003368	-0.0402	2.844E-08	-0.010341	7.4E-09	PHF2	9q22.31	known
	rs4937872	11	112956992	A	G	-0.0255	0.00002352	-0.0387	3.207E-08	-0.010963	1.7E-10	NCAM1	11q23.2	known
	rs2813573	13	53369198	T	C	-0.0209	0.0004136	-0.0378	3.308E-08	-0.010247	1.3E-09	OLFM4	13q14.3	known
	rs34865566	17	52256990	T	G	-0.036	4.807E-09	-0.0248	0.0005181	-0.009978	2.6E-08	CA10	17q21.33-q22	new
	rs8106322	19	31533324	A	G	-0.0251	0.00005608	-0.0394	1.452E-07	-0.010727	1.2E-09	TSHZ3	19q12	new
Diverticular disease	rs57810551	1	214353269	T	G	-0.002671	0.0000021	-0.0336	2.285E-06	-0.0114	1.3E-08	SMYD2	1q32.3	new
	rs4414623	2	143592402	A	G	0.0093444	1.3E-46	-0.022	0.007811	-0.014783	2.2E-10	ARHGAP15	2q22.2-q22.3	new
	rs28810515	3	151221539	A	G	0.0042819	0.000000011	0.0487	2.455E-07	0.016798	1.8E-10	GPR171	3q25.1	new
	rs7766089	6	31281816	A	G	-0.002185	0.00014	0.0451	4.461E-08	0.01212	9.3E-10	MHC region		known
	rs10156602	9	93583046	A	G	0.0022839	0.000054	0.0417	4.355E-09	0.013088	5.5E-11	PHF2	9q22.31	known
	rs726972	19	31543925	A	C	-0.001634	0.0045	0.0388	2.553E-07	0.011461	2.4E-08	TSHZ3	19q12	new
Peptic ulcer	rs1248857	3	84969461	A	G	-0.042759	0.00012	-0.0356	2.003E-07	-0.011647	3E-09	CADM2	3p12.1	known
	rs10761226	9	93461754	T	C	-0.037034	0.00095	-0.0402	5.68E-09	-0.012684	1.7E-10	PHF2	9q22.31	known
	rs10891481	11	112959839	A	G	-0.034075	0.003	-0.0376	9.084E-08	-0.011845	4.4E-09	NCAM1	11q23.2	known
	rs2813573	13	53369198	T	C	-0.032379	0.0038	-0.0378	3.308E-08	-0.011853	1.6E-09	OLFM4	13q14.3	known
Cholelithiasis and cholecystitis	rs1248825	3	84944260	A	C	0.0397	0.00149	0.0444	1.204E-09	0.013613	2E-10	CADM2	3p12.1	known
	rs12549729	8	8666402	T	G	0.0359	0.00558	0.0475	2.881E-08	0.011849	8.3E-09	CLDN23	8p23.1	new
	rs10156602	9	93583046	A	G	0.0381	0.00184	0.0417	4.355E-09	0.012789	8E-10	PHF2	9q22.31	known
Stool frequency	rs1248860	3	84966628	A	G	-0.0088	0.001654	-0.0356	2.024E-07	-0.010983	4.7E-08	CADM2	3p12.1	known
	rs2077491	6	31638599	T	C	-0.0074	0.007885	-0.0423	1.964E-09	-0.011527	1E-08	MHC region		known
	rs10761226	9	93461754	T	C	-0.0078	0.00532	-0.0402	5.68E-09	-0.012229	1.8E-09	PHF2	9q22.31	known
Gastritis-duodenitis	rs7106434	11	112989857	T	C	-0.0312	0.000563	0.0384	3.189E-08	0.012222	7.7E-10	NCAM1	11q23.2	known
	rs2813573	13	53369198	T	C	-0.0261	0.00346	-0.0378	3.308E-08	-0.011771	1.7E-09	OLFM4	13q14.3	known
Inflammatory bowel disease	rs2753961	6	31787053	T	C	0.0931	0.000001808	0.0577	8.262E-07	0.016215	3.3E-08	MHC region		known
Crohn's disease	rs622871	6	31910718	A	G	-0.0182	0.000001139	-0.0434	1.286E-08	-0.013639	2.4E-10	MHC region		known

Supplementary Table 9. Multi-trait meta-analysis between digestive diseases and gastroesophageal reflux disease in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Gastroesophageal reflux disease		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Irritable bowel syndrome	rs35975336	3	58451634	A	G	0.0361	0.000132	0.0415	2.834E-07	0.013962754	8.8902E-09	KCTD6	3p14.3	new
	rs13092463	3	70959754	A	G	0.0194	0.009461	0.0361	2.301E-08	0.02917814	8.9488E-09	MDFC2	3p13	known
	rs9266197	6	31324830	A	G	0.0401	0.00001872	0.0394	3.604E-10	0.016675437	1.8419E-12	MHC region		known
	rs4728049	7	126344575	A	G	-0.0213	0.002179	-0.0334	2.816E-08	-0.0155863	3.326E-09	GRM8	7q31.33	new
	rs117113729	8	68391710	T	C	0.0652	0.001865	0.0969	5.88E-08	0.014629091	7.3218E-09	ARFGEP1	8q13.2	new
	rs6991878	8	73907806	T	C	-0.0232	0.0029	-0.0338	2.705E-08	-0.01386189	4.7092E-09	TERF1	8q21.11	known
	rs10789929	11	112830663	T	C	0.0376	9.429E-08	0.0263	0.00001538	0.015486246	3.8748E-08	NCAM1	11q23.2	known
	rs02046253	16	60644621	T	C	-0.0205	0.0042	-0.0352	1.297E-08	-0.01479923	2.8535E-09	CDH8	16q21	known
	rs11647182	16	82896398	A	G	-0.0235	0.00229	-0.0334	4.636E-07	-0.01309921	4.9697E-08	CDH13	16q23.3	known
	rs12939066	17	50270268	T	C	0.0209	0.003879	0.0415	3.132E-11	0.017296583	6.7218E-12	CA10	17q21.33-q22	known
Gastritis-duodenitis	rs6658412	1	98309251	A	C	-0.0279	0.00917	0.0404	1.19E-08	0.015058273	1.64E-08	DPYD	1p21.3	known
	rs1858828	3	50242387	T	G	0.0247	0.00579	0.0327	3.23E-08	0.013714685	3.19E-08	SLC38A3	3p21.31	known
	rs6809836	3	70940892	A	G	0.0295	0.00264	0.0383	3.7E-09	0.018255905	3.85E-09	MDFC2	3p13	known
	rs769671	4	140883618	T	C	-0.0248	0.00913	-0.0385	9.28E-10	-0.01665023	1.56E-09	MAML3	4q31.1	known
	rs12705982	7	114336114	T	C	0.0282	0.00163	0.0326	3.67E-08	0.014695047	2.55E-08	MDFC	7q31.1-q31.2	known
	rs773109	12	56374695	A	G	-0.0247	0.00877	-0.0341	4.86E-08	-0.01589014	4.44E-08	RAB5B	12q13.2	known
	rs02046253	16	60644621	T	C	-0.0305	0.0011	-0.0352	0.000000013	-0.01492995	1.03E-08	CDH8	16q21	known
	rs79286782	19	18716550	A	G	0.0503	0.00366	0.0664	8.58E-09	0.014298653	8.11E-09	TMEM59L	19p13.11	new
	rs953988	17	50311047	T	C	0.0391	0.000183	-0.0398	4.61E-11	-0.01675493	1.42E-11	CA10	17q21.33-q22	known
	rs7755997	6	26483048	A	G	0.0281	0.00182	0.0376	3.23E-10	0.018575597	4.02E-10	MHC region		known
Diverticular disease	rs3072	2	20878406	T	C	-0.0023035	0.000052	-0.0345	1.863E-08	-0.01618376	2.6379E-09	GDP7	2p24.1	new
	rs9309272	2	56095366	T	G	0.00703876	6.4E-19	0.0441	4.203E-07	0.015237362	7.5442E-10	EFEMP1	2p16.1	new
	rs7609078	2	100490363	A	G	-0.00172223	0.0023	-0.049	1.626E-10	-0.01646839	8.9811E-11	AFF3	2q11.2	known
	rs6762606	3	134379752	T	C	-0.00197149	0.0013	-0.0359	4.181E-08	-0.01415244	1.2003E-08	KY	3q22.2	known
	rs56051594	5	494064	T	C	0.00177969	0.0012	0.0329	4.179E-08	0.017542801	1.567E-08	SLC9A3	5p15.33	new
	rs699188	7	114160742	A	G	0.00236916	0.000016	0.0317	1.012E-07	0.023018006	1.0234E-10	MDFC	7q31.1-q31.2	known
	rs1050458	6	31324925	A	G	-0.00177329	0.0022	-0.0393	3.117E-10	-0.01852619	1.2259E-10	MHC region		known
Peptic ulcer	rs809955	4	140874760	A	G	-0.03163404	0.0064	-0.0373	1.064E-09	-0.0300865	8.3914E-10	MAML3	4q31.1	known
	rs9800013	5	542023	A	G	-0.03916627	0.0027	-0.0372	8.803E-08	-0.01379482	4.0044E-08	SLC9A3	5p15.33	new
	rs2344609	11	6270056	T	C	-0.08900029	9.8E-12	-0.0376	1.168E-07	-0.01982084	3.5887E-09	CKBR	11p15.4	known
	rs1789865	16	60630724	A	G	-0.03514064	0.0021	-0.0325	7.025E-08	-0.02128225	3.323E-08	CDH8	16q21	known
	rs200980	6	27832011	T	C	-0.04371402	0.0022	-0.0443	4.778E-09	-0.01468003	3.39E-09	MHC region		known
Cholelithiasis and cholecystitis	rs7531444	2	44069772	A	G	0.767	4.16E-201	0.0498	0.0000353	0.028757756	1.22E-12	ABCG5	2p21	new
	rs2861695	2	67846727	A	G	0.0412	0.00526	0.0424	1.18E-08	0.036885705	7.21E-09	ETAA1	2p14	known
	rs10250103	7	114294942	T	C	0.0357	0.00237	0.0325	4.11E-08	0.022810512	2.13E-08	MDFC	7q31.1-q31.2	known
	rs11171710	12	56368078	A	G	0.0376	0.0015	0.0351	4.17E-09	0.010576822	2.8E-09	RAB5B	12q13.2	known
	rs4808844	19	18811966	A	G	0.036	0.00258	0.0341	0.000000016	0.016237789	8.11E-09	CRTC1	19p13.11	new
Acute pancreatitis	rs7531444	2	44069772	A	G	0.0266862	4.081E-28	0.0498	0.0000353	0.022089517	4.37E-08	ABCG5	2p21	new
	rs1794442	16	77139145	T	C	0.0149077	0.00389	0.033	8.319E-08	0.013709559	3.1865E-08	MON1B	16q23.1	new
Non-alcoholic fatty liver disease	rs7609078	2	100490363	A	G	-0.0522793	0.001701	-0.039	1.63E-10	-0.01685795	4.57E-11	AFF3	2q11.2	known
	rs4688745	3	50240338	T	C	-0.0425995	0.009278	-0.0316	9.57E-08	-0.01374351	3.54E-08	SLC38A3	3p21.31	known
	rs7509	6	27418847	T	G	-0.0438781	0.008958	-0.0316	0.000000085	-0.01785114	3.51E-08	MHC region		known
Inflammatory bowel disease	rs6724133	2	67858671	A	G	0.0655	0.0000211	0.0449	4.113E-09	0.015148646	1.1357E-09	ETAA1	2p14	known
	rs11065987	12	112072424	A	G	-0.0779	1.074E-09	-0.031	2.124E-07	-0.01638733	3.7907E-08	ATXN2	12q24.12	new
	rs11649417	16	82881108	A	G	-0.0523	0.0000717	-0.0336	8.711E-08	-0.01891984	3.6715E-08	CDH13	16q23.3	known
	rs72846794	6	28137499	A	G	-0.0548	0.009212	-0.0343	6.707E-09	-0.01452662	5.2501E-09	MHC region		known
Ulcerative colitis	rs6710685	2	67858666	T	C	0.0626	0.0002513	0.0391	1.958E-09	0.01539008	5.7446E-10	ETAA1	2p14	known
	rs1265564	12	111708458	A	C	-0.0651	0.00008095	-0.0319	1.232E-07	-0.04200059	2.9999E-08	PHETA1	12q24.12	new
	rs11649417	16	82881108	A	G	-0.0972	9.859E-09	-0.0336	8.711E-08	-0.01961124	1.0812E-08	CDH13	16q23.3	known
rs3922717	6	27030924	A	G	0.0728	0.0002219	0.0429	5.554E-10	0.039502415	1.58E-10	MHC region		known	
Stool frequency	rs6969188	7	114160742	A	G	0.0074	0.008363	0.0317	0.000000101	0.022145628	0.00000005	MDFC	7q31.1-q31.2	known
	rs12939066	17	50270268	T	C	0.0096	0.001168	0.0415	3.13E-11	0.018015595	1.1E-11	CA10	17q21.33-q22	known
	rs4713177	6	28673998	A	G	-0.0168	0.0001033	-0.0544	2.16E-09	-0.01846486	3.81E-08	MHC region		known
Colorectal cancer	rs13097265	3	70943143	A	G	0.0250505	0.00200844	0.0383	3.969E-09	0.022996943	1.8573E-08	MDFC2	3p13	known
	rs15071	5	82877689	T	C	-0.0486971	1.24337E-07	-0.0428	1.007E-08	-0.01614768	5.6685E-09	VCAN	5q14.2	known
	rs1050458	6	31324925	A	G	-0.0247638	0.00213623	-0.0393	3.117E-10	-0.01767609	1.3404E-09	MHC region		known

Supplementary Table 10. Multi-trait meta-analysis between psychiatric disorders and gastritis-duodenitis in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Gastritis-duodenitis		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Major depressive disorder	rs10035289	5	153095918	G	A	-0.0168	0.00009845	-0.0418	2.59E-06	-0.009866	2.588E-08	GRIA1	5q33.2	known
	rs4713692	6	33807638	T	C	-0.0188	0.0000268	-0.0411	7.82E-06	-0.010156	3.076E-08	MHC region		known
	rs1020006	7	12255664	A	G	0.0295	1.137E-11	0.0275	0.0022	0.010548	3.982E-09	TMEM106B	7p21.3	known
	rs2396133	7	109197067	G	A	0.0227	1.323E-07	0.0325	0.000265	0.0097356	3.827E-08	DNAJB9	7q31.1	known
	rs6539062	12	103552910	A	C	0.02	0.00000365	0.0379	2.17E-05	0.0099523	1.899E-08	PAH	12q23.2	known
	rs17488531	18	50754996	A	G	0.0237	4.31E-08	0.0342	0.000132	0.0102238	9.062E-09	DCC	18q21.2	known
rs2924321	18	53125435	A	G	-0.0282	7.155E-11	-0.0265	0.00309	-0.010037	1.553E-08	TCF4	18q21.2	known	
Attention-deficit hyperactivity disorder	rs62369151	5	87883503	C	T	0.03040239	1.379E-13	0.0251	0.00603	0.0107845	1.007E-10	MEF2C	5q14.3	new
	rs9969232	7	114158954	A	G	0.02966242	9.983E-12	0.033	0.00042	0.0113906	2.116E-11	MDFIC	7q31.1-q31.2	known
	rs11255912	10	8808327	A	C	-0.0228859	5.144E-08	-0.0306	0.000811	-0.009535	1.114E-08	GATA3	10p14	known
	rs525101	13	111969728	C	T	0.01850304	0.00001117	0.0378	4.04E-05	0.009418	1.984E-08	TEX29	13q34	known
	rs7260067	19	57517611	A	G	0.03044432	0.0002434	0.0823	5.51E-06	0.0179744	4.106E-08	USP29	19q13.43	known
Neuroticism	rs10487459	7	126378255	G	A	0.0102133	3.388E-11	0.0316	0.000513	0.0103205	3.204E-08	GRM8	7q31.33	known
	rs10891490	11	112885527	C	T	-0.0110313	9.1834E-13	-0.0315	0.0005	-0.010695	8.256E-09	NCAM1	11q23.2	known
	rs8089828	18	50669725	C	T	-0.0119605	2.0922E-15	-0.034	0.00014	-0.011609	2.012E-10	DCC	18q21.2	known
	rs1262465	18	52857732	G	A	0.0109108	4.4337E-13	0.0318	0.00039	0.0106775	4.748E-09	CCDC68	18q21.2	known
Post traumatic stress disorder	rs12894125	14	34301824	A	G	-0.0286202	0.005578	-0.0763	2.19E-08	-0.01974	1.65E-09	SPTSSA	14q13.1	known
	rs144877686	16	4689686	A	C	0.06905358	0.004346	0.161	3.93E-07	0.040868	3.28E-08	MGRN1	16p13.3	known
Depression	rs2102341	1	37193908	C	T	-0.0230034	6.802E-11	-0.0257	0.00877	-0.009242	4.33E-08	CSF3R	1p34.3	new
	rs12466671	2	22583435	G	A	0.0208968	1.412E-10	0.0265	0.00377	0.0086774	3.447E-08	KLHL29	2p24.1	new
	rs6441859	3	44625897	A	G	0.0242005	9.838E-13	0.026	0.00664	0.0096545	4.932E-09	ZNF197	3p21.31	known
	rs39654	3	173095123	G	A	0.0181029	2.331E-08	0.0347	0.000103	0.0088802	8.072E-09	NLGN1	3q26.31	known
	rs4273649	5	153120048	G	A	-0.0178989	2.995E-06	-0.0394	9.48E-06	-0.009252	1.017E-08	GRIA1	5q33.2	known
	rs219498	5	167059459	T	C	0.0182047	1.06E-08	0.0302	0.000707	0.0083966	4.607E-08	TENM2	5q34	known
	rs2523734	6	30129676	C	A	0.0337016	2.069E-12	0.0358	0.00586	0.0130905	5.955E-09	MHC region		known
	rs4869748	6	152225383	G	T	-0.0248975	6.63E-14	-0.0239	0.00945	-0.009566	1.835E-09	ESR1	6q25.1-q25.2	known
	rs62435650	7	1823265	G	A	-0.0226026	6.096E-09	-0.0394	0.000372	-0.010727	1.792E-08	ELFN1	7p22.3	known
	rs6460905	7	12283227	G	A	0.0226035	3.326E-12	0.0277	0.00208	0.009418	1.445E-09	TMEM106B	7p21.3	known
	rs1476535	7	114071035	T	C	0.0222967	4.793E-11	0.0287	0.00144	0.009657	2.958E-09	FOXP2	7q31.1	known
	rs7105462	11	112912048	A	G	-0.020998	1.626E-10	-0.0316	0.000479	-0.009266	3.168E-09	NCAM1	11q23.2	known
	rs6539062	12	103552910	A	C	0.0175023	5.389E-08	0.0379	2.17E-05	0.0090595	3.685E-09	PAH	12q23.2	known
	rs17488531	18	50754996	A	G	0.0253999	1.994E-15	0.0342	0.000132	0.0108555	2.006E-12	DCC	18q21.2	known
	rs12454204	18	52500011	T	G	-0.0270995	3.958E-13	-0.0325	0.00196	-0.01126	5.18E-10	CCDC68	18q21.2	known

Supplementary Table 11. Multi-trait meta-analysis between digestive diseases and gastritis-duodenitis in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Gastritis-duodenitis		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Peptic ulcer	rs2976388	8	143760256	A	G	-0.08673	1.8E-14	-0.0296	0.000998	-0.012322	8.91659E-10	JRK	8q24.3	known
	rs2344609	11	6270056	C	T	0.0890003	9.8E-12	0.0315	0.00322	0.01303	4.71769E-08	CCKBR	11p15.4	known
	rs681343	19	49206462	T	C	0.0887658	1.9E-15	0.0311	0.000488	0.01275	1.38759E-10	FUT2	19q13.33	known
Diverticular disease	rs7595012	2	144356358	T	C	0.0109587	1.8E-14	-0.0364	0.000998	-0.012322	2.2E-19	ARHGAP15	2q22.2-q22.3	known
	rs1047989	6	32605257	A	C	-0.001499	9.8E-12	0.0497	0.00322	0.01303	8.44E-09	MHC region		known
	rs17168118	7	134576840	G	A	0.0030004	1.9E-15	-0.0413	0.000488	0.01275	2.11E-08	AGBL3	7q33	known
Cholelithiasis and cholecystitis	rs75331444	2	44069772	A	G	0.767	4.2E-201	0.0575	0.00136	0.035077	4.68722E-15	ABCG5	2p21	known
	rs9272722	6	32609404	T	C	0.0334	0.0057	0.0505	3.72E-08	0.012782	1.06307E-08	MHC region		known
Acute pancreatitis	rs75331444	2	44069772	A	G	0.29339	4.08E-28	0.0575	0.00136	0.026844	5.58598E-10	ABCG5	2p21	known
Gastroesophageal reflux disease	rs6809836	3	70940892	A	G	0.0383	3.7E-09	0.0295	0.00264	0.008876	2.27028E-08	MDFIC2	3p13	known
	rs13143388	4	140917009	C	T	0.0355	4.75E-09	-0.0302	0.00095	0.008387	1.5762E-08	MAML3	4q31.1	known
	rs7755997	6	26483048	A	G	0.0376	3.23E-10	0.0281	0.00182	0.008661	3.38245E-09	MHC region		known
	rs62046253	16	60644621	T	C	-0.0352	1.3E-08	-0.0305	0.0011	-0.008398	3.14315E-08	CDH8	16q21	known
	rs953988	17	50311047	C	T	-0.0398	4.61E-11	0.0391	0.0000183	-0.00982	2.83181E-11	CA10	17q21.33-q22	known
	rs79286782	19	18716550	A	G	0.0664	8.58E-09	0.0503	0.00366	0.015359	4.74257E-08	TMEM59L	19p13.11	known

Supplementary Table 12. Multi-trait meta-analysis between psychiatric disorders and peptic ulcer in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Peptic ulcer		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Attention-deficit hyperactivity disorder	rs2906471	1	44306422	C	T	0.0673034	1.582E-10	0.04046	0.0011	0.010816	7.53267E-10	ARTN	1p34.1	new
	rs72671494	8	93195457	T	C	-0.0691036	3.727E-07	-0.06289	0.0001	-0.013342	5.58826E-09	RUNX1T1	8q21.3	new
	rs10965176	9	2198424	G	T	0.0619978	5.903E-08	0.0469	0.0011	0.011055	2.29443E-08	SMARCA2	9p24.3	new
	rs770082	12	89776485	G	A	-0.0507987	6.582E-08	-0.03848	0.00065	-0.008942	1.43157E-08	DUSP6	12q21.33	new
Neuroticism	rs169287	6	27854760	C	A	0.016426	1.48633E-15	0.04387	0.0021	0.01266	6.03194E-09	MHC region		known
	rs2071754	11	31812582	C	T	0.0135339	3.78606E-12	0.04425	0.0012	0.011781	3.69696E-08	PAX6	11p13	new
	rs7948789	11	112839532	A	G	-0.0113381	1.12999E-13	-0.03514	0.0022	-0.009829	2.45446E-08	NCAM1	11q23.2	new
	rs1875140	12	117672339	T	C	-0.0143882	3.86062E-15	-0.04465	0.0013	-0.012731	4.09202E-09	FBXO21	12q24.22	new
	rs601338	19	49206674	G	A	-0.0044037	0.003004862	-0.08848	2.4E-15	-0.0129	5.66709E-14	FUT2	19q13.33	known
Major depressive disorder	rs2568957	1	72764430	A	G	-0.0349	2.156E-10	-0.03809	0.0076	-0.010626	2.15448E-08	NEGR1	1p31.1	new
	rs9536383	13	53865563	T	C	0.0255	3.883E-08	-0.04308	0.00032	0.009297	8.36922E-09	OLFM4	13q14.3	new
	rs200973	6	27858421	A	G	0.0433	9.392E-15	0.04607	0.0013	0.012903	1.00273E-11	MHC region		known
Depression	rs2815757	1	72764289	C	T	-0.0296039	9.159E-13	-0.03772	0.0082	-0.010018	1.77309E-09	NEGR1	1p31.1	new
	rs2341392	1	73986097	G	A	0.0262037	1.308E-14	0.03117	0.0051	0.00914	5.42175E-11	LRR1Q3	1p31.1	new
	rs1267067	2	162007748	T	C	0.0215951	3.519E-10	0.03219	0.0084	0.007849	4.24119E-08	TANK	2q24.2	known
	rs12694079	2	208041399	A	G	0.0222995	3.398E-11	0.03074	0.009	0.00778	2.2395E-08	KLF7	2q33.3	new
	rs7629352	3	16848835	A	G	-0.022399	6.798E-11	-0.04204	0.00048	-0.008796	8.31405E-10	PLCL2	3p24.3	new
	rs200973	6	27858421	A	G	0.0323994	1.609E-13	0.04607	0.0013	0.01074	1.07513E-10	MHC region		known
	rs10268609	7	1962163	G	T	-0.0332983	1.125E-15	-0.04212	0.0058	-0.011564	6.98347E-11	ELFN1	7p22.3	new
	rs12575544	11	112918985	G	A	-0.0243952	2.206E-10	-0.04651	0.00073	-0.00984	2.34331E-09	NCAM1	11q23.2	new
	rs1923773	13	53750354	A	G	-0.0208968	2.515E-09	-0.04236	0.00052	-0.008235	8.99932E-09	OLFM4	13q14.3	new
rs281276	15	47660070	A	G	-0.0262002	7.005E-07	-0.06099	6.7E-05	-0.010887	2.21801E-08	SEMA6D	15q21.1	new	

Supplementary Table 13. Multi-trait meta-analysis between digestive diseases and peptic ulcer in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Peptic ulcer		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Diverticular disease	rs2484242	6	160772171	G	A	0.001807	0.0063	0.07488	1.5E-07	0.012763	2.29215E-08	SLC22A3	6q25.3	known
	rs687621	9	136137065	A	G	0.0044938	8.5E-15	0.07354	1.3E-09	0.016754	1.03292E-17	ABO	9q34.2	new
	rs281393	19	49224484	C	T	0.0016643	0.0034	0.06843	1E-08	0.011775	1.10772E-09	FUT2	19q13.33	known
	rs9983207	21	41412497	G	A	0.0024339	0.00015	0.06424	9E-07	0.01268	6.44599E-09	PCP4	21q22.2	known
Cholelithiasis and cholecystitis	rs10794340	11	918339	C	T	0.0609	0.000968	0.11366	5.5E-10	0.021316	1.62592E-11	CHID1	11p15.5	known
	rs681343	19	49206462	T	C	-0.0925	2.97E-15	-0.08877	1.9E-15	-0.01945	2.45762E-22	FUT2	19q13.33	known
Gastritis-duodenitis	rs2976388	8	143760256	G	A	-0.0296	0.000998	-0.08673	1.8E-14	-0.011854	1.90196E-12	PSCA	8q24.3	known
	rs10500661	11	6273744	T	C	0.0329	0.00288	0.10157	4.1E-14	0.014019	1.11469E-11	CCKBR	11p15.4	known
	rs681343	19	49206462	C	T	0.0311	0.000488	0.08877	1.9E-15	0.01223	1.95982E-13	FUT2	19q13.33	known
Gastroesophageal reflux disease	rs809955	4	140874760	G	A	-0.0373	1.064E-09	0.03163	0.0064	-0.007714	1.38855E-08	MAML3	4q31.1	new
	rs55660354	5	684888	A	C	-0.038	3.702E-07	0.0583	2.8E-05	-0.009382	1.8687E-08	TPPP	5p15.33	known
	rs200980	6	27852011	C	T	-0.0443	4.778E-09	0.04371	0.0022	-0.009354	1.80074E-08	MHC region		known
	rs695174	6	160775510	G	A	-0.0279	2.291E-06	0.05037	6.9E-06	-0.007247	3.25605E-08	SLC22A3	6q25.3	known
	rs2978977	8	143755720	C	A	-0.0212	0.0003939	0.08489	8.8E-14	-0.008082	1.17073E-09	PSCA	8q24.3	known
	rs10500661	11	6273744	T	C	-0.0373	3.58E-07	0.10157	4.1E-14	-0.0118	3.86759E-13	CCKBR	11p15.4	known
Irritable bowel syndrome	rs1248857	3	84969461	G	A	-0.0356	2.003E-07	-0.04276	0.00012	-0.010194	6.52999E-09	CADM2	3p12.1	new
	rs10512225	9	93464818	G	A	0.0401	6.429E-09	0.03768	0.00078	0.010123	1.13913E-08	FAM120AOS	9q22.31	new
	rs2587363	13	53341798	G	A	-0.0348	4.298E-07	-0.0464	3.6E-05	-0.010531	2.84575E-09	OLFM4	13q14.3	new

Supplementary Table 14. Multi-trait meta-analysis between psychiatric disorders and colorectal cancer in European.

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Peptic ulcer		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Attention-deficit hyperactivity disorder	rs9425569	1	182942202	A	G	-0.032203	0.0008976	-0.06498	1.43502E-17	-0.026366	2.2E-14	SHCBP1L	1q25.3	new
	rs2790760	1	222109518	A	G	0.0253999	0.006427	0.04345	3.33251E-09	0.02008	6E-09	DUSP10	1q41	known
	rs11692435	2	98275354	A	G	-0.0416974	0.007819	-0.09104	7.16234E-12	-0.021185	8.4E-10	ACTR1B	2q11.2	known
	rs116607676	6	32604139	A	C	-0.0882032	0.004678	-0.17466	8.7338E-13	-0.024102	2.9E-12	MHC region		known
	rs145623959	8	117669894	C	T	0.111103	0.008568	0.33966	5.35012E-35	0.038917	1.8E-29	UTP23	8q24.11	known
	rs78932310	8	118050835	A	G	0.0667985	0.0009188	0.10629	4.94352E-11	0.020036	6.5E-09	SLC30A8	8q24.11	known
	rs1250569	10	81045207	C	T	0.0256974	0.006114	0.04808	1.45554E-10	0.021681	3.4E-10	PP1F	10q22.3	known
	rs2026482	13	73692738	G	A	0.0292023	0.008166	0.0425	1.59044E-08	0.019195	2.7E-08	KLIF5	13q22.1	new
	rs1562929	15	33168075	T	G	-0.0243023	0.009599	-0.06002	2.85617E-16	-0.027342	2.4E-15	GREM1	15q13.3	known
	rs11647839	16	80036384	G	A	-0.0246048	0.009597	-0.05855	3.60196E-15	-0.026339	2.3E-14	MAF	16q23.2	known
	rs10423689	19	33505101	C	T	-0.031799	0.008045	-0.05244	1.72184E-08	-0.019158	2.9E-08	FAAP24	19q13.11	new
	rs6126017	20	49093789	C	T	-0.0366983	7.459E-05	-0.0497	9.82576E-12	-0.023404	1.2E-11	PTPN1	20q13.13	known
	rs11692435	2	98275354	A	G	-0.0863979	3.176E-08	-0.09104	7.16234E-12	-0.022721	5.7E-11	ACTR1B	2q11.2	known
	rs4675033	2	199824567	T	C	0.02510245	0.00645	0.06269	1.22736E-15	0.02636	3E-14	SATB2	2q33.1	known
	rs2001732	3	52880740	T	C	-0.0469981	0.0001696	-0.07592	1.46699E-12	-0.023375	1.6E-11	MUSTN1	3p21.1	new
rs1529544	3	53039455	A	G	-0.0226035	0.009685	-0.05044	1.58916E-11	-0.021987	2.3E-10	SFMBT1	3p21.1	known	
rs10049390	3	133701119	A	G	0.02849999	0.004129	0.05287	7.79088E-10	0.020038	7.6E-09	SLC02A1	3q22.1-q22.2	known	
rs6533183	4	106133184	T	C	0.02439989	0.006039	0.05676	1.13848E-13	0.024224	2.9E-12	TET2	4q24	known	
rs112082449	5	40225064	A	G	0.02599496	0.005902	0.08106	3.68401E-24	0.033372	6.5E-22	PTGER4	5p13.1	known	
rs1559050	5	134470030	A	G	-0.0270995	0.004549	-0.05558	1.28221E-11	-0.022328	1.2E-10	PITX1	5q31.1	known	
rs9271770	6	32594248	A	G	0.03649585	0.001893	0.08389	9.35407E-18	0.028009	6.7E-16	MHC region		known	
rs72874231	6	55925194	A	G	0.060504	0.008194	0.10584	3.98483E-09	0.019414	2.2E-08	BMP5	6p12.1	known	
rs56057462	8	117577255	A	G	0.05210415	0.004064	0.13986	6.32168E-21	0.030901	5.1E-19	UTP23	8q24.11	known	
rs141408842	8	118215090	A	G	0.08309957	0.00652	0.17571	7.90172E-13	0.023375	1.6E-11	SLC30A8	8q24.11	known	
rs4871790	8	128441535	C	A	-0.0235041	0.006998	-0.08347	3.32729E-29	-0.036669	4E-26	POU5F1B	8q24.21	known	
rs174564	11	61588305	G	A	-0.0243952	0.007007	-0.05357	6.23888E-12	-0.022424	1E-10	FADS1	11q12.2	known	
rs7304445	12	506885741	C	A	0.0353961	0.0001114	0.0731	3.17615E-21	0.030843	6E-19	LIMA1	12q13.12	known	
rs11169572	12	51216890	C	T	0.02770271	0.001896	0.08601	2.72401E-30	0.037369	4.6E-27	TMPPRS12	12q13.12	known	
rs324015	12	57490100	C	T	0.06480522	2.048E-10	0.05369	6.95151E-10	0.020504	3.4E-09	NAB2	12q13.3	known	
rs10879238	12	71429938	G	A	0.02260355	0.009153	0.04359	3.21221E-09	0.019529	1.8E-08	PTPRR	12q15	known	
rs7311331	12	96064549	G	A	0.0260976	0.002875	0.04898	5.95644E-11	0.021594	4.8E-10	USP44	12q22	known	
rs4943114	13	34083781	C	T	-0.0267004	0.002067	-0.04894	4.76406E-11	-0.021707	3.9E-10	STARD13	13q13.1	new	
rs1919360	15	33043455	T	C	0.036303	0.001157	0.10278	1.5551E-28	0.036195	1.7E-25	GREM1	15q13.3	known	
rs62202951	20	49055858	G	A	0.02470261	0.007669	0.06793	5.50332E-18	0.028458	2.3E-16	PTPN1	20q13.13	known	
rs2839223	21	47777063	A	G	-0.0451961	0.0005218	-0.06606	1.62525E-09	-0.019626	1.5E-08	PCNT	21q22.3	new	
rs17241778	2	199766411	C	T	0.00900038	0.008225	0.06148	1.65284E-14	0.025344	2.9E-13	SATB2	2q33.1	known	
rs6808387	3	53079732	T	C	-0.0141001	3.315E-05	0.05267	2.258E-12	0.02277	5.5E-11	SFMBT1	3p21.1	known	
rs2905746	6	31451849	G	T	0.014799	0.0001014	-0.05553	2.61736E-10	-0.020477	3.7E-09	MHC region		known	
rs72550838	8	128413087	C	T	0.0299027	0.005174	0.15833	8.03188E-11	0.0215	6E-10	POU5F1B	8q24.21	known	
rs10116277	9	22081397	T	G	0.00940408	0.003082	-0.0554	5.41874E-14	-0.02448	1.8E-12	CDKN2B	9p21.1	known	
rs11195986	10	114289017	T	G	0.0139975	0.009695	0.10033	3.72408E-16	0.026889	9.6E-15	ZDHHC6	10q25.2	known	
rs174583	11	61609750	T	C	0.0178992	6.793E-08	-0.05403	4.11489E-12	-0.02239	1.1E-10	FADS1	11q12.2	known	
rs9665746	11	74288886	A	G	0.0102019	0.009441	0.06105	2.64323E-12	0.023106	2.9E-11	POLD3	11q13.4	known	
rs10859923	12	96069858	C	T	-0.0089994	0.005755	0.05086	1.95529E-11	0.02183	3.2E-10	USP44	12q22	known	
rs11670192	19	59017640	A	G	-0.0147999	0.0003434	0.06004	1.7978E-10	0.020685	2.6E-09	SLC27A5	19q13.43	known	
rs6126017	20	49093789	C	T	-0.0118001	0.0002162	-0.0497	9.82576E-12	-0.022571	8E-11	PTPN1	20q13.13	known	
rs2738783	20	62308612	G	T	0.0128016	0.001799	-0.06247	1.70471E-11	-0.02187	3E-10	RTEL1-TNFRSF6B	20q13.33	known	
rs2839224	21	47777222	G	A	-0.0141987	0.006934	-0.06923	9.00583E-09	-0.019027	4.3E-08	PCNT	21q22.3	new	

Supplementary Table 15. Multi-trait meta-analysis between digestive diseases and colorectal cancer in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Colorectal cancer		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Gastroesophageal reflux disease	rs12404594	1	182988027	A	G	-0.0193	0.001121	-0.07726	3.54379E-23	-0.033072	9.77823E-22	LAMC1	1q25.3	known
	rs1119401	2	199843454	C	T	0.0216	0.0005625	0.06275	1.26699E-15	0.026868	7.12296E-15	SATB2	2q33.1	known
	rs77572134	3	52895934	C	T	-0.023	0.006693	-0.07589	2.00548E-12	-0.023554	8.94487E-12	MUSTN1	3p21.1	new
	rs280097	4	94937860	C	T	0.0158	0.00901	0.052	4.92625E-12	0.023125	2.10929E-11	ATOH1	4q22.2	known
	rs75686861	4	145621328	A	G	0.0267	0.009381	0.09019	1.57958E-12	0.023635	7.6067E-12	HHPH	4q31.21	known
	rs62329683	5	1299087	T	C	0.026	0.002749	0.06969	4.81788E-11	0.020666	2.15053E-09	TERT	5p15.33	known
	rs617578	6	32574603	A	G	0.0296	0.004639	0.06413	3.40955E-09	0.019926	7.85182E-09	MHC region		known
	rs16878812	6	35569562	G	A	-0.0244	0.006548	-0.08758	6.71949E-14	-0.02505	3.99624E-13	TULP1	6p21.31	known
	rs6958168	7	45019814	G	T	-0.024	0.0007734	-0.05585	1.51974E-09	-0.018832	4.90807E-08	MYO1G	7p13	known
	rs2015069	8	117639532	T	C	0.028	0.002711	0.07984	1.14886E-12	0.023881	4.60933E-12	UTP23	8q24.11	known
	rs28626202	8	128464353	A	C	-0.0228	0.003053	-0.07002	6.69286E-13	-0.022655	5.30651E-11	POU5F1B	8q24.21	known
	rs1537372	9	22103183	T	G	-0.0179	0.002733	-0.06315	2.74696E-17	-0.026787	8.57738E-15	CDKN2B	9p21.3	known
	rs11213811	11	111136809	T	C	-0.0177	0.006902	-0.0563	9.46355E-10	-0.022834	3.74556E-11	C11orf53	11q23.1	new
	rs1316442	12	51114427	A	C	0.0159	0.009564	0.08057	1.65129E-25	0.034609	1.18946E-23	ATF1	12q13.12	known
	rs653178	12	112007756	T	C	0.0305	2.311E-07	0.07573	2.29129E-24	0.031876	2.63393E-20	ATXN2	12q24.12	known
	rs35107139	14	54419106	C	A	0.0245	7.795E-05	0.08934	2.87062E-26	0.035476	9.08188E-25	BMP4	14q22.2	new
	rs2600521	15	33054229	A	G	0.0193	0.006311	0.05013	1.32569E-08	0.01916	2.86163E-08	GREM1	15q21.3	known
	rs4776316	15	67007813	G	A	-0.0193	0.003671	-0.05566	1.89535E-11	-0.022566	6.30737E-11	SMAD6	15q22.31	new
	rs7179095	15	91186461	A	G	0.0229	0.003536	0.06248	2.09635E-10	0.021389	5.81528E-10	BLM	15q26.1	new
	rs73975588	17	816741	C	A	-0.0243	0.006191	-0.08912	6.61966E-16	-0.026955	5.82948E-15	NXN	17p13.3	known
rs6507874	18	46448805	C	T	-0.0173	0.003762	-0.06694	1.2678E-11	-0.073764	2.7759E-10	SMAD7	18q21.1	known	
rs6091189	20	49256285	T	C	0.0225	0.006837	0.05921	8.9755E-09	0.019374	2.00375E-08	RIPOR3	20q13.13	known	
rs2427296	20	60927475	A	G	-0.0173	0.009707	-0.10936	4.04845E-36	-0.041469	3.09318E-33	LAMA5	20q13.33	known	
rs2738783	20	62308612	G	T	-0.02	0.005781	-0.06247	1.70471E-11	-0.021215	7.99269E-10	RTEL1-TNFRSF6B	20q13.33	known	
Diverticular disease	rs4072980	1	38456106	A	G	0.0016113	0.0028	0.05456	2.4903E-13	0.02448	1.43299E-12	SEF3A3	1p34.3	known
	rs12144319	1	55246035	C	T	0.0018901	0.0035	0.06429	6.26464E-14	0.025086	3.9871E-13	PARS2	1p32.3	known
	rs994261	2	199908378	C	T	0.0015583	0.006	0.05139	1.16782E-11	0.022716	5.01077E-11	SATB2	2q33.1	known
	rs4974053	3	40957939	C	T	0.0017718	0.0078	0.06448	3.23199E-13	0.024314	2.02547E-12	CTNNB1	3p21.1	new
	rs2001732	3	52880740	T	C	-0.00297	0.00018	-0.07592	1.46699E-12	-0.023881	4.92872E-12	MUSTN1	3p21.1	new
	rs2736108	5	1297488	T	C	-0.001506	0.01	-0.05962	6.14369E-13	-0.022916	3.3933E-11	TERT	5p15.33	known
	rs9986145	5	134453390	A	G	0.0014592	0.0095	0.04658	1.19221E-09	0.019277	2.46194E-08	PITX1	5q31.1	known
	rs11752007	6	7242605	C	T	-0.002281	0.0045	-0.06806	2.57483E-09	-0.02001	7.12965E-09	SSR1	6p24.3	new
	rs28724138	6	32552617	A	G	0.0023563	0.000061	0.05588	5.65965E-10	0.02105	1.13839E-09	MHC region		known
	rs6939861	6	41703041	A	G	-0.001706	0.0057	-0.05217	2.28266E-09	-0.020062	6.5196E-09	TFEB	6p21.1	known
	rs17686932	7	130600748	G	A	-0.003017	0.0092	-0.11264	1.59135E-11	-0.022539	7.05855E-11	KLF14	7q32.2	known
	rs7834164	8	117644462	G	A	0.0018383	0.0099	0.06481	1.12022E-11	0.022682	5.35629E-11	UTP23	8q24.11	known
	rs7894531	10	8734761	A	G	-0.001661	0.0059	-0.09692	2.84327E-34	-0.040398	1.52323E-31	GATA3	10p14	known
	rs17578234	10	101343317	T	C	0.0018067	0.0084	0.0933	1.78255E-23	0.033105	1.01273E-21	SLC25A28	10q24.2	known
	rs56188434	10	114305761	A	G	0.0024263	0.0089	0.10221	3.46048E-16	0.027148	4.07647E-15	ZDHHC6	10q25.2	known
	rs10160763	11	10238173	T	G	-0.001814	0.0011	-0.04151	2.60957E-08	-0.018847	4.9977E-08	SBF2	11p15.4	new
	rs35905518	11	74220395	C	T	-0.00321	0.00066	-0.10658	7.03645E-17	-0.027927	6.60032E-16	POLD3	11q13.4	known
	rs59830047	11	74338355	A	G	0.0016829	0.0017	0.07859	7.34434E-27	0.035636	6.51197E-25	CHRD2	11q13.4	known
	rs117042741	11	74628743	T	C	-0.004464	0.0011	-0.22612	1.43443E-30	-0.038157	2.54076E-28	XRRA1	11q13.4	known
	rs11169572	12	51216890	C	T	0.0019555	0.00045	0.08601	2.72401E-30	0.038033	3.78296E-28	ATF1	12q13.12	known
rs2870841	12	71476684	G	T	-0.00177	0.0015	-0.04494	1.37789E-09	-0.020433	3.41748E-09	PTPRR	12q15	known	
rs7298851	12	115882695	T	G	-0.001503	0.0073	-0.05366	3.06371E-12	-0.023297	1.60012E-11	TBX3	12q24.21	known	
rs11621479	14	54500492	A	G	-0.00154	0.0071	-0.05114	1.86052E-09	-0.020158	5.51764E-09	BMP4	14q22.2	known	
rs3812927	15	33059225	A	C	0.0020855	0.0078	0.10266	2.15743E-22	0.032282	9.86368E-21	GREM1	15q13.3	known	
rs7199483	16	86697008	T	C	0.0025591	0.00021	0.06159	2.14683E-11	0.022619	6.05229E-11	FOXL1	16q24.1	known	
rs7226855	18	46454048	G	A	-0.002439	0.000065	-0.16808	2.546E-114	-0.075026	2.0038E-104	SMAD7	18q21.1	known	
rs2216595	19	33533292	T	C	-0.001839	0.0093	-0.07005	9.7235E-14	-0.024815	7.08793E-13	RHPN2	19q13.11	new	
rs2064278	20	49363182	T	G	0.001575	0.0093	0.05534	1.87551E-11	0.022437	8.60132E-11	RIPOR3	20q13.13	known	
rs6014965	20	55831203	G	A	-0.001598	0.0033	-0.04661	2.89258E-10	-0.021176	9.06289E-10	BMP7	20q13.31	known	
rs2738783	20	62308612	G	T	-0.00232	0.00039	-0.06247	1.70471E-11	-0.022675	5.43382E-11	RTEL1-TNFRSF6B	20q13.33	known	
rs3747239	22	45740126	C	A	0.0016875	0.0034	0.04876	4.02891E-10	0.019763	1.08912E-08	FAM118A	22q13.31	known	

Supplementary Table 16. Multi-trait meta-analysis between psychiatric disorders and stool frequency in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Stool frequency		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Attention-deficit hyperactivity disorder	rs12273363	11	27723312	T	C	0.0352956	0.002113	0.0324	4.792E-21	0.037803577	6.02074E-19	BDNF	11p14.1	known
	rs5995603	22	38644728	A	G	0.0409991	0.0001502	0.0174	6.073E-08	0.023260217	4.91356E-09	FAM227A	22q13.1	known
Bipolar disorder	rs60712207	5	141378509	T	C	-0.035203	0.0006806	-0.016	1.127E-07	-0.021370409	8.51807E-09	PCDHGA7	5q31	new
	rs11030108	11	27673917	A	G	-0.0263985	0.008661	-0.0193	8.657E-11	-0.02117846	6.80694E-09	BDNF	11p14.1	known
	rs5757162	22	38597365	T	C	0.0289964	0.004684	0.0169	4.041E-08	0.021773546	7.488E-09	FAM227A	22q13.1	known
Major depressive disorder	rs2932277	3	87900306	A	G	-0.0191	0.0003005	-0.0169	7.125E-07	-0.022736939	4.59273E-08	HTRIF	3p12	new
	rs4880051	9	37007478	T	G	-0.017	0.0001121	-0.0139	8.025E-07	-0.018970547	3.59E-08	PAX5	9p13.2	new
	rs56133711	11	27701787	A	G	-0.0142	0.003794	-0.0281	6.654E-19	-0.03475225	2.35311E-19	BDNF	11p14.1	known
	rs596668	18	55597112	A	G	-0.0245	0.0006629	-0.0194	6.865E-07	-0.02637484	2.87734E-08	TCF4	18q21.2	new
	rs5995603	22	38644728	A	G	0.0144	0.003734	0.0174	6.073E-08	0.022633541	7.59452E-09	FAM227A	22q13.1	known
Neuroticism	rs879620	16	3965728	T	C	-0.00655554	0.00071781	-0.0153	1.002E-07	-0.019507338	3.39557E-08	CREBBP	16p13.3	new
	rs56192752	17	45477887	A	G	-0.0212518	9.4454E-18	-0.0223	4.212E-10	-0.03107485	2.62606E-12	PLEKHM1	17q21.31	new
	rs596668	18	55597112	A	G	-0.0136617	6.1173E-11	-0.0194	6.865E-07	-0.026999121	2.41556E-08	TCF4	18q21.2	new
	rs5757162	22	38597365	T	C	0.00506403	0.00852059	0.0169	4.041E-08	0.021358261	2.0605E-08	FAM227A	22q13.1	known
Depression	rs1538686	1	196428689	A	G	0.00950503	0.003245	0.0146	2.541E-07	0.01894309	3.05532E-08	KCNT2	1q31.3	new
	rs2932277	3	87900306	A	G	-0.0170037	0.00001	-0.0169	7.125E-07	-0.023067754	2.56489E-08	HTRIF	3p12	new
	rs60712207	5	141378509	T	C	0.00950469	0.006359	-0.016	1.127E-07	-0.020571605	2.09938E-08	PCDHGA7	5q31	new
	rs4880051	9	37007478	T	G	0.0189984	5.379E-09	-0.0139	8.025E-07	-0.019981054	5.63134E-09	PAX5	9p13.2	new
	rs10835211	11	27679818	A	G	0.0100988	0.005688	-0.0281	9.799E-19	-0.034211386	5.76693E-19	BDNF	11p14.1	known
	rs879620	16	3965728	T	C	0.00999983	0.002324	-0.0153	1.002E-07	-0.019388751	2.04278E-08	CREBBP	16p13.3	new
	rs2732706	17	46274320	T	C	-0.011597	0.003883	0.0235	4.421E-12	0.028993909	8.98319E-13	LRRC37A	17q21.31	new
	rs596668	18	55597112	A	G	-0.0221025	0.0000179	-0.0194	6.865E-07	-0.026777367	1.54346E-08	TCF4	18q21.2	new
	rs5995603	22	38644728	A	G	-0.00959589	0.009208	0.0174	6.073E-08	0.022160793	1.34788E-08	FAM227A	22q13.1	known

Supplementary Table 17. Multi-trait meta-analysis between digestive diseases and stool frequency in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Stool frequency		MTAG		Genes	Cytogenetic band	Annotation	
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag				
Diverticular disease	rs1538686	1	196428689	A	G	0.0015278	0.0051	0.0146	2.541E-07	0.018911	1.86834E-08	KCNT2	1q31.3	new	
	rs4333882	1	234217153	A	G	-0.0069955	2.5E-24	-0.0118	0.0009542	-0.024395	5.23898E-09	COA6	1q42.2	new	
	rs13409480	2	143646227	A	G	-0.0056006	1.6E-25	-0.0083	0.002785	-0.018651	1.7964E-08	ARHGAP15	2q22.2-q22.3	new	
	rs60570941	3	15404374	T	C	-0.0049345	1.7E-07	-0.0229	1.344E-06	-0.034109	1.74408E-09	EAFF1	3p25.1	new	
	rs75686861	4	144700176	A	G	-0.0041857	0.000011	-0.0238	0.00000083	-0.03347	4.97569E-09	HHIP	4q31.21	new	
	rs39819	5	122965981	A	G	0.003071	6.5E-08	0.0179	1.153E-09	0.025462	5.05528E-13	PPIC	5q23.2	new	
	rs78566116	6	32428369	T	G	-0.0053388	4.8E-07	-0.0249	3.566E-06	-0.036125	1.38376E-08	MHC region		known	
	rs3113037	7	96449252	T	C	0.004142	1E-10	0.0154	2.501E-06	0.023986	8.47896E-10	SLC25A13	7q21.3	new	
	rs4556017	7	100989509	T	C	0.0027802	0.00015	0.024	1.02E-09	0.0315	1.66686E-11	MUC12	7q22.1	known	
	rs6472566	8	71088249	A	G	0.0016412	0.0029	0.0162	1.676E-08	0.020639	1.8552E-09	XKR9	8q13.3	new	
	rs2588992	10	61754913	T	C	0.0018819	0.005	0.0172	4.325E-07	0.022323	3.90592E-08	CABCOC01	10q21.2	new	
	rs6486216	11	15032243	T	C	0.0038743	2.9E-10	0.0183	1.135E-08	0.026139	1.75574E-12	CALCA	11p15.2	new	
	rs12273363	11	27723312	T	C	0.0055924	1.2E-16	0.0324	4.792E-21	0.045897	4.5701E-29	BDNF	11p14.1	known	
	rs9938120	16	19966411	T	C	0.0029199	0.0002	0.0214	8.808E-08	0.02835	1.78321E-09	GPRC5B	16p12.3	new	
	rs759555	18	57223332	T	C	0.0031915	2.6E-07	0.0145	7.667E-06	0.021645	1.88707E-08	BOD1L2	18q21.31	new	
	rs5757236	22	38677819	T	C	-0.0031318	3.7E-07	-0.0168	9.521E-08	-0.023922	1.02009E-10	FAM227A	22q13.1	known	
	Irritable bowel syndrome	rs11264871	1	154018414	A	C	-0.0253	0.000679	-0.0161	1.217E-07	-0.021151	2.06639E-08	RPS27	1q21.3	new
		rs6472566	8	71088249	A	G	0.0199	0.004992	0.0162	1.676E-08	0.020579	8.98658E-09	XKR9	8q13.3	new
Gastroesophageal reflux disease	rs383638	5	122988983	A	C	0.0174	0.005539	0.0176	2.459E-09	0.022983	2.60466E-10	PPIC	5q23.2	new	
	rs2732706	17	46274320	T	C	-0.0215	0.002938	0.0235	4.421E-12	0.025605	4.9232E-10	LRRC37A	17q21.31	new	
	rs5757162	22	38597365	T	C	0.0237	0.0002812	0.0169	4.041E-08	0.022163	4.53693E-09	FAM227A	22q13.1	known	

Supplementary Table 18. Multi-trait meta-analysis between psychiatric disorders and diverticular disease in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Diverticular disease		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Attention-deficit hyperactivity disorder	rs7606067	2	144477751	G	A	0.0271968	0.004347	0.00435	1.4E-15	0.017131	1.64172E-16	ARHGAP15	2q22.2-q22.3	known
	rs2226917	11	15111580	T	C	0.0305001	0.00142	0.00284	3.1E-07	0.011802	3.3646E-08	INSC	11p15.2	known
	rs17309930	11	27748493	C	A	0.0350988	0.002269	0.00564	6.8E-17	0.019327	3.68426E-14	BDNF	11p14.1	known
	rs2289328	15	40705417	G	A	-0.0366017	0.003131	-0.00476	7.5E-11	-0.01919	5.2019E-12	DISP2	15q15.1	known
	rs2935536	16	84973880	A	C	0.0338989	0.0003834	0.00277	2.3E-07	0.011695	1.57927E-08	ZDHHC7	16q24.1	known
	rs12942267	17	7372637	C	T	-0.0322959	0.0004272	-0.0037	6.7E-11	-0.015129	2.11011E-12	ZBTB4	17p13.1	known
	rs138699	22	39129708	G	A	-0.0347985	0.001487	-0.00342	6.3E-08	-0.014119	3.84133E-09	GTPBP1	22q13.1	known
	rs59098711	22	40877004	T	C	-0.0303974	0.008113	-0.00371	2.6E-07	-0.015118	3.81844E-08	ADSL	22q13.1	known
Anxiety, panic disorder	rs11899888	2	56102744	A	G	-0.00106693	0.0012	-0.00612	1.4E-16	-0.024198	9.24305E-17	EFEMP1	2p16.1	known
	rs17615220	6	32677413	A	G	0.00149027	0.0074	0.007	2.6E-08	0.026017	2.89299E-08	MHC region		known
	rs9520339	13	107897823	C	T	0.000741298	0.0077	0.00492	1.1E-14	0.019443	5.97956E-15	NALF1	13q33.3	known
Bipolar disorder	rs9287353	2	144383727	C	T	-0.0295005	0.002957	-0.0057	3.3E-23	-0.021673	1.38074E-21	ARHGAP15	2q22.2-q22.3	known
	rs7640510	3	15417197	C	T	0.040201	0.007095	0.00458	1.2E-07	0.018278	3.87427E-08	METTL6	3p25.1	known
	rs3775010	4	95821419	T	C	-0.0254046	0.009675	-0.0035	6.8E-10	-0.013233	2.20964E-09	BMP1B	4q22.3	known
	rs4839715	6	98365289	G	A	0.0449032	3.336E-06	0.00377	1.4E-11	0.014001	1.80348E-10	MMS22L	6q16.1	known
	rs6465554	7	96498284	T	C	-0.0296039	0.002005	-0.00295	9.6E-08	-0.011857	4.82443E-08	DLX6	7q21.3	known
	rs7077800	10	25819228	C	T	0.0272993	0.003608	0.00526	1.7E-22	0.020082	3.30362E-21	GPR158	10p12.1	known
	rs11030108	11	27695464	A	G	-0.0263985	0.008661	-0.00452	5.2E-15	-0.017196	3.60747E-14	BDNF	11p14.1	known
	rs12942267	17	7372637	C	T	-0.0310986	0.00152	-0.0037	6.7E-11	-0.014768	2.33659E-11	ZBTB4	17p13.1	known
	rs8074740	17	42312778	G	A	-0.055703	2.393E-08	-0.00365	2.4E-10	-0.01495	4.386E-11	UBTF	17q21.31	known
rs138699	22	39129708	G	A	-0.0306963	0.005	-0.00342	6.3E-08	-0.013697	2.57544E-08	GTPBP1	22q13.1	known	
Major depressive disorder	rs7569139	2	144557317	G	A	-0.0151	0.008885	-0.00378	1.6E-07	-0.01504	2.8041E-08	ARHGAP15	2q22.2-q22.3	known
	rs11736215	4	7762502	A	C	0.0177	7.745E-05	0.00272	5.2E-07	0.011538	1.21139E-08	AFAP1	4p16.1	known
	rs2049865	8	116588546	C	A	-0.0152	0.000556	-0.00302	4.9E-08	-0.012284	1.79828E-09	TRPS1	8q23.3	known
	rs187535429	10	69614235	C	T	-0.0168	0.0003058	0.00291	4.1E-07	0.012064	1.31783E-08	DNAJC12	10q21.3	new
	rs61888800	11	27722278	G	T	0.0141	0.004045	0.0048	7.6E-15	0.018422	9.73799E-16	BDNF	11p14.1	known
	rs11078680	17	7386428	G	A	-0.0122	0.005571	-0.00323	6.8E-09	-0.012732	6.10551E-10	ZBTB4	17p13.1	known
	rs575217	22	39055303	C	T	-0.0128	0.007232	-0.00307	3.4E-07	-0.012297	3.64081E-08	GTPBP1	22q13.1	known
rs6001870	22	40695172	A	C	-0.0145	0.002249	-0.00338	4.3E-09	-0.013386	3.0335E-10	ADSL	22q13.1	known	
Neuroticism	rs9490003	6	98331316	A	G	0.00770711	0.000174	0.00291	6.2E-08	0.01198	6.84917E-09	MMS22L	6q16.1	known
	rs2049865	8	116588546	C	A	-0.00652299	1.972E-05	-0.00302	4.9E-08	-0.012501	2.1827E-09	TRPS1	8q23.3	known
	rs12942267	17	7372637	C	T	-0.00545516	0.0004256	-0.0037	6.7E-11	-0.014768	6.22576E-12	ZBTB4	17p13.1	known
	rs759555	18	54890563	T	C	0.0087614	2.372E-06	0.00319	2.6E-07	0.013636	1.28393E-08	BOD1L2	18q21.31	known
	rs138699	22	39129708	G	A	-0.00586016	0.0011279	-0.00342	6.3E-08	-0.013816	7.60941E-09	GTPBP1	22q13.1	known
rs4470425	22	40716488	C	A	-0.00461145	0.0056337	-0.0032	3.8E-08	-0.012665	1.04427E-08	ADSL	22q13.1	known	
Depression	rs11679600	2	144394398	G	A	-0.0104039	0.002381	-0.00659	2.2E-29	-0.023872	1.5008E-28	ARHGAP15	2q22.2-q22.3	known
	rs11736215	4	7762502	A	C	0.0156962	9.105E-07	0.00272	5.2E-07	0.011807	2.70346E-09	AFAP1	4p16.1	known
	rs2049865	8	116588546	C	A	-0.00979784	0.002537	-0.00302	4.9E-08	-0.011747	4.39701E-09	TRPS1	8q23.3	known
	rs7864396	9	96251318	A	C	0.0200967	1.476E-09	0.00242	0.000021	0.011572	1.90522E-08	FAM120A	9q22.31	known
	rs7072763	10	69632512	T	C	0.0118989	0.0008319	0.00283	8.6E-07	0.011618	4.63855E-08	DNAJC12	10q21.3	new
	rs61888800	11	27722278	G	T	0.00999983	0.006152	0.0048	7.6E-15	0.017759	2.83839E-15	BDNF	11p14.1	known
	rs7993272	13	107898340	T	C	0.00880116	0.009103	0.00323	1.8E-08	0.012312	4.45217E-09	NALF1	13q33.3	known
	rs7209131	17	7376411	C	T	-0.00910129	0.009283	-0.00358	2.4E-10	-0.013741	4.05254E-11	ZBTB4	17p13.1	known
	rs9299	17	46669430	C	T	0.0156962	2.317E-06	0.00265	3.2E-06	0.011646	2.2414E-08	HOXB5	17q21.32	known
	rs11877758	18	35138110	T	G	-0.0289037	1.672E-16	-0.00224	0.00016	-0.012409	5.97149E-09	CELF4	18q12.2	new
	rs1262465	18	52857732	A	G	-0.0202027	2.645E-10	-0.00235	0.000016	-0.011282	1.16375E-08	CCDC68	18q21.2	known
	rs9980967	21	47033905	C	A	-0.0131967	0.007086	-0.00418	2.5E-07	-0.016166	4.25133E-08	COL6A1	21q22.3	known
	rs4470425	22	40716488	C	A	-0.0182964	9.91E-08	-0.0032	3.8E-08	-0.013858	6.30813E-11	ADSL	22q13.1	known

Supplementary Table 20. Multi-trait meta-analysis between psychiatric disorders and cholelithiasis and cholecystitis in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Cholelithiasis and cholecystitis		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Attention-deficit hyperactivity disorder	rs142761319	2	43944191	T	G	0.1144	0.002952	0.452	4.81E-14	0.058882715	3.79705E-09	ABCG8	2p21	known
	rs2290846	4	151199080	A	G	0.0335981	0.001065	0.114	1.44E-18	0.020835478	1.11588E-19	DCLK2	4q31.23-q31.3	known
	rs836536	7	6475091	T	G	0.0263953	0.004623	0.0651	0.000000028	0.012484275	2.42122E-09	KDEL2	7p22.1	known
	rs28507397	8	94928911	A	C	0.0246001	0.009824	0.0635	0.000000107	0.012078535	1.34897E-08	PDP1	8q22.1	known
	rs9738226	12	121423659	G	A	0.0282959	0.003106	0.095	3.61E-15	0.013295631	6.04034E-10	HNFA	12q24.31	known
	rs112635299	14	94838142	T	G	0.0908004	0.007016	0.248	1.95E-09	0.045809796	2.5976E-10	SERPINA2	14q32.13	known
	rs35866622	19	49218060	T	C	0.0254046	0.007297	0.0954	5.05E-16	0.013516791	8.62678E-11	FUT2	19q13.33	known
rs138430	22	38874396	T	C	-0.0361005	0.0003378	-0.0654	8.72E-08	-0.01302659	1.76866E-09	DDX17	22q13.1	known	
Major depressive disorder	rs1200161	1	169117533	G	A	-0.0177	0.0000731	-0.0629	0.000000221	-0.01276893	2.50876E-09	ATP1B1	1q24.2	known
	rs4952682	2	44036491	G	A	0.0142	0.009497	0.133	8.13E-19	0.01887715	7.6914E-13	ABCG8	2p21	known
	rs143861800	2	44425237	T	C	0.1033	0.0008854	0.398	0.00000045	0.067975052	1.80088E-08	PPM1B	2p21	known
	rs3905238	4	3078937	G	A	-0.0236	1.977E-07	-0.0556	0.0000031	-0.01241273	3.42802E-09	HTT	4p16.3	known
	rs10109419	8	94912072	G	A	0.0132	0.002808	0.0627	0.000000159	0.011920596	1.31979E-08	PDP1	8q22.1	known
	rs174566	11	61592362	G	A	0.0155	0.000609	0.0685	2.19E-08	0.01338278	6.46311E-10	FADS1	11q12.2	known
	rs34514836	19	46385438	C	A	0.0195	0.003537	0.113	3.55E-10	0.021036167	3.98898E-11	IRF2BP1	19q13.32	known
rs763121	22	38879940	G	A	0.0135	0.00291	0.0678	3.78E-08	0.012951096	2.80496E-09	DDX17	22q13.1	known	
Neuroticism	rs1200161	1	169117533	G	A	-0.0052697	0.001311993	-0.0629	0.000000221	-0.01198292	2.15443E-08	ATP1B1	1q24.2	known
	rs11891859	2	44044680	A	C	0.00664261	0.009190619	0.171	3.8E-20	0.024551858	4.15374E-14	ABCG8	2p21	known
	rs2979160	8	8307666	G	A	-0.0194558	8.36415E-23	-0.0514	0.0000121	-0.01393197	1.52101E-11	PRAG1	8p23.1	known
	rs7844163	8	94920742	T	C	0.00427115	0.005407328	0.0635	0.000000107	0.011810568	2.12852E-08	PDP1	8q22.1	known
	rs1169286	12	121419056	C	T	-0.0042425	0.006648174	-0.0865	2.87E-13	-0.0122088	5.07927E-09	HNFA	12q24.31	known
	rs633372	19	49209226	A	G	0.00472125	0.001458389	0.0929	2.68E-15	0.016566781	1.21246E-15	FUT2	19q13.33	known
	rs138457	22	38898051	C	T	-0.005365	0.00186477	-0.0639	0.000000147	-0.01205252	2.07497E-08	DDX17	22q13.1	known
Depression	rs2815753	1	72812324	A	G	0.0292949	2.165E-19	0.034	0.00436	0.011432229	7.92487E-09	NEGR1	1p31.1	known
	rs1200161	1	169117533	G	A	-0.0134985	0.0005525	-0.0629	0.000000221	-0.01195914	2.80904E-09	ATP1B1	1q24.2	known
	rs11891859	2	44044680	A	C	-0.0128965	0.008972	0.171	3.8E-20	0.020724647	1.17942E-11	ABCG8	2p21	known
	rs3905238	4	3078937	G	A	-0.0167981	2.679E-07	-0.0556	0.0000031	-0.01159343	4.22704E-09	HTT	4p16.3	known
	rs7864396	9	96251318	C	A	-0.0200967	1.476E-09	-0.0472	0.00011	-0.01127537	2.5038E-08	FAM120A	9q22.31	known
	rs12783517	10	21878407	T	C	0.00920221	0.007641	0.0703	0.000000034	0.012061708	1.16495E-08	SKIDA1	10p12.31	known
	rs174564	11	61588305	G	A	0.0186019	1.916E-08	0.0684	2.29E-08	0.013992727	6.3377E-12	FADS1	11q12.2	known
	rs11065363	12	121388498	T	C	0.0145047	0.001414	0.0821	0.000000299	0.014786835	2.72778E-08	HNFA	12q24.31	known
	rs12929503	16	69565461	C	T	-0.0103958	0.002313	-0.0613	0.000000275	-0.011277	2.26236E-08	NFAT5	16q22.1	known
	rs12967855	18	35138245	G	A	-0.0282959	1.643E-16	-0.037	0.00303	-0.01165634	1.62846E-08	CELF4	18q12.2	known
	rs7231742	18	50762502	A	G	0.0338981	1.39E-12	0.0638	0.000378	0.01693281	1.46332E-08	DCC	18q21.2	known

Supplementary Table 21. Multi-trait meta-analysis between digestive diseases and cholelithiasis and cholecystitis in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Cholelithiasis and cholecystitis		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Diverticular disease	rs4333882	1	234352899	G	A	0.006996	2.5E-24	0.0399	0.00802	0.015313	5.51137E-09	COA6	1q42.2	new
	rs11677892	2	144430711	G	A	0.005421	4E-22	0.0384	0.00165	0.013247	9.5497E-10	ARHGAP15	2q22.2-q22.3	known
	rs2290846	4	151199080	A	G	0.002165	0.00036	0.114	1.44E-18	0.020888	5.99707E-20	DCLK2	4q31.23-q31.3	known
	rs8191528	8	11628649	T	C	0.001729	0.0064	0.0794	1.23E-08	0.014816	1.66389E-09	NEIL2	8p23.1	known
	rs12783517	10	21878407	T	C	0.001806	0.0024	0.0703	0.000000034	0.013542	1.9588E-09	SKIDA1	10p12.31	known
	rs11239595	10	46217082	T	G	0.002198	0.0017	0.125	5.66E-17	0.016595	2.1605E-10	WASHC2C	10q11.22	known
	rs1169292	12	121426478	T	C	-0.001485	0.0084	-0.0985	9.19E-15	-0.013594	1.40452E-09	HNF1A	12q24.31	known
	rs4886824	15	76969256	G	A	0.003097	1.2E-08	0.0516	0.00001	0.012262	3.30749E-09	SCAPER	15q24.3	known
	rs35318830	19	46380325	G	T	0.002196	0.0082	0.113	7.81E-10	0.020767	1.48527E-10	IRF2BP1	19q13.32	known
	rs281393	19	49224484	T	C	-0.001664	0.0034	-0.065	0.000000172	-0.012489	1.32834E-08	FUT2	19q13.33	known
rs1043402	22	38879688	A	G	0.002508	0.000026	0.0707	3.28E-08	0.014523	1.62113E-10	DDX17	22q13.1	known	
Gastritis-duodenitis	rs75331444	2	44069772	A	G	0.0575	0.00136	0.767	4.16E-201	0.120697	3.1567E-175	ABC5	2p21	known
	rs17588356	4	151210677	T	G	0.0273	0.00486	0.111	3.08E-18	0.020069	3.30355E-18	DCLK2	4q31.23-q31.3	known
	rs31670	7	87059164	A	G	0.0325	0.00311	0.0826	1.12E-08	0.015884	1.1976E-09	ABC4	7q21.12	known
	rs35866622	19	49218060	T	C	0.0332	0.000207	0.0954	5.05E-16	0.017883	2.45386E-17	FUT2	19q13.33	known
Gastroesophageal reflux disease	rs75331444	2	44069772	A	G	0.0498	0.0000353	0.767	4.16E-201	0.095146	4.4185E-137	ABC5	2p21	known
	rs4681515	3	149212076	G	A	-0.0243	0.0004519	-0.106	2.82E-19	-0.016637	2.02084E-18	TM4SF4	3q25.1	known
	rs2290846	4	151199080	A	G	0.0201	0.00195	0.114	1.44E-18	0.016945	3.39547E-16	DCLK2	4q31.23-q31.3	known
	rs45502492	7	87089898	T	C	-0.0277	0.001078	-0.147	5.9E-18	-0.022007	5.79766E-16	ABC4	7q21.12	known
	rs9297994	8	59392324	A	G	-0.0258	0.0000366	-0.105	1.7E-17	-0.016735	5.01823E-17	CYP7A1	8q12.1	known
	rs1243189	10	21935248	G	A	0.0234	0.0002291	0.0679	6.46E-08	0.011834	5.11985E-09	SKIDA1	10p12.31	known
	rs34851490	19	46384554	G	A	0.031	0.0007671	0.114	4.81E-10	0.018569	2.68558E-10	IRF2BP1	19q13.32	known
rs1043402	22	38879688	A	G	0.0224	0.0005436	0.0707	3.28E-08	0.012017	5.96393E-09	DDX17	22q13.1	known	
Irritable bowel syndrome	rs56374126	4	151243864	T	C	0.0215	0.008362	0.11	2.43E-15	0.020867	7.21875E-16	DCLK2	4q31.23-q31.3	known
	rs10275443	7	107462440	T	C	-0.0199	0.005539	-0.0638	0.000000219	-0.012449	3.50764E-08	SLC26A3	7q22.3-q31.1	known
	rs13280055	8	11522353	A	G	0.0293	0.005968	0.109	6.07E-10	0.020702	1.05187E-10	NEIL2	8p23.1	known
	rs4738684	8	59393273	G	A	-0.0311	0.00001593	-0.105	1.89E-17	-0.016247	1.82923E-12	CYP7A1	8q12.1	known
	rs11239535	10	45978387	T	C	0.0217	0.003196	0.11	3.14E-18	0.0209	5.5853E-19	WASHC2C	10q11.22	known
	rs112635299	14	94838142	T	G	0.0647	0.008503	0.248	1.95E-09	0.047405	3.9159E-10	SERPINA2	14q32.13	known
Non-alcoholic fatty liver disease	rs10107182	8	59392737	T	C	-0.074737	8.148E-06	-0.105	1.69E-17	-0.020953	5.51099E-20	CYP7A1	8q12.1	known
	rs7924036	10	65191645	T	G	0.04869	0.002768	0.0659	1.74E-08	0.013178	1.09255E-09	REEP3	10q21.3	known
	rs28929474	14	94844947	T	C	0.22823	0.0001189	0.249	3.16E-09	0.050513	4.43119E-11	SERPINA2	14q32.13	known
Peptic ulcer	rs174566	11	61592362	G	A	-0.034175	0.0032	0.0685	2.19E-08	0.013701	2.41989E-09	FADS1	11q12.2	known
	rs34514836	19	46385438	C	A	-0.050709	0.0026	0.113	3.55E-10	0.022325	3.80325E-11	IRF2BP1	19q13.32	known
	rs62129966	19	48374950	A	C	-0.04173	0.0049	-0.139	2.52E-18	-0.022894	9.93441E-15	TPRX2	19q13.33	known
	rs516246	19	49206172	T	C	-0.087713	4.1E-15	0.0929	2.28E-15	0.020189	3.23078E-20	FUT2	19q13.33	known
	rs5757140	22	38957013	C	T	-0.032063	0.0087	0.0672	0.000000204	0.013366	3.52948E-08	DDX17	22q13.1	known

Supplementary Table 22. Multi-trait meta-analysis between psychiatric disorders and non-alcoholic fatty liver disease in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Non-alcoholic fatty liver disease		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Neuroticism	rs3115672	6	31760120	T	C	-0.01807	3.7975E-12	-0.0916367	0.004892	-0.007807	5.20403E-09	MHC region		known
	rs2979204	8	8441347	T	C	0.0173638	1.0539E-17	0.0593777	0.001446	0.005132	1.40919E-12	PRAG1	8p23.1	new
	rs10891570	11	113542843	A	G	-0.0110001	1.9726E-12	-0.04397	0.009882	-0.004136	6.56875E-09	ANKK1	11q23.2	new
	rs11152363	18	55389957	A	G	0.0127336	3.8457E-11	0.0653313	0.001751	0.005032	8.81154E-09	TCF4	18q21.2	new
Attention-deficit hyperactivity disorder	rs7613360	3	49879277	T	C	0.0534008	3.175E-08	0.0451071	0.007454	0.004046	3.14163E-08	CAMKV	3p21.31	new
	rs10419672	19	19360432	T	C	-0.0494004	0.0000217	-0.1076665	5.998E-07	-0.005509	2.41715E-08	GATAD2A	19p13.11	known
Major depressive disorder	rs12619197	2	22343676	A	G	0.0233	6.834E-08	0.0610887	0.0001834	0.003764	1.3133E-08	KLHL29	2p24.1	new
	rs7509	6	27451068	T	G	-0.0274	2.226E-10	-0.0438781	0.008958	-0.003976	2.46776E-09	MHC region		known
	rs7240481	18	55431501	A	G	-0.0317	2.483E-11	-0.053711	0.003984	-0.004545	4.11311E-10	TCF4	18q21.2	new
Depression	rs12619197	2	22343676	A	G	0.0203966	2.043E-10	0.0610887	0.0001834	0.003088	2.482E-09	KLHL29	2p24.1	known
	rs34890793	3	49582060	T	C	-0.0361005	1.444E-16	-0.0603317	0.009958	-0.005073	3.18728E-12	BSN	3p21.31	new
	rs2844795	6	30106070	T	C	0.0239034	8.241E-14	0.0467349	0.008197	0.003366	1.204E-10	MHC region		known
	rs1273044	11	113123126	T	C	0.0243999	1.749E-10	0.0716365	0.00007079	0.003616	1.12472E-09	NCAM1	11q23.2	new
	rs10891570	11	113542843	A	G	-0.0212032	1.192E-10	-0.04397	0.009882	-0.002951	1.75188E-08	ANKK1	11q23.2	new
	rs7212293	17	67851209	A	G	-0.0234017	1.912E-09	-0.0838086	0.00002482	-0.003657	5.46232E-09	BPTF	17q24.2	new
	rs7240481	18	55431501	A	G	-0.0289955	1.827E-16	-0.053711	0.003984	-0.004052	1.0455E-12	TCF4	18q21.2	new

Supplementary Table 23. Multi-trait meta-analysis between digestive diseases and non-alcoholic fatty liver disease in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Non-alcoholic fatty liver disease		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Cholelithiasis and cholecystitis	rs10107182	8	58480178	T	C	-0.105	1.69E-17	-0.0747368	0.000008148	-0.006643704	4.42944E-20	CYP7A1	8q12.1	new
	rs7924036	10	63431885	T	G	0.0659	1.74E-08	0.0486896	0.002768	0.00426934	9.70512E-10	REEP3	10q21.3	known
	rs28929474	14	94378610	T	C	0.249	3.16E-09	0.22823	0.0001189	0.018148788	2.06989E-11	SERPINA2	14q32.13	new
	rs429358	19	44908684	T	C	0.0628	0.0000992	0.1366152	1.135E-08	0.005477592	1.34917E-08	APOE	19q13.32	known
Diverticular disease	rs17615220	6	32709636	A	G	0.0069987	2.6E-08	0.0848791	0.008288	0.010018426	4.21278E-08	MHC region		known
Gastritis-duodenitis	rs10419672	19	19360432	T	C	-0.0354	0.00245	-0.1076665	5.998E-07	-0.008744823	4.81972E-08	GATAD2A	19p13.11	known
Gastroesophageal reflux disease	rs7609078	2	99873901	A	G	-0.039	1.626E-10	-0.0522793	0.001701	-0.002947981	1.60381E-10	AFF3	2q11.2	new

Supplementary Table 24. Multi-trait meta-analysis between psychiatric disorders and crohn's disease in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Crohn's disease		MTAG		Genes	Cytogenetic band	Annotation	
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag				
Anxiety, panic disorder	rs3129883	6	32442360	C	T	-0.000854828	0.0016	-0.1802	1.122E-19	-0.053751	4.13175E-19	MHC region		known	
	rs10790020	11	114537576	G	A	-0.000615515	0.0095	-0.0934	3.418E-09	-0.035452	3.81303E-09	NXPE1	11q23.2	known	
	rs2836881	21	39094373	G	T	0.000745223	0.0053	0.2217	1.105E-32	0.069844	3.7471E-31	PSMG1	21q22.2	known	
Bipolar disorder	rs4870	1	2556714	G	A	-0.0347985	0.0002618	-0.1095	6.432E-12	-0.038691	1.61006E-10	TNFRSF14	1p36.32	known	
	rs4655208	1	19802043	C	T	-0.0346018	0.003275	-0.1671	2.701E-14	-0.04295	1.26124E-12	TMCO4	1p36.13	known	
	rs7554511	1	200908434	C	A	0.0324962	0.001833	0.1448	4.267E-16	0.047572	3.77031E-15	KIF21B	1q32.1	known	
	rs4560096	2	60977782	G	T	0.0247999	0.009792	0.1595	3.751E-23	0.056331	1.27699E-20	REL	2p16.1	known	
	rs62180182	2	198989863	C	A	-0.026498	0.005959	-0.121	1.526E-12	-0.041343	8.31749E-12	SATB2	2q33.1	known	
	rs4676408	2	240634984	G	A	-0.0305004	0.00148	-0.1433	1.19E-17	-0.05015	1.14704E-16	GPCR35	2q37.3	known	
	rs2960545	3	49692625	G	A	-0.0281987	0.002497	-0.0963	8.636E-10	-0.036039	2.57969E-09	APEH	3p21.31	known	
	rs9268912	6	32464732	C	A	0.0335992	0.0005324	0.3225	2.966E-76	0.107471	1.38943E-70	MHC region		known	
	rs4330804	9	136399795	G	T	0.0251023	0.009439	0.1203	6.618E-14	0.042595	1.92424E-12	SNAPC4	9q34.3	known	
	rs12766430	10	62681444	G	A	-0.0439977	4.736E-06	-0.1029	1.396E-10	-0.03584	3.1537E-09	ADO	10q21.3	known	
rs12936409	17	39887396	C	T	-0.0374018	0.00006516	-0.1365	5.62E-18	-0.048691	8.46354E-16	ZBP2	17q21.1	known		
rs6062475	20	63647034	G	A	-0.0251998	0.009495	-0.1008	5.48E-10	-0.035136	6.36034E-09	STMN3	20q13.33	known		
Major depressive disorder	rs6702590	1	201050977	G	A	0.0125	0.00605	0.1261	5.431E-14	0.044433	1.19159E-13	KIF21B	1q32.1	known	
	rs1809028	2	61186588	G	A	0.0171	0.008038	0.1023	5.519E-08	0.033218	2.93172E-08	C2orf74	2p15	known	
	rs12474120	2	198828721	C	A	0.0125	0.008314	0.1201	5.044E-12	0.040938	8.23767E-12	SATB2	2q33.1	known	
	rs6871626	5	159399784	C	A	-0.0122	0.008489	-0.1713	8.895E-24	-0.054856	5.29753E-20	IL12B	5q33.3	known	
	rs9271546	6	32622377	C	T	-0.0118	0.006695	-0.212	4.075E-37	-0.069604	3.26605E-31	MHC region		known	
	rs13234982	7	107837916	G	A	0.0117	0.007204	0.141	1.035E-17	0.050255	4.87713E-17	SLC26A3	7q22.3-q31.1	known	
rs12766391	10	62681444	G	A	-0.016	0.0002678	-0.1029	1.396E-10	-0.035551	2.12952E-08	ADO	10q21.3	known		
Neuroticism	rs12122809	1	201045838	C	T	0.00425142	0.00957688	0.1301	1.725E-13	0.043352	5.5766E-13	KIF21B	1q32.1	known	
	rs7608697	2	60977506	C	A	0.00453079	0.00542154	0.1597	3.031E-23	0.057667	8.68978E-22	REL	2p16.1	known	
	rs62180181	2	198987286	C	T	-0.00618788	0.00013962	-0.1226	8.084E-13	-0.04299	8.66008E-13	SATB2	2q33.1	known	
	rs1131095	3	49676792	C	T	0.00563987	0.0011431	0.1593	2.177E-21	0.050825	2.82669E-17	APEH	3p21.31	known	
	rs9274655	6	32668512	C	T	-0.00585351	0.00271693	-0.331	2.542E-46	-0.077853	2.38316E-38	MHC region		known	
	rs798498	7	2756248	G	T	-0.00419345	0.00907111	-0.1094	2.933E-10	-0.037168	6.32944E-10	AMZ1	7p22.3	known	
	rs12942547	17	42375526	G	A	-0.00426818	0.00542825	-0.1047	1.203E-10	-0.03401	1.54324E-08	STAT3	17q21.2	known	
	rs2823290	21	15468984	C	A	-0.00441703	0.0032347	-0.1255	2.905E-13	-0.038789	1.10709E-10	USP25	21q21.1	known	
	Schizophrenia	rs7522794	1	161505035	C	T	-0.02820402	0.00211	-0.1685	1.19E-22	-0.050777	9.15079E-18	FCGR2A	1q32.3	known
		rs72749142	1	200982179	G	A	0.064401012	8.118E-08	0.1824	2.127E-15	0.048423	2.69537E-16	KIF21B	1q32.1	known
rs62180181		2	198987286	C	T	-0.032202995	0.0006443	-0.1226	8.084E-13	-0.042448	7.17531E-13	SATB2	2q33.1	known	
rs1131095		3	49676792	C	T	0.025605029	0.006281	0.1593	2.177E-21	0.054454	3.38991E-20	APEH	3p21.31	known	
rs9271176		6	32610350	G	A	-0.043002017	0.00001002	-0.3495	4.2E-91	-0.11474	8.08265E-84	MHC region		known	
rs34530632		6	111455132	C	T	-0.052504554	0.005746	-0.2114	9.111E-11	-0.03808	1.21322E-10	TRAF3IP2	6q21	known	
rs822341		9	5453396	C	T	-0.025696986	0.009173	-0.1063	3.33E-09	-0.034753	4.22268E-09	CD274	9p24.1	known	
rs3812555		9	136367481	C	T	-0.026795823	0.005381	-0.104	1.927E-09	-0.035518	1.92141E-09	SNAPC4	9q34.3	known	
rs10761659		10	62685804	G	A	0.024702369	0.004272	0.1276	1.327E-15	0.040984	4.24801E-12	ADO	10q21.3	known	
rs2012070		17	42505083	G	T	0.032895162	0.0007368	0.1037	6.271E-09	0.035026	3.19212E-09	NAGLU	17q21.2	known	
rs5771069	22	49997051	G	A	0.023698607	0.006786	0.0998	2.472E-10	0.037093	3.58984E-10	IL17REL	22q13.33	known		
Depression	rs296547	1	200923009	C	T	0.00879859	0.007062	0.1088	4.014E-11	0.03891	1.10935E-10	INAVA	1q32.1	known	
	rs4671401	2	61246013	C	T	-0.0120965	0.0009042	-0.1035	1.61E-08	-0.033884	1.93137E-08	C2orf74	2p15	known	
	rs58513831	2	198859590	C	T	0.00910129	0.008501	0.1199	3.527E-12	0.041031	1.02569E-11	SATB2	2q33.1	known	
	rs1131095	3	49676792	C	T	-0.0188021	5.424E-08	0.1593	2.177E-21	0.051571	1.22571E-17	APEH	3p21.31	known	
	rs60689680	5	159407359	G	T	0.00909848	0.006367	-0.134	1.722E-15	-0.044219	2.27557E-13	IL12B	5q33.3	known	
	rs6905775	6	32658244	G	A	-0.0122953	0.00442	0.385	3.816E-53	0.086203	2.45211E-46	MHC region		known	
	rs798502	7	2750246	C	A	-0.0108015	0.0018	-0.1162	3.895E-11	-0.0392	8.06269E-11	AMZ1	7p22.3	known	
	rs13234982	7	107837916	G	A	0.00850374	0.007896	0.141	1.035E-17	0.050046	1.06271E-16	SLC26A3	7q22.3-q31.1	known	
	rs12302207	12	68121059	G	A	-0.0129029	0.005826	-0.1285	3.173E-09	-0.03511	5.84256E-09	IFNG	12q15	known	
	rs7222154	17	39933720	G	A	0.00859685	0.009738	-0.1148	7.365E-12	-0.037768	3.80431E-10	ZBP2	17q21.1	known	
rs2738783	20	63677259	G	T	0.0128016	0.001799	0.1302	9.445E-10	0.03638	1.62197E-09	TNFRSF6B	20q13.33	known		

Gastroesophageal reflux disease	rs10067892	5	40291889	G	A	-0.0159	0.009915	0.1034	5.372E-10	0.040497	2.978E-08	PTGER4	5p13.1	known
	rs6873866	5	96912106	C	T	-0.017	0.004873	-0.1314	1.346E-15	-0.057735	2.744E-15	LNPEP	5q15	known
	rs2188962	5	132435113	C	T	0.0175	0.003277	-0.2004	5.588E-36	-0.083889	1.63E-30	SLC22A5	5q31.1	known
	rs17772583	5	132617818	G	A	0.0192	0.004869	0.1169	6.778E-10	0.040228	3.672E-08	IL13	5q31.1	known
	rs181826	5	142146492	C	A	0.0158	0.009218	-0.1162	3.245E-12	-0.050251	6.079E-12	NDFIP1	5q31.3	known
	rs11135059	5	159344329	G	A	0.0162	0.009696	-0.1488	8.821E-19	0.063337	4.364E-18	IL12B	5q33.3	known
	rs41291790	6	31604887	G	A	-0.083	0.007161	-0.7443	3.978E-18	-0.062179	1.735E-17	MHC region		known
	rs10114470	9	114785492	C	T	0.0202	0.001419	0.1687	1.755E-21	0.068537	6.562E-21	TNFSF15	9q32	known
	rs1388585	12	40137889	G	A	-0.065	0.009823	0.4265	1.241E-15	0.052974	4.154E-13	SLC2A13	12q12	known
	rs11066188	12	112172910	G	A	-0.0294	1.023E-06	-0.0979	4.593E-09	-0.044692	9.542E-10	TRAFD1	12q24.13	known
	rs56135636	16	50305757	G	A	-0.0199	0.007344	-0.1218	1.483E-09	-0.044138	1.53E-09	ADCY7	16q12.1	known
	rs2357623	16	50660100	G	A	-0.02	0.002702	-0.2184	4.37E-33	-0.08538	1.507E-31	NOD2	16q12.1	known
	rs10492862	16	82833851	C	A	-0.0312	1.833E-06	-0.1067	1.261E-09	-0.045987	3.092E-10	CDH13	16q23.3	new
	rs12450323	17	39816455	G	T	-0.0194	0.009131	0.1377	3.679E-11	0.043404	2.838E-09	ZBPB2	17q21.1	known
	rs4809330	20	63718234	G	A	0.0232	0.0001956	0.1263	2.665E-13	0.053612	2.172E-13	TNFRSF6B	20q13.33	known
	rs4820371	22	39263083	C	T	0.0201	0.003818	-0.1365	1.23E-11	-0.044331	1.299E-09	PDGFB	22q13.1	known
	Gastritis-duodenitis	rs6736400	2	43273665	G	A	0.0427	0.000336	0.1288	1.047E-09	0.044369	1.692E-09	ZFP36L2	2p21
rs13362202		5	40473350	G	A	0.0359	0.00762	0.2368	6.386E-22	0.068699	1.074E-20	PTGER4	5p13.1	known
rs4244437		5	159346109	G	A	-0.0247	0.00948	-0.1621	2.404E-20	-0.066119	2.75E-19	IL12B	5q33.3	known
rs9268026		6	32258704	G	A	0.0512	0.0000954	-0.207	6.58E-14	-0.050995	4.372E-12	MHC region		known
rs2285147		6	167092060	G	A	0.0263	0.00327	-0.1339	8.48E-17	-0.057141	8.556E-15	CCR6	6q27	known
rs1026422		7	50280211	G	A	-0.0257	0.00429	-0.1097	2.09E-11	-0.048166	6.137E-11	IKZF1	7p12.2	known
rs28374519		16	28478021	G	A	0.0255	0.00559	0.1272	4.937E-13	0.051906	1.812E-12	NPIP7	16p12.1	known
rs78947484		16	51016373	G	A	-0.0451	0.00902	-0.2365	1.077E-14	-0.055358	5.605E-14	SALL1	16q12.1	known
rs601338	19	48703417	G	A	-0.0311	0.000491	-0.1085	2.33E-11	-0.048493	4.556E-11	FUT2	19q13.33	known	
Appendicitis	rs1909129	1	67269616	G	A	-0.000556	0.005	0.2687	2.265E-57	0.113708	3.165E-54	IL12RB2	1p31.3	known
	rs12136659	1	172875110	C	T	0.0006259	0.0031	0.1718	2.939E-21	0.063296	6.057E-18	TNFSF18	1q25.1	known
	rs72745992	5	40567094	C	T	-0.000513	0.01	-0.1438	3.584E-16	-0.054783	7.989E-14	PTGER4	5p13.1	known
	rs10515794	5	159481219	G	A	-0.000635	0.0053	-0.1239	5.891E-10	-0.040842	2.555E-08	IL12B	5q33.3	known
	rs12213415	6	31783811	G	A	0.000993	0.0043	-0.1647	6.208E-08	-0.040088	4.588E-08	MHC region		known
	rs78530715	10	62601721	C	T	0.0010503	0.0086	0.2121	2.487E-10	0.041923	1.085E-08	ADO	10q21.3	known
	rs192007	10	62826635	G	A	0.0005871	0.0026	-0.114	5.008E-12	-0.050607	5.162E-12	EGR2	10q21.3	known
	rs6584282	10	99526738	G	A	0.000495	0.0073	-0.1658	3.437E-25	-0.074386	3.536E-24	NKX2-3	10q24.2	known
	rs2508755	11	76534518	G	A	-0.000483	0.0091	0.1081	1.997E-11	0.048917	2.548E-11	LRR32	11q13.5	known
	rs149399409	16	50076931	G	A	-0.001596	0.0017	-0.2584	8.387E-11	-0.04262	6.176E-09	HEATR3	16q12.1	known
	rs2066844	16	50712015	C	T	-0.001171	0.0084	-0.6752	6.26E-99	-0.144775	9.324E-87	NOD2	16q12.1	known
	rs12150079	17	39869164	G	A	0.0006548	0.00099	-0.1058	4.21E-10	-0.046321	2.674E-10	ZBPB2	17q21.1	known
rs2838515	21	44188654	G	A	0.000565	0.0036	-0.112	4.83E-11	-0.048289	4.549E-11	ICOSLG	21q22.3	known	

Supplementary Table 30. Multi-trait meta-analysis between psychiatric disorders and appendicitis in Europeans

Type of psychiatric disorders	SNP	CHR	BP	A1	A2	Psychiatric disorders (all)		Appendicitis		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Major depressive disorder	rs203876	6	28078895	T	C	0.0323	1.289E-11	0.00056	0.0061	0.026688	1.69072E-09	MHC region		known

Supplementary Table 31. Multi-trait meta-analysis between digestive diseases and appendicitis in Europeans

Type of digestive diseases	SNP	CHR	BP	A1	A2	Digestive diseases (all)		Appendicitis		MTAG		Genes	Cytogenetic band	Annotation
						Beta	P-value	Beta	P-value	Beta-mtag	P-mtag			
Crohn's disease	rs2088242	1	67298097	C	T	-0.1837	7.65E-25	0.00054	0.0087	0.035425	2.81965E-19	IL12RB2	1p31.3	new
	rs6735694	2	240647279	C	T	-0.1273	3.91E-12	0.00055	0.01	0.027503	7.21337E-11	AQP12B	2q37.3	new
	rs34659678	6	111567337	C	T	-0.2165	1.66E-11	0.00134	0.00084	0.054067	1.04866E-11	TRAF3IP2	6q21	known
	rs7911680	10	99533711	A	C	0.1525	6.71E-22	-0.00052	0.005	-0.031518	1.15757E-17	NKX2-3	10q24.2	known
	rs2508755	11	76534518	G	A	0.0901	1.37E-08	-0.00048	0.0091	-0.020749	2.01028E-08	EMSY	11q13.5	new
	rs16940202	16	85980635	T	C	-0.135	3.07E-10	0.00092	0.00025	0.033349	2.22088E-11	IRF8	16q24.1	known
	rs62066988	17	39836028	C	T	-0.1229	2.84E-13	0.00064	0.0012	0.028087	7.82077E-13	ZBPB2	17q21.1	known
Inflammatory bowel disease	rs2088242	1	67298097	C	T	-0.2309	3.02E-61	0.00054	0.0087	0.043777	2.08898E-42	IL12RB2	1p31.3	new
	rs6735694	2	240647279	C	T	-0.0814	1.19E-08	0.00055	0.01	0.018877	3.73103E-08	AQP12B	2q37.3	new
	rs67289879	6	42039665	C	T	-0.0898	3.04E-08	0.00089	0.00018	0.022407	2.59623E-09	CCND3	6p21.1	known
	rs34659678	6	111567337	C	T	-0.1655	7.42E-11	0.00134	0.00084	0.041944	8.54689E-11	TRAF3IP2	6q21	known
	rs192007	10	62826635	G	A	-0.0808	2.93E-10	0.00059	0.0026	0.019425	6.3134E-10	EGR2	10q21.3	known
	rs11190140	10	99531836	T	C	0.1503	3.37E-34	-0.00052	0.0048	0.031519	6.2956E-26	NKX2-3	10q24.2	known
	rs2508755	11	76534518	G	A	0.0968	8.16E-15	-0.00048	0.0091	0.021234	1.60146E-12	EMSY	11q13.5	new
	rs2066844	16	50712015	C	T	-0.3497	1.42E-38	-0.00117	0.0084	-0.061307	1.70217E-17	NOD2	16q12.1	new
	rs16940202	16	85980635	T	C	-0.113	2.51E-11	0.00092	0.00025	-0.027442	1.24859E-11	IRF8	16q24.1	known
rs62066988	17	39836028	C	T	-0.1105	4.78E-17	0.00064	0.0012	0.024962	4.71657E-15	ZBPB2	17q21.1	known	
rs2838515	21	44188654	A	G	0.0858	5.18E-11	-0.00056	0.0036	0.019428	2.74446E-10	ICOSLG	21q22.3	known	
rs62226440	22	30194233	G	A	-0.076	2.18E-08	0.00061	0.0034	-0.018777	2.15238E-08	LIF	22q12.2	known	
Ulcerative colitis	rs7546245	1	67284791	T	C	-0.2691	2.25E-57	0.00061	0.0022	-0.044153	4.91963E-42	IL12RB2	1p31.3	new
	rs6425143	1	172875212	T	G	-0.1706	4.07E-21	-0.00062	0.0037	-0.019886	9.59018E-09	TNFSF18	1q25.1	known
	rs150064688	5	40526093	A	G	-0.421	7.17E-11	0.00227	0.0037	-0.0814	1.9397E-10	PTGER4	5p13.1	known
	rs12213415	6	31783811	G	A	-0.1647	6.21E-08	0.00099	0.0043	0.031595	3.64093E-08	MHC region		known
	rs67289879	6	42039665	C	T	-0.1102	2.03E-07	0.00089	0.00018	0.022141	7.51968E-09	CCND3	6p21.1	known
	rs192007	10	62826635	G	A	-0.114	5.01E-12	0.00059	0.0026	0.021494	1.83775E-11	EGR2	10q21.3	known
	rs6584281	10	99526723	A	G	0.1648	6.66E-25	-0.00052	0.0048	0.028037	3.62672E-20	NKX2-3	10q24.2	known
	rs2508755	11	76534518	G	A	0.1081	2E-11	-0.00048	0.0091	-0.019503	1.85341E-10	EMSY	11q13.5	new
	rs2066844	16	50712015	C	T	-0.6752	6.3E-99	-0.00117	0.0084	-0.108033	4.05888E-49	NOD2	16q12.1	new
	rs12150079	17	39869164	G	A	-0.1058	4.21E-10	0.00065	0.00099	0.020748	1.97392E-10	ZBPB2	17q21.1	known
	rs2838515	21	44188654	A	G	0.112	4.83E-11	-0.00056	0.0036	0.020137	1.31365E-10	ICOSLG	21q22.3	known

Supplementary Table 32. Number of genes ($P < 0.01$) identified by MAGMA

Category	Disease	Genes
Psychiatric disorders	AN	682
	ADHD	1049
	ANX	267
	ASD	545
	BIP	1989
	DEP	2255
	MDD	1340
	NE	2003
	PTSD	290
	SCZ	2738
Digestive diseases	AP	371
	APP	199
	CC	624
	DD	1166
	CD	1263
	CRC	1512
	GD	430
	GERD	1292
	IBD	1732
	IBS	636
	NAFLD	231
	PU	343
	SF	716
	UC	1550

Supplementary Table 33. Details of gene co-expression networks constructed using GTEx RNAseq data

Tisuss Name	Samples Count	Gene Count	Modules Count
Brain - Cortex	255	18726	14
Brain - Caudate (basal ganglia)	246	17768	12
Brain - Hypothalamus	202	17942	18
Brain - Amygdala	152	17627	19
Brain - Hippocampus	197	17470	13
Brain - Cerebellar Hemisphere	215	18789	15
Brain - Spinal cord (cervical c-1)	159	17539	15
Esophagus - Mucosa	555	16483	17
Esophagus - Muscularis	515	16802	17
Esophagus - Gastroesophageal Junction	375	16892	16
Stomach	359	16429	4
Small Intestine - Terminal Ileum	187	18229	5
Colon - Transverse	406	17057	3
Colon - Sigmoid	373	17073	17

Supplementary Table 34. Co-expression modules associated neurological pathways in six highly correlated diseases.

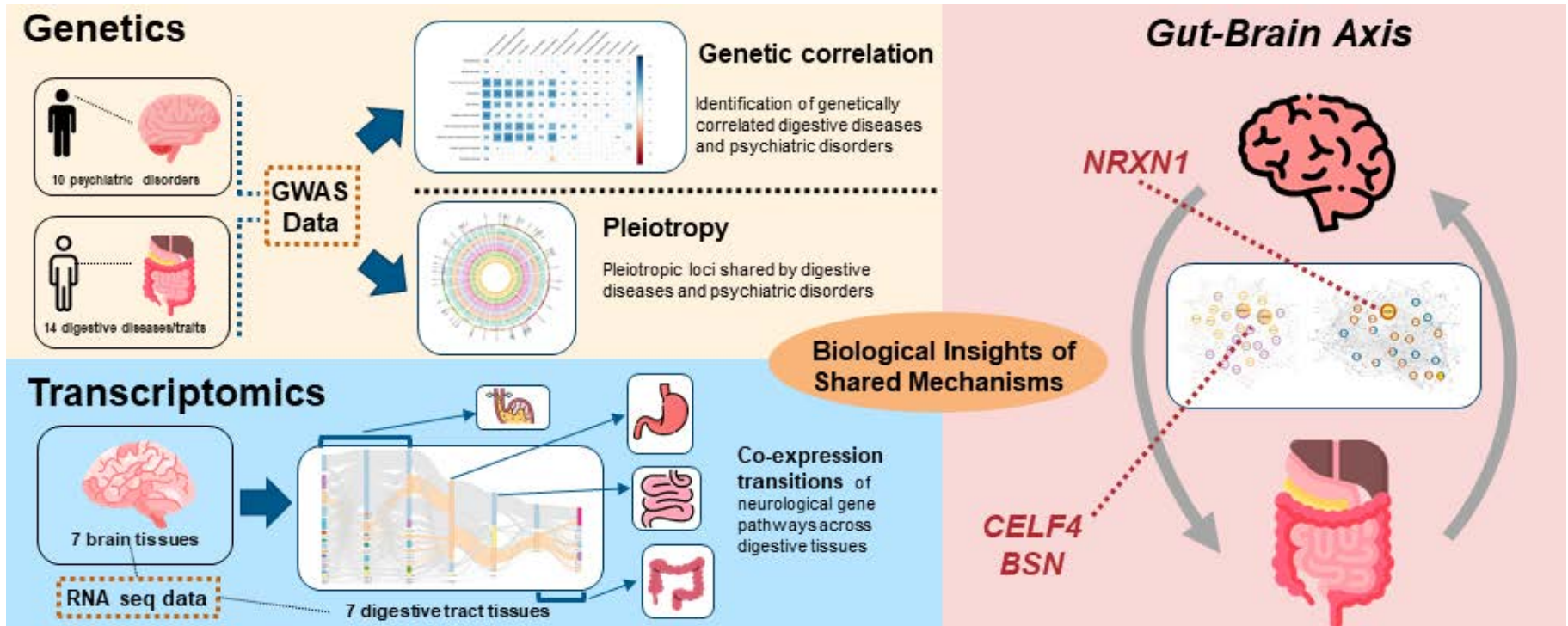
Disease	Tissue	Module
IBS	Brain - Hypothalamus	9
	Esophagus - Mucosa	3
GERD	Brain - Amygdala	2
	Brain - Spinal cord (cervical c-1)	2
	Esophagus - Muscularis	2
DEP	Brain - Hypothalamus	1
	Brain - Amygdala	1
	Brain - Hippocampus	1
	Brain - Cerebellar Hemisphere	4
	Brain - Spinal cord (cervical c-1)	2
	Esophagus - Muscularis	2
	Esophagus - Gastroesophageal Junction	14
	Small Intestine - Terminal Ileum	3
	Colon - Transverse	2
Colon - Sigmoid	13	
MDD	Brain - Amygdala	1
	Brain - Hippocampus	1
	Brain - Spinal cord (cervical c-1)	2
	Esophagus - Gastroesophageal Junction	14
	Colon - Transverse	2
	Colon - Sigmoid	13
NE	Brain - Caudate (basal ganglia)	1
	Brain - Hypothalamus	1
	Brain - Amygdala	1
	Brain - Hippocampus	1
	Brain - Cerebellar Hemisphere	4
	Brain - Spinal cord (cervical c-1)	2
	Esophagus - Mucosa	3
	Esophagus - Muscularis	2
	Esophagus - Gastroesophageal Junction	14
	Small Intestine - Terminal Ileum	3
	Colon - Transverse	2
	Colon - Sigmoid	8
	Colon - Sigmoid	13

Supplementary Table35. Percentile rank of selected hub genes from each tissue (Selected gene must rank within top 10% in the modules from at least two different tissues, top 5% is colored in red, top 10% is colored in yellow).

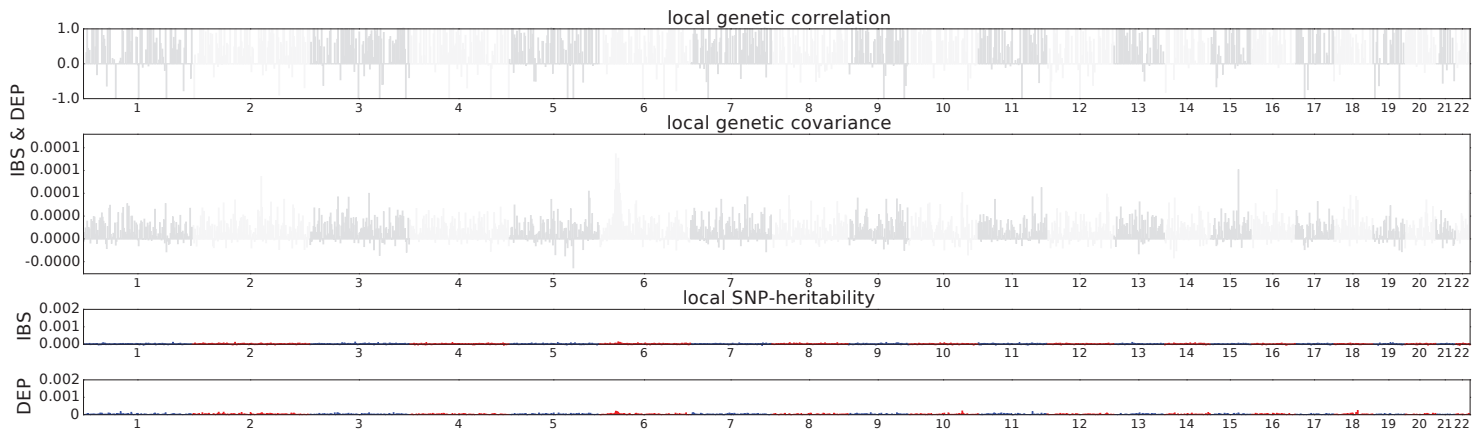
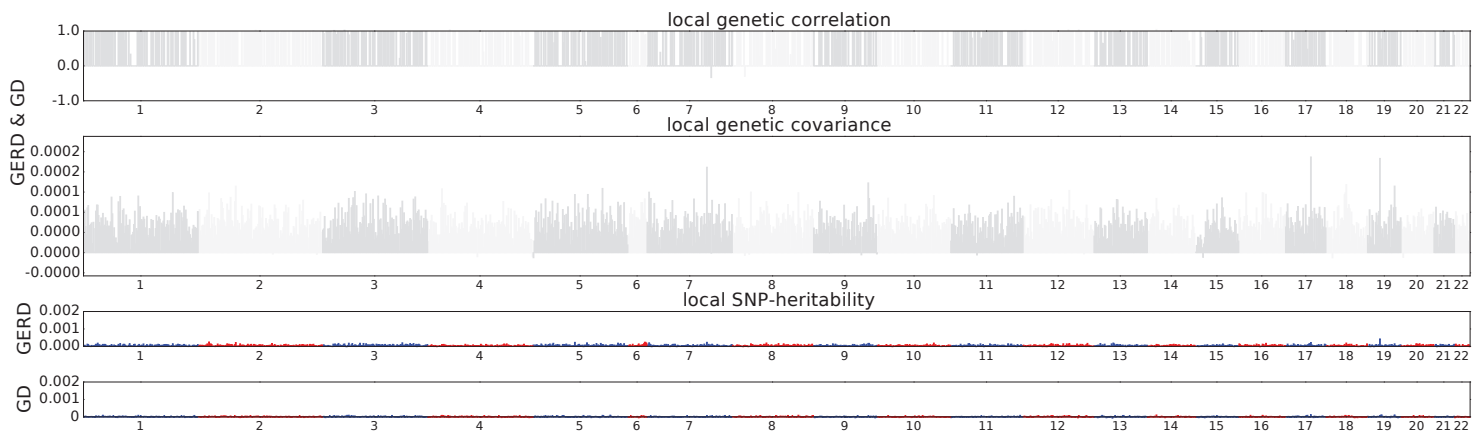
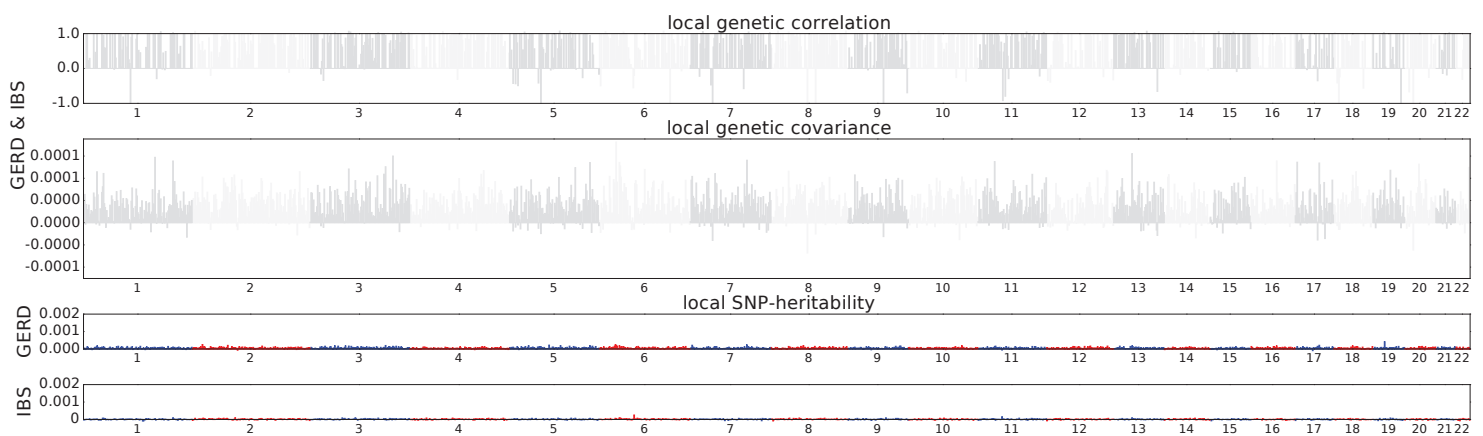
GENE	Brain - Cortex	Brain - Caudate (basal ganglia)	Brain - Amygdala	Brain - Cerebellar Hemisphere	Brain - Hypothalamus	Brain - Spinal cord (cervical c-1)	Brain - Hippocampus	Small Intestine - Terminal Ileum	Colon - Transverse	Esophagus - Mucosa	Esophagus - Muscularis	Esophagus - Gastroesophageal Junction	Stomach	Colon - Sigmoid
	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank	Percentile rank
SPINT2	14.27	14.13	10.73	NA	10.04	26.33	5.90	3.21	0.89	NA	74.80	80.95	0.46	8.43
NRXN1	17.35	49.40	22.49	3.76	11.02	29.39	7.96	29.74	66.57	35.97	24.57	1.44	15.27	0.30
KLHL29	5.12	5.61	18.55	NA	8.95	18.30	1.66	23.36	15.92	72.83	57.08	52.61	1.45	47.34
NEGR1	1.28	9.85	7.75	86.08	22.68	60.48	12.79	11.58	11.26	4.94	60.60	NA	4.17	30.06
ATP1B1	3.78	10.00	7.67	58.13	10.36	37.58	17.73	15.10	43.06	NA	36.03	20.09	5.16	71.94
IRF8	10.90	24.15	14.81	NA	20.46	8.50	26.27	8.99	52.20	11.86	32.52	26.09	25.37	14.49
ERBB3	0.36	1.35	2.11	NA	1.89	5.49	0.40	14.71	29.24	NA	30.22	6.47	6.37	20.28
ANTXR2	39.23	26.14	75.52	41.78	65.71	31.02	49.20	21.92	58.97	13.45	5.29	2.24	0.40	6.05
PCLO	9.75	8.12	1.67	32.83	7.38	77.19	3.11	10.75	58.31	91.78	84.16	NA	21.73	52.55
SLC45A1	6.49	15.94	16.90	NA	7.35	44.99	6.01	25.26	17.80	29.69	43.89	31.03	14.48	NA
TMEM59L	5.64	8.63	2.60	NA	3.22	0.39	0.34	64.23	51.56	89.96	NA	NA	27.25	12.42
CEL44	10.80	2.67	3.73	NA	2.42	2.20	5.65	66.09	58.01	NA	16.83	NA	NA	6.69
PPP1R14A	12.80	18.72	33.89	NA	3.81	18.21	26.93	8.37	14.96	20.45	53.93	41.13	5.07	NA
BSN	1.01	3.56	1.72	85.71	5.58	9.13	0.56	75.36	NA	NA	71.29	NA	NA	28.34
DISP2	9.48	15.06	12.37	NA	1.30	12.12	1.33	31.54	71.56	NA	83.17	NA	80.42	38.99
PBX3	36.93	23.43	75.64	22.30	90.80	18.91	43.92	4.62	0.34	63.52	53.04	NA	4.11	10.50
CACNB2	18.87	1.72	9.60	NA	5.67	65.67	3.15	30.17	NA	21.01	NA	6.43	3.63	NA
LRRTM1	10.21	1.68	9.84	63.98	14.62	92.11	3.91	34.98	88.99	NA	20.94	31.65	NA	16.13
SLC12A5	0.71	0.96	1.12	86.48	1.57	0.53	0.54	NA	NA	NA	NA	NA	NA	75.48
SLC25A13	14.06	43.00	48.95	NA	21.67	1.26	7.49	6.77	22.55	16.54	62.08	49.77	16.66	24.21
LHFPL4	0.76	2.61	2.81	NA	1.59	75.02	2.01	61.69	NA	NA	NA	NA	NA	30.57
LRFN5	3.00	19.42	14.22	93.66	7.32	4.02	1.94	19.06	49.93	NA	NA	NA	NA	76.75
MDFIC	26.89	32.44	51.61	5.35	45.10	7.35	65.51	38.68	56.82	NA	NA	88.91	24.97	77.19
ARHGAP15	45.73	31.50	37.12	NA	16.91	30.26	60.38	11.43	NA	NA	6.62	1.71	NA	19.63
ADGRB2	9.50	11.47	2.01	NA	62.43	29.03	5.74	47.70	92.11	64.18	49.60	61.47	43.75	NA
TENM2	4.99	9.55	19.57	NA	8.62	21.00	3.61	NA	NA	53.08	90.08	63.70	NA	NA
TRPS1	NA	NA	19.55	0.22	NA	83.27	51.35	13.68	9.19	NA	66.94	55.60	1.79	20.85
AB2	47.45	14.60	30.98	79.57	70.45	72.80	37.63	25.33	1.88	54.89	62.64	78.18	3.70	12.17
CAMKV	6.62	1.64	0.80	NA	9.63	12.83	1.05	NA	NA	NA	NA	NA	NA	NA
GPR158	1.44	1.95	13.10	19.92	49.56	82.13	17.84	NA	NA	NA	NA	NA	NA	62.10
MEF2C	4.76	61.05	7.70	NA	NA	21.12	68.84	22.50	82.01	0.86	55.47	45.03	17.36	67.28
WDR12	6.89	8.93	53.00	NA	2.19	89.52	6.64	82.84	87.83	3.01	NA	40.77	74.50	NA
STAG1	45.61	45.59	38.87	5.88	NA	NA	21.82	NA	NA	NA	5.69	2.64	30.57	10.14
DYNLT5	65.23	5.86	4.18	13.26	12.23	14.98	9.08	NA	NA	NA	47.26	19.42	80.16	36.74
ADCY2	NA	43.44	3.96	2.43	NA	0.14	30.00	12.20	12.51	23.56	NA	NA	33.20	65.55
HHPH	10.04	5.06	1.66	NA	6.13	74.01	30.44	NA	95.57	NA	46.48	34.95	21.18	NA
FOXP2	81.58	23.91	98.57	76.10	NA	99.56	NA	42.01	24.39	62.91	34.82	26.70	5.01	12.96
GYGI	56.23	NA	85.07	73.90	NA	70.75	NA	6.20	16.07	28.04	8.57	1.51	5.23	3.33
EFEMP1	NA	NA	22.62	6.29	NA	17.01	68.81	77.77	NA	18.92	NA	4.56	67.31	NA
CNTNAP2	2.38	17.76	4.36	NA	NA	15.19	12.54	NA	NA	87.99	NA	NA	NA	NA
CDH8	2.36	1.35	16.68	NA	53.66	50.52	10.93	NA	NA	NA	NA	NA	NA	NA
PDP1	8.30	5.45	10.10	NA	43.44	35.15	16.61	NA	NA	NA	NA	77.85	NA	NA
COL6A1	NA	46.22	46.22	48.26	62.01	22.25	68.72	0.96	1.54	0.96	NA	NA	0.58	NA
ELAVL2	6.31	34.37	3.65	NA	20.41	6.79	20.40	NA	NA	NA	NA	NA	NA	NA
BMPR1B	NA	NA	0.73	1.66	NA	0.41	5.84	NA	NA	97.68	66.92	NA	95.37	67.58
CCKBR	10.39	11.57	4.53	NA	68.10	NA	6.02	NA	NA	NA	NA	NA	10.44	NA
PHETA1	71.65	33.98	47.49	60.65	NA	83.54	NA	1.06	10.80	NA	46.78	58.13	7.79	28.20
TSHZ3	38.31	84.10	85.48	NA	NA	33.65	NA	1.65	0.58	2.47	63.90	82.35	0.29	9.96
TCF4	NA	36.26	NA	NA	31.51	90.29	90.26	14.43	45.50	8.07	NA	2.95	24.20	44.95
KBDC1	16.92	79.25	9.27	NA	NA	8.49	9.36	82.59	95.14	NA	89.75	NA	73.90	68.79
ZBTB4	53.78	NA	NA	98.46	NA	84.88	85.25	26.29	0.67	47.62	24.69	29.67	7.44	11.39
ABO	74.71	39.18	50.33	NA	NA	44.64	84.98	6.16	8.92	NA	74.90	46.05	24.49	2.53
APOE	NA	NA	7.51	21.91	NA	42.87	6.74	94.99	NA	87.03	92.49	65.05	96.08	68.11
CLDN23	40.74	63.52	83.22	NA	85.97	60.51	85.29	4.39	16.62	NA	NA	NA	2.76	6.50
EP300	NA	19.40	NA	NA	NA	NA	NA	NA	11.57	NA	4.40	0.79	87.55	2.62
ESR1	82.12	NA	NA	2.71	NA	58.44	NA	46.57	NA	89.05	9.08	1.54	56.50	NA
RAB5B	77.20	NA	NA	NA	22.51	10.10	NA	14.69	NA	NA	0.91	0.90	64.81	13.98
FUT2	96.69	36.56	71.45	NA	98.58	86.03	79.19	12.21	5.06	NA	67.04	NA	2.45	1.82
GTDC1	44.38	76.93	NA	NA	9.97	4.63	NA	66.88	NA	45.01	NA	29.20	NA	46.88
PAX6	NA	NA	9.05	50.99	NA	22.18	9.55	NA	NA	NA	NA	NA	NA	NA
NFAT5	NA	48.32	NA	0.18	NA	NA	NA	NA	NA	5.56	NA	17.99	82.78	39.96
PIAS1	NA	NA	NA	11.66	NA	33.03	NA	NA	NA	NA	11.64	7.19	93.12	4.09
GALNT2	NA	86.52	52.53	NA	77.34	76.95	NA	43.98	NA	NA	6.44	6.30	15.96	NA
C6orf118	NA	1.53	2.32	NA	0.91	NA	6.60	NA	NA	NA	NA	NA	NA	NA
SLC9A3	98.57	NA	NA	NA	NA	96.11	98.60	7.75	41.62	99.34	95.03	NA	4.95	59.73

Supplementary Table 36. Details on the characteristics of GWAS datasets in this study.

Phenotype	Abbreviation	Data source	Total sample size	Ncase	Ncontrol	GWAS Catalog accession ID / Download website
Irritable bowel syndrome	IBS	Eijsbouts C., et al. Genome-wide analysis of 53,400 people with irritable bowel syndrome highlights shared genetic pathways with mood and anxiety disorders. <i>Nat Genet.</i> 2021 Nov;53(11):1543-1552. doi: 10.1038/s41588-021-00950-8	486,601	53,400	433,201	GCST90016564
Gastroesophageal reflux disease	GERD	An J., et al. Gastroesophageal reflux GWAS identifies risk loci that also associate with subsequent severe esophageal diseases. <i>Nat Commun.</i> 2019 Sep 16;10(1):4219. doi: 10.1038/s41467-019-11968-2	332,601	71,522	261,079	10.6084 / m9.figshare.8986589
Peptic ulcer	PU	Wu Y., et al. GWAS of peptic ulcer disease implicates <i>Helicobacter pylori</i> infection, other gastrointestinal disorders and depression. <i>Nat Commun.</i> 2021 Feb 19;12(1):1146. doi: 10.1038/s41467-021-21280-7	456,327	16,666	439,661	https://cns.genomics.com/content/data
Acute pancreatitis	AP	Bourgault J., et al. Proteome-wide Mendelian randomization identifies causal links between blood proteins and acute pancreatitis. <i>Gastroenterology.</i> 2023 May;164(6):953-965.e3. doi: 10.1053/j.gastro.2023.01.028	855,309	10,630	844,679	GCST90255375
Non-alcoholic fatty liver disease	NAFLD	Ghodsian N., et al. Electronic health record-based genome-wide meta-analysis provides insights on the genetic architecture of non-alcoholic fatty liver disease. <i>Cell Rep Med.</i> 2021 Nov 3;2(11):100437. doi: 10.1016/j.xcrm.2021.100437	778,614	8,434	770,180	GCST90091033
Appendicitis	APP	Dönertag HM., et al. Common genetic associations between age-related diseases. <i>Nat Aging.</i> 2021 Apr;1(4):400-412. doi: 10.1038/s43587-021-00051-5	484,598	4,089	480,509	GCST90038695
Colorectal cancer	CRC	Fernandez-Rozadilla C., et al. Describing colorectal cancer genetics through multi-omic analysis of 100,204 cases and 154,587 controls of European and east Asian ancestries. <i>Nat Genet.</i> 2023 Jan;55(1):89-99. doi: 10.1038/s41588-022-01222-2	185,616	78,473	107,143	GCST90255675
Inflammatory bowel disease	IBD	de Lange KM., et al. Genome-wide association study implicates immune activation of multiple integrin genes in inflammatory bowel disease. <i>Nat Genet.</i> 2017 Feb;49(2):256-261. doi: 10.1038/ng.3760	59,957	25,042	34,915	GCST004131
Crohn's disease	CD	de Lange KM., et al. Genome-wide association study implicates immune activation of multiple integrin genes in inflammatory bowel disease. <i>Nat Genet.</i> 2017 Feb;49(2):256-261. doi: 10.1038/ng.3761	40,266	12,194	28,072	GCST004132
Ulcerative colitis	UC	de Lange KM., et al. Genome-wide association study implicates immune activation of multiple integrin genes in inflammatory bowel disease. <i>Nat Genet.</i> 2017 Feb;49(2):256-261. doi: 10.1038/ng.3762	45,975	12,366	33,609	GCST004133
Stool frequency	SF	Bonfiglio F., et al. GWAS of stool frequency provides insights into gastrointestinal motility and irritable bowel syndrome. <i>Cell Genom.</i> 2021 Dec 8;1(3):None. doi: 10.1016/j.celgen.2021.100001	167,875			GCST90002250
Diverticular disease	DD	Schafmayer C., et al. Genome-wide association analysis of diverticular disease points towards neuromuscular, connective tissue and epithelial pathomechanisms. <i>Gut.</i> 2019 May;60(5):854-865. doi: 10.1136/gut.2018.317619	451,099	31,964	419,135	GCST008105
Gastritis-duodenitis	GD		407,065	28,941	378,124	https://www.leelabsa.org/resources
Cholelithiasis and cholecystitis	CL&CC		407,532	16,225	391,307	https://www.leelabsa.org/resources
Anxiety, panic disorder	ANX	Dönertag HM., et al. Common genetic associations between age-related diseases. <i>Nat Aging.</i> 2021 Apr;1(4):400-412. doi: 10.1038/s43587-021-00051-5	484,598	6,514	478,084	GCST90038651
Neuroticism	NE	Baselmans BML., et al. Multivariate genome-wide analyses of the well-being spectrum. <i>Nat Genet.</i> 2019 Mar;51(3):445-451. doi: 10.1038/s41588-018-0320-8	523,783			GCST007339
Major depressive disorder	MDD	McIntosh AM., et al. Genome-wide meta-analysis of depression identifies 102 independent variants and highlights the importance of the prefrontal brain regions. <i>Nat Neurosci.</i> 2019 Mar;22(3):343-352. doi: 10.1038/s41593-018-0326-7	670,955	170,756	500,199	https://pgc.unc.edu/for-researchers/download-results/
Depression	DEP	Thomas D Als., et al. Depression pathophysiology, risk prediction of recurrence and comorbid psychiatric disorders using genome-wide analyses. <i>Nat Med.</i> 2023 Jul;29(7):1832-1844. doi: 10.1038/s41591-023-02352-1	1,035,760	294,322	741,438	https://ipsytech.dk/en/research/downloads/
Schizophrenia	SCZ	Trubetskoy V., et al. Schizophrenia Working Group of the Psychiatric Genomics Consortium. Mapping genomic loci implicates genes and synaptic biology in schizophrenia. <i>Nature.</i> 2022 Apr;604(7906):502-508. doi: 10.1038/s41586-022-02722-2	320,404	76,755	243,649	https://pgc.unc.edu/for-researchers/download-results/
Attention-deficit hyperactivity disorder	ADHD	Demontis D., et al. Genome-wide analyses of ADHD identify 27 risk loci, refine the genetic architecture and implicate several cognitive domains. <i>Nat Genet.</i> 2023 Feb;55(2):198-208. doi: 10.1038/s41588-022-01285-8	225,534	38,691	186,843	https://pgc.unc.edu/for-researchers/download-results/
Autism spectrum disorder	ASD	Grove J., et al. Identification of common genetic risk variants for autism spectrum disorder. <i>Nat Genet.</i> 2019 Mar;51(3):431-444. doi: 10.1038/s41588-019-0344-8	46,350	18,381	27,969	https://pgc.unc.edu/for-researchers/download-results/
Bipolar disorder	BIP	Mullins N., et al. Genome-wide association study of more than 40,000 bipolar disorder cases provides new insights into the underlying biology. <i>Nat Genet.</i> 2021 Jun;53(6):817-829. doi: 10.1038/s41588-021-00857-4	413,466	41,917	371,549	https://pgc.unc.edu/for-researchers/download-results/
Post traumatic stress disorder	PTSD	Nievergelt CM., et al. International meta-analysis of PTSD genome-wide association studies identifies sex- and ancestry-specific genetic risk loci. <i>Nat Commun.</i> 2019 Oct 8;10(1):4558. doi: 10.1038/s41467-019-12576-w	206,655	32,428	174,227	https://pgc.unc.edu/for-researchers/download-results/
Anorexia nervosa	AN	Watson HJ., et al. Genome-wide association study identifies eight risk loci and implicates metabo-psychiatric origins for anorexia nervosa. <i>Nat Genet.</i> 2019 Aug;51(8):1207-1214. doi: 10.1038/s41588-019-0439-2	72,517	16,992	55,525	https://pgc.unc.edu/for-researchers/download-results/



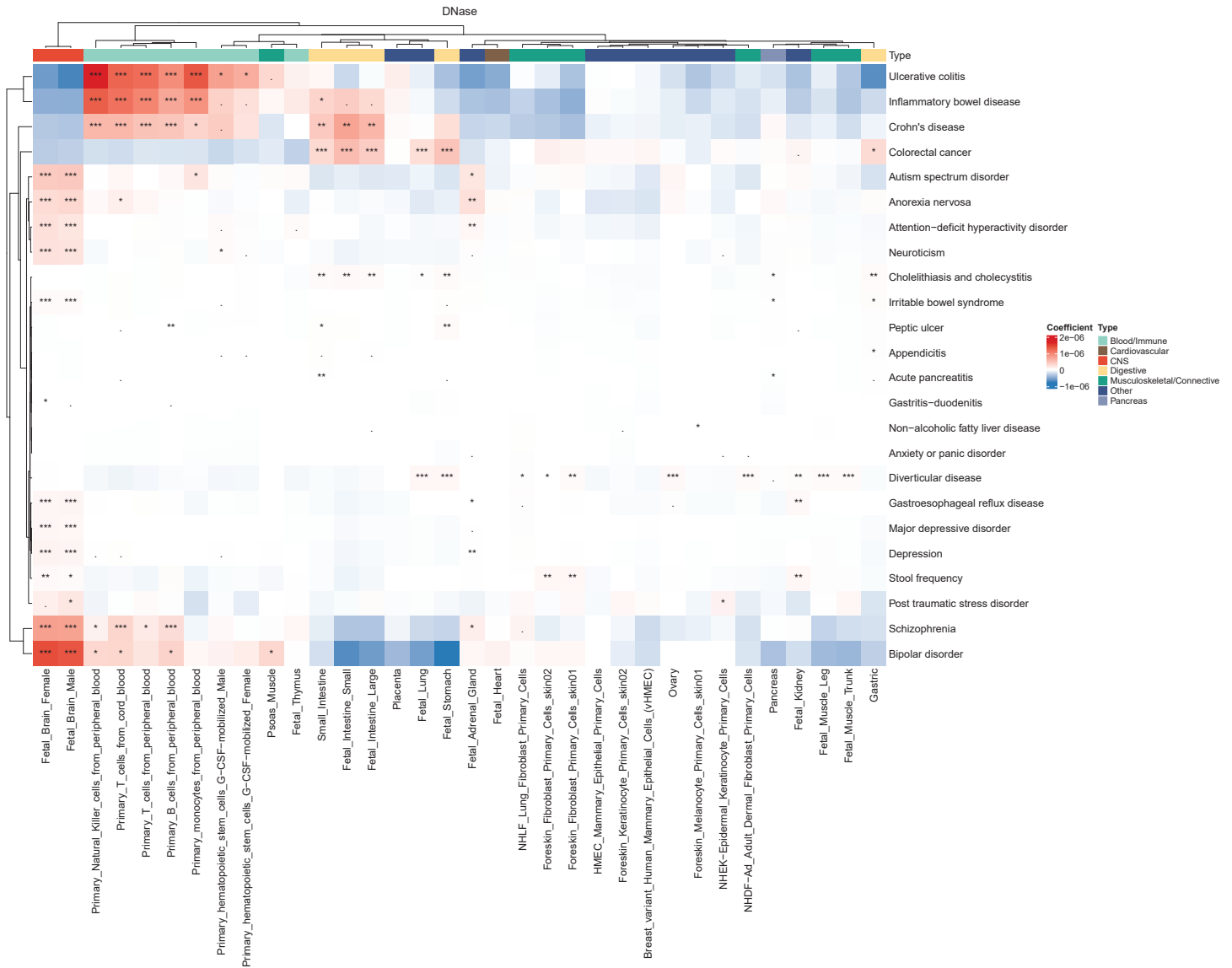
Supplementary Figure 1. The overview of the study.

A**B****C**

Supplementary Figure 2. Local genetic correlations among psychiatric disorders and digestive conditions.

(A) Manhattan plot showing the estimates of local genetic correlation, genetic covariance, and SNP heritability between IBS and DEP. (B) Manhattan plot showing the estimates of local genetic correlation, genetic covariance, and SNP heritability between GERD and GD in Europeans. (C) Manhattan plot showing the estimates of local genetic correlation, genetic covariance, and SNP heritability between IBS and GERD in Europeans. Red bars represent loci showing significant local genetic correlation after multiple testing adjustment. GERD, gastroesophageal reflux disease; IBS, irritable bowel syndrome; DEP, depression; GD, gastritis-duodenitis.

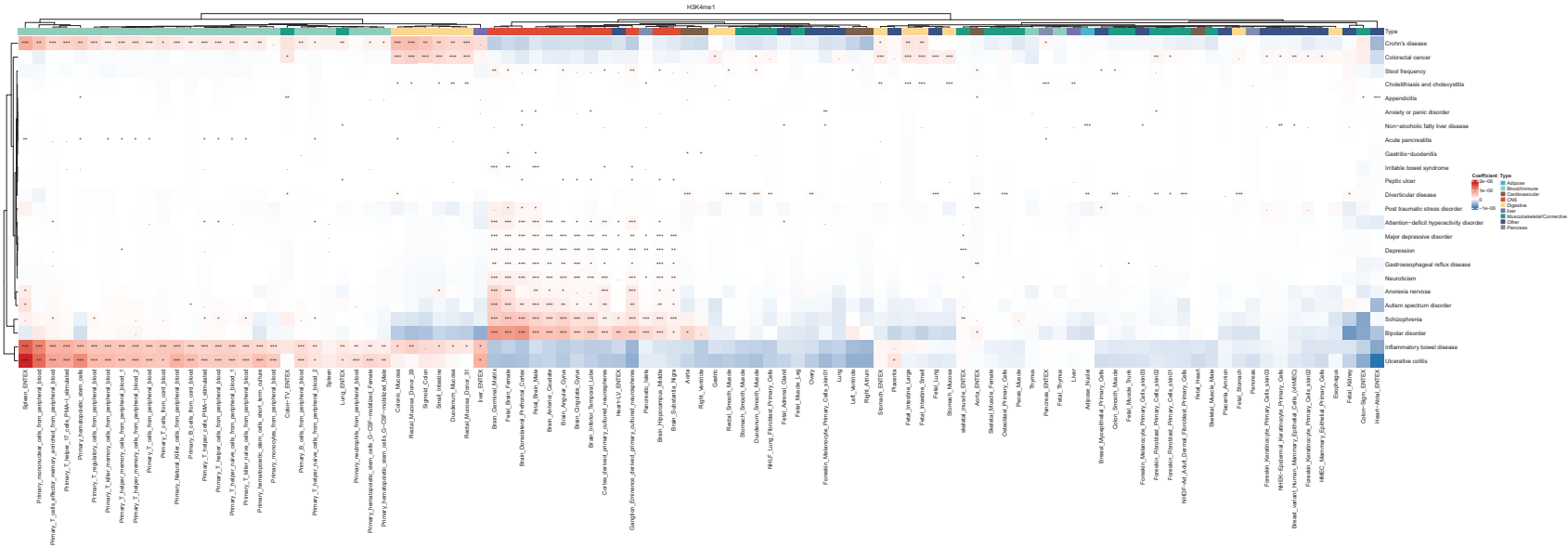
Supplementary Figure 3

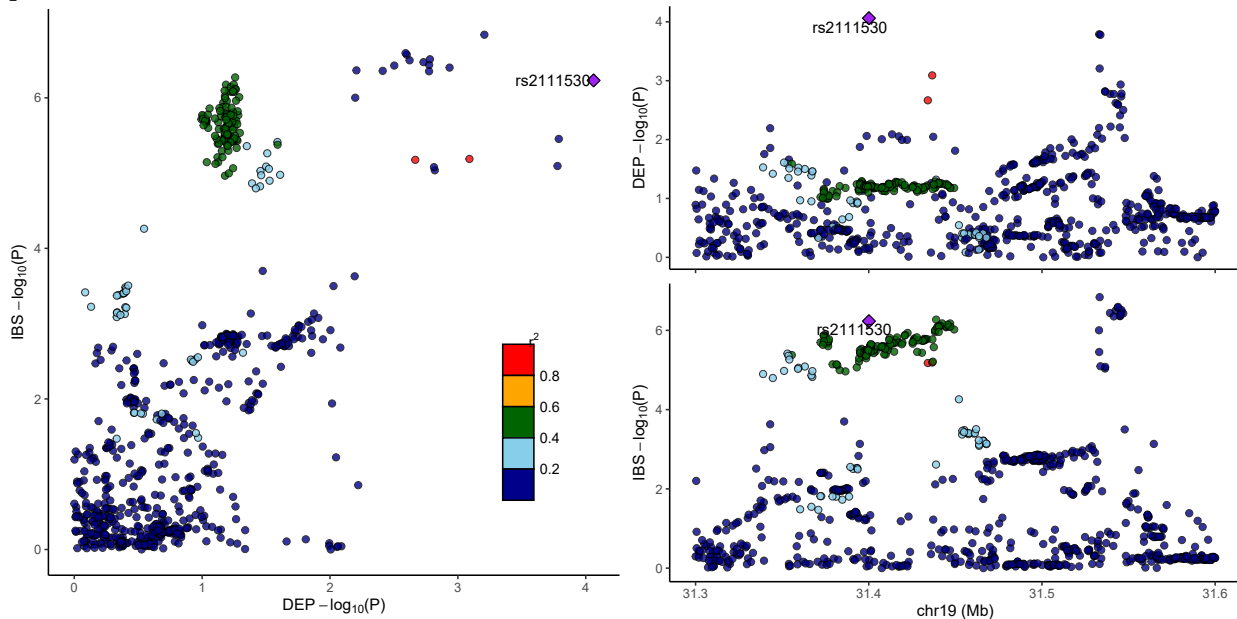
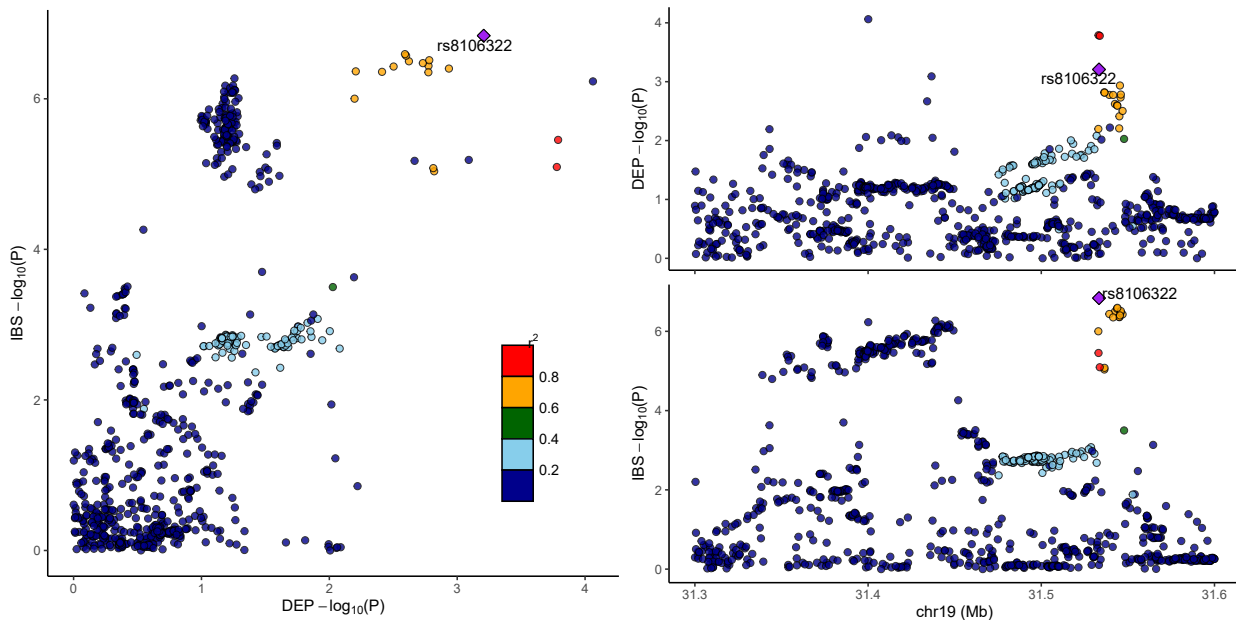


Supplementary Figure 3-8. Cell-type-specific enrichment of SNP heritability.

Heat maps showing patterns of cell-type-specific enrichments of SNP-heritability for genetically associated traits across 88 cell types- or tissues-specific annotations. Each checkered rectangle reflects the z-score, scaled by traits. Red indicates enrichment, blue indicates depletion. Deeper color represents stronger magnitude of effects. Asterisks represent statistical significance. The category of cell-types is color coded to the left. S3) DNase (DNase I hypersensitive sites), S4) H3K4me1, S5) H3K4me3, S6) H3K9ac, S7) H3K27ac, and S8) H3K36me3.

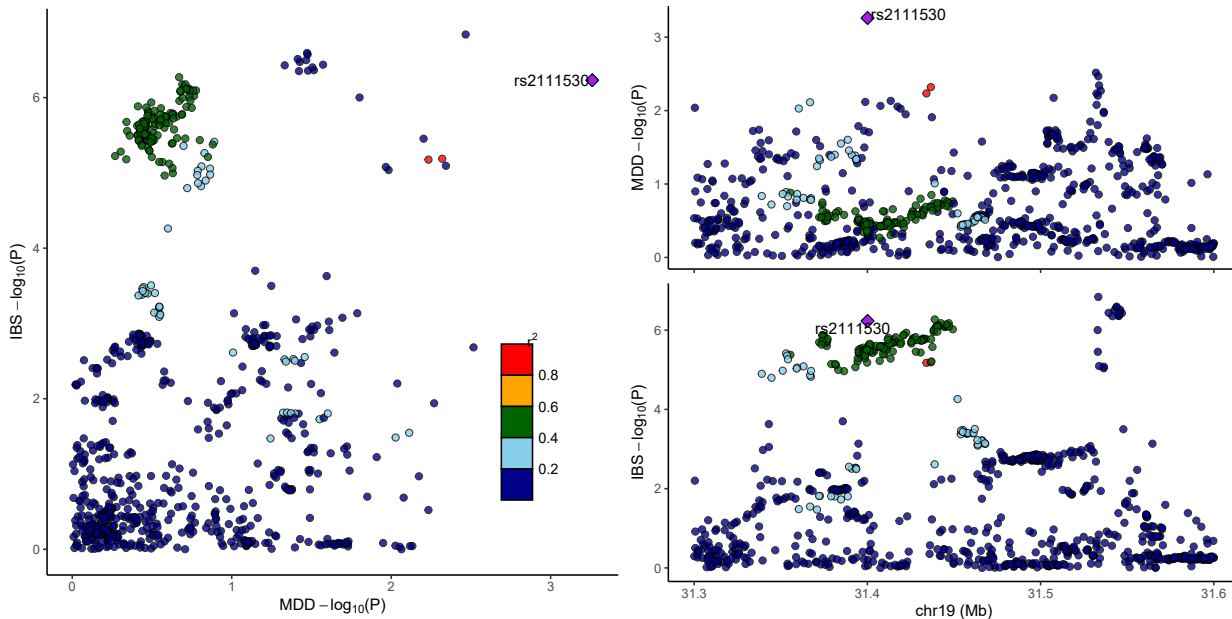
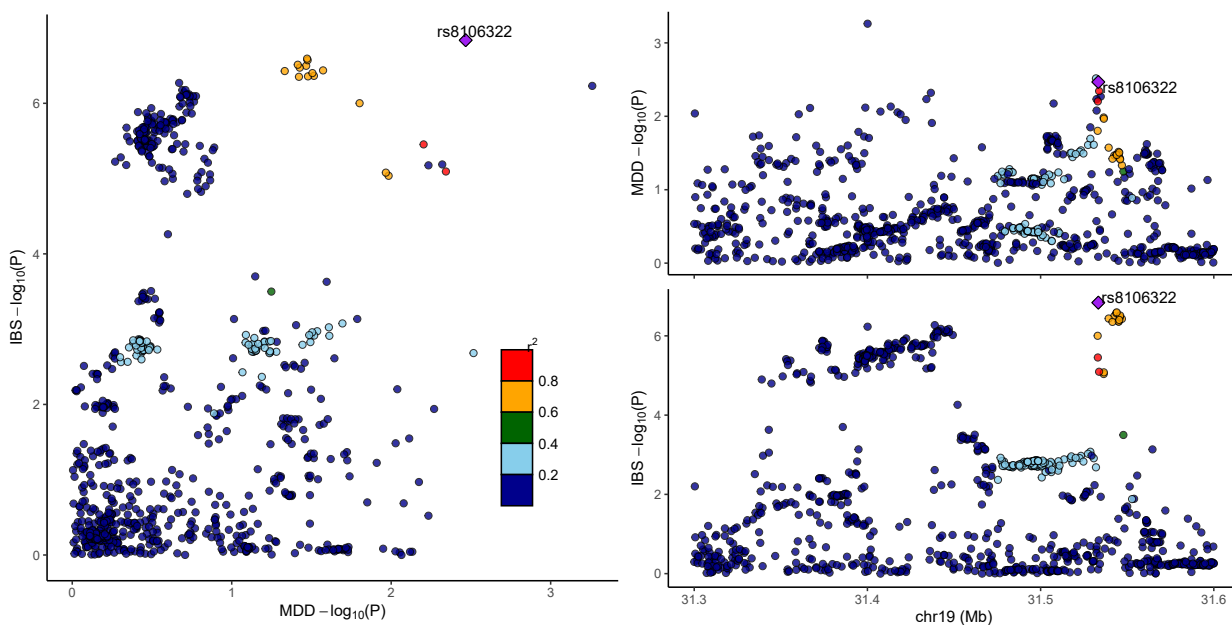
Supplementary Figure 4



A**B**

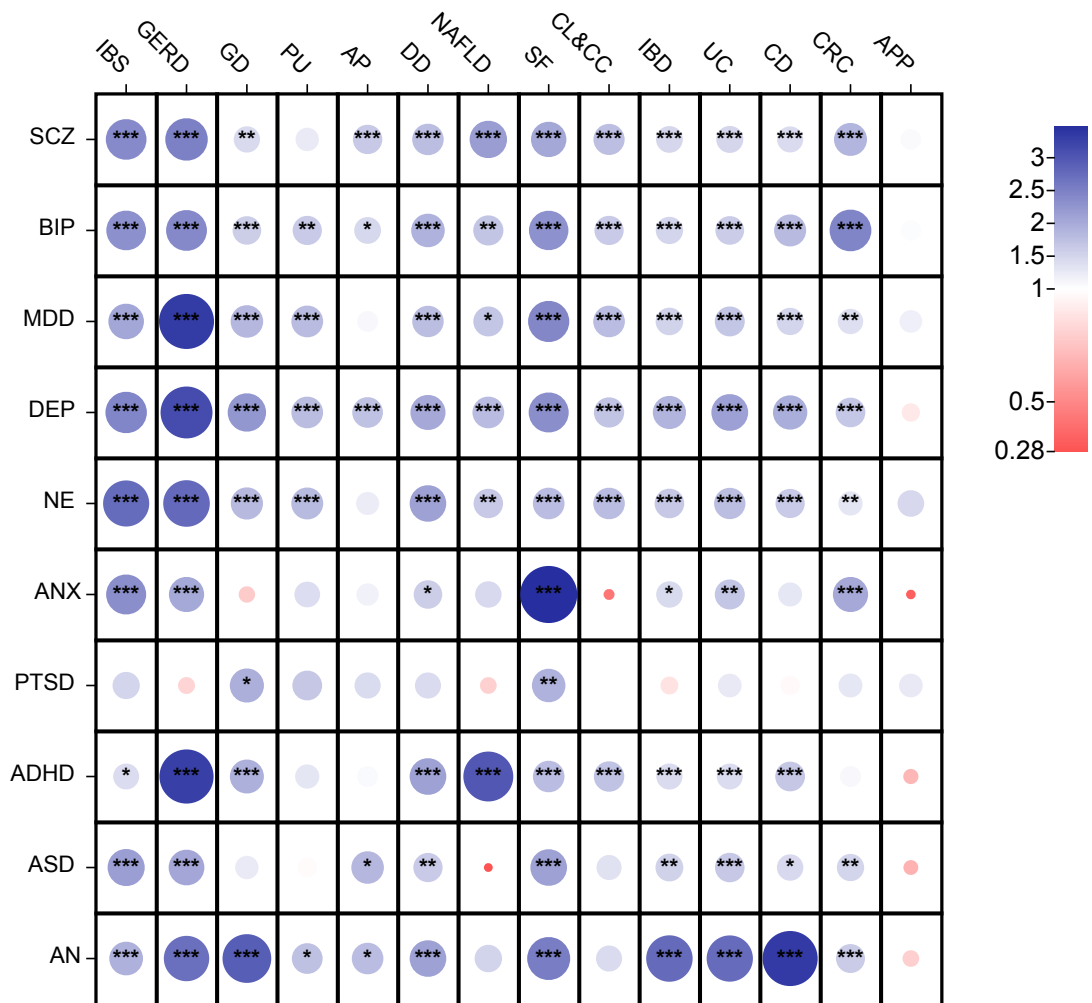
Supplementary Figure 9. The regional plots near rs2111530 (A) and rs8106322 (B) for IBS and DEP using LocusZoom.

(A) novel locus rs2111530 in IBS and DEP. (B) novel locus rs8106322 in IBS and DEP. Purple diamond indicates the lead SNP, and circles represent the other SNPs in the region, with coloring from the linkage disequilibrium (r^2 , based on the 1000 Genomes Project Europeans) between each SNP and the lead SNP. IBS, irritable bowel syndrome; DEP, depression.

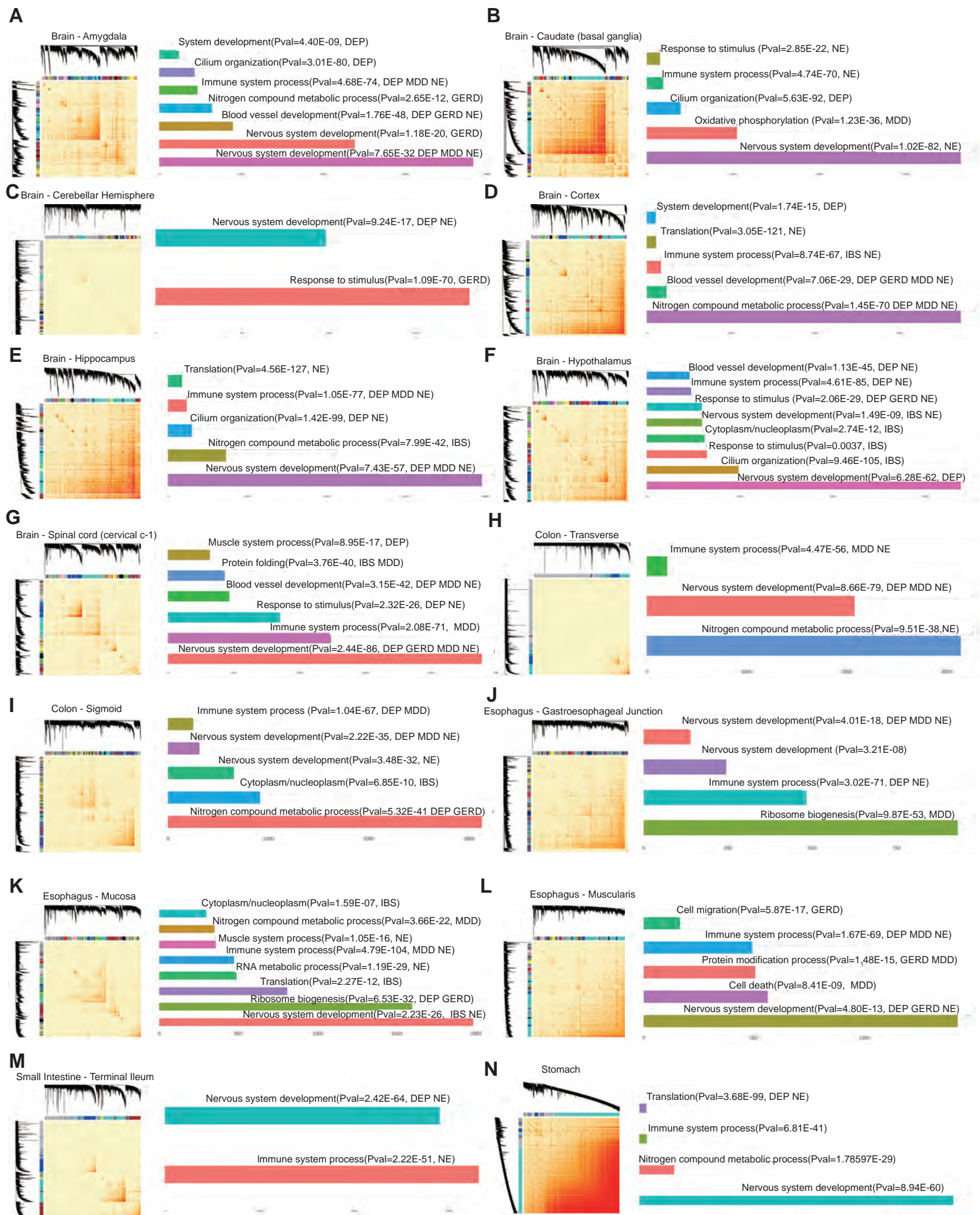
A**B**

Supplementary Figure 10. The regional plots near rs2111530 (A) and rs8106322 (B) for IBS and MDD using LocusZoom.

(A) novel locus rs2111530 in IBS and DEP. (B) novel locus rs8106322 in IBS and MDD. Purple diamond indicates the lead SNP, and circles represent the other SNPs in the region, with coloring from the linkage disequilibrium (r^2 , based on the 1000 Genomes Project Europeans) between each SNP and the lead SNP. IBS, irritable bowel syndrome; MDD, major depressive disorder.



Supplementary Figure 11. Gene set enrichment analysis of the overlapping genes detected by MAGMA between ten psychiatric disorders and 14 Digestive Diseases. Gene set enrichment of the overlapping genes between trait-pairs is evaluated by Fisher's Exact test, with significant enrichment marked by an asterisk (FDR < 0.05). The shading of each circle indicates a enrichment (blue) or depletion (red), with the intensity of the shading varying according to the magnitude of OR value. *FDR < 0.05, **FDR < 0.01, ***FDR < 0.001 .



Supplementary Figure 12. Topological overlap matrix (TOM) plots for seven brain tissues and seven digestive tract tissues.

The color bars at the right side of each plot show module color and size with their enriched GO functions and enriched disorders/diseases. The most closely related three psychiatric disorders and three digestive disorders selected based on genetic correlation analysis. The scale at the bottom right of each plot represents the module size. GO terms' p-values are shown in parentheses.