

附表 1 转录组测序数据质控分析

Supplementary Table 1: Quality Control Analysis of Transcriptome Sequencing Data

样本	原始 reads	质控后 reads	Q20	Q30
Sample	Original reads	Read after QC		
B_1	46546034	46470152	97.24%	93.21%
B_2	50149000	50069458	97.35%	93.44%
B_3	49908850	49840102	96.99%	92.90%
B_4	43773616	43705322	97.06%	93.02%
B_5	46739880	46672374	97.37%	93.45%
B_6	43925938	43863912	97.23%	93.21%
W_1	46151516	46084560	97.17%	92.99%
W_2	53158390	53086296	97.40%	93.55%
W_3	41088596	41035366	96.82%	92.38%
W_4	45351482	45285124	96.75%	92.28%
W_5	43159950	43095424	97.17%	93.03%
W_6	56052112	55965948	97.30%	93.30%

附表 2 GWAS 显著位点注释基因

Supplementary Table 2. Genes annotated to significant GWAS loci

基因区间	Gene location	功能注释	Function annotation
1:24454999:24463332		含锚蛋白重复结构域蛋白 26	ankyrin repeat domain 26
1:24508686:24515241		U6 小核 RNA 相关的 LSM8 同源蛋白	LSM8 homolog, U6 small nuclear RNA associated
1:24635651:24678905		皮质肌动蛋白结合蛋白 2	cortactin binding protein 2
1:24715305:24799300		囊性纤维化跨膜传导调节蛋白	cystic fibrosis transmembrane conductance regulator
1:24818867:24855571		含锚蛋白重复、SAM 及碱性亮氨酸拉链结构域蛋白 1	ankyrin repeat, SAM and basic leucine zipper domain containing 1
1:24859746:24866915		Wnt 家族成员 2	Wnt family member 2
1:24879187:24936329		肿瘤发生抑制蛋白 7	suppression of tumorigenicity 7
1:25027649:25056220		肌肉 Z 线 α 2 亚基肌动蛋白封端蛋白	capping actin protein of muscle Z-line alpha subunit 2
1:25079168:25148274		MET 原癌基因受体型酪氨酸激酶	MET proto-oncogene, receptor tyrosine kinase
1:25212408:25229141		小窝蛋白 1	caveolin 1
1:25235364:25244372		小窝蛋白 2	caveolin 2
1:25329453:25352055		Testin LIM 结构域蛋白	testin LIM domain protein
1:25443391:25505442		转录因子 EC	transcription factor EC
1:25919822:25968465		含 MyoD 家族抑制结构域蛋白	MyoD family inhibitor domain containing
1:184992117:185022735		Mastermind 样转录共激活因子 2	mastermind like transcriptional coactivator 2
1:185045272:185101631		肌小管蛋白相关蛋白 2	myotubularin related protein 2
1:185112897:185127118		中心体蛋白 57	centrosomal protein 57
1:185127728:185133523		序列相似性家族 76 成员 B	family with sequence similarity 76 member B
1:185304684:185319443		Sestrin 蛋白 3	sestrin 3

1:185328663:185337875	内含切核酸酶结构域蛋白 1 endonuclease domain containing 1
1:185351022:185368166	剪接体相关蛋白 CWC15 同源蛋白 CWC15 spliceosome associated protein homolog
1:185381925:185434275	血管运动蛋白样 1 angiotensin like 1
1:185487140:185488210	岩藻糖基转移酶 4 fucosyltransferase 4
1:185495934:185500705	11 号染色体开放阅读框 97 chromosome 11 open reading frame 97
1:185501994:185504319	含锚蛋白重复结构域蛋白 49 ankyrin repeat domain 49
1:185504504:185524330	MRE11 同源双链断裂修复核酸酶 MRE11 homolog, double strand break repair nuclease
1:185527340:185533770	G 蛋白偶联受体 83 G protein-coupled receptor 83
1:185561485:185570051	潘通道蛋白 1 pannexin 1
1:185573678:185603709	Hephaestin 样蛋白 1 hephaestin like 1
1:185616737:185633119	跨膜 4L 六家族成员 1A transmembrane 4 L six family member 1a
1:185658125:185670453	含 V-set 及跨膜结构域蛋白 5 V-set and transmembrane domain containing 5
1:185665533:185679690	介导子复合体亚基 17 mediator complex subunit 17
1:185680680:185689143	11 号染色体开放阅读框 54 同源蛋白 C11orf54 homolog
1:185689308:185692783	TATA 盒结合蛋白相关因子 RNA 聚合酶 I 亚基 D TATA-box binding protein associated factor, RNA polymerase I subunit D
1:185700813:185740587	中心体蛋白 295 centrosomal protein 295
1:185787824:185794046	含卷曲螺旋结构域的单跨膜蛋白 4 single-pass membrane protein with coiled-coil domains 4
1:185800908:185846578	去中心体组装蛋白 1 deuterosome assembly protein 1
1:185909023:185979184	溶质载体家族 36 成员 4 solute carrier family 36 member 4
1:186097788:186118266	褪黑素受体 1B melatonin receptor 1B
1:186249024:186593866	FAT 非典型钙黏蛋白 3 FAT atypical cadherin 3
5:7418414:7501609	TEA 结构域转录因子 1 TEA domain transcription factor 1
5:7593432:7621347	α -帕文蛋白 parvin alpha
5:7700176:7772777	微管相关单加氧酶、calponin 及 LIM 结构域蛋白 2 microtubule associated monooxygenase, calponin and LIM domain containing 2
5:7811332:7834266	Dickkopf WNT 信号通路抑制因子 3 dickkopf WNT signaling pathway inhibitor 3
5:7837035:7888837	泛素特异性肽酶 47 ubiquitin specific peptidase 47
5:8052564:8190966	多肽 N-乙酰半乳糖胺转移酶 18 polypeptide N-acetylgalactosaminyltransferase 18
5:8424856:8436057	真核翻译起始因子 4 γ 2 eukaryotic translation initiation factor 4 gamma 2
5:8450158:8468644	CTR9 同源蛋白, Paf1/RNA 聚合酶 II 复合物组分 CTR9 homolog, Paf1/RNA polymerase II complex component
5:8521803:8559278	肌醇 1,4,5-三磷酸受体相关蛋白 1 inositol 1,4,5-triphosphate receptor associated 1
5:8562871:8573459	淋巴管内皮透明质酸受体 1 lymphatic vessel endothelial hyaluronan receptor 1
5:8575207:8586405	环指蛋白 141 ring finger protein 141
5:8593520:8615753	腺苷一磷酸脱氨酶 3 adenosine monophosphate deaminase 3
5:8654784:8655750	肾上腺髓质素 adrenomedullin
5:8662383:8801766	SET 结合因子 2 SET binding factor 2
5:8948083:8976227	B 细胞转换复合物亚基 SWAP70 switching B cell complex subunit SWAP70
5:8988938:8994892	WEE1 G2 期检查点激酶 WEE1 G2 checkpoint kinase
5:9002117:9025991	锌指蛋白 143 zinc finger protein 143
5:9036556:9069532	导入蛋白 7 importin 7

5:9083526:9091756	跨膜蛋白 41B transmembrane protein 41B
5:9109786:9152177	含 DENN 结构域蛋白 5A DENN domain containing 5A
5:9159362:9193924	含信号肽、CUB 及 EGF 样结构域蛋白 2 signal peptide, CUB domain and EGF like domain containing 2
34:16155:19868	Wnt 家族成员 1 Wnt family member 1
34:23713:28107	ADP 核糖基化因子 3 ADP ribosylation factor 3
34:29692:32517	FK506 结合蛋白 11 FK506 binding protein 11
34:31902:35539	含卷曲螺旋结构域蛋白 65 coiled-coil domain containing 65
34:40427:55225	DEAD 盒解旋酶 23 DEAD-box helicase 23
34:45784:48407	Rho 家族 GTP 酶 1 Rho family GTPase 1
34:55266:61406	ENSGALG00010022767
34:66548:82901	腺苷酸环化酶 6 adenylate cyclase 6
34:83265:91649	细胞周期蛋白 T1 cyclin T1
34:92409:102318	KAT8 调控 NSL 复合体亚基 2 KAT8 regulatory NSL complex subunit 2
34:113658:116409	含跨膜 BAX 抑制基序蛋白 6 transmembrane BAX inhibitor motif containing 6
34:143158:146355	自噬相关蛋白 101 autophagy related 101
34:149610:154574	核受体亚家族 4A 组成员 1 nuclear receptor subfamily 4 group A member 1
34:158812:165435	磷脂酰肌醇通用受体 1 相关支架蛋白 general receptor for phosphoinositides 1 associated scaffold protein
34:168652:176498	激活素 A 受体 1B 型 activin A receptor type 1B
34:184073:191708	激活素 A 受体样 1 型 activin A receptor like type 1
34:227387:232584	Fidgetin 样蛋白 2 fidgetin like 2
34:239586:271551	钠电压门控通道 α 亚基 8 sodium voltage-gated channel alpha subunit 8
34:293591:295641	甲基转移酶样 7A methyltransferase like 7A
34:296130:300413	跨膜丝氨酸蛋白酶 12 transmembrane serine protease 12
34:300927:313804	激活转录因子 1 activating transcription factor 1
34:317741:377676	Disco 相互作用蛋白 2 同源蛋白 B disco interacting protein 2 homolog B
34:382516:394091	La 核糖核蛋白结构域家族成员 4 La ribonucleoprotein domain family member 4
34:406505:430642	LIM 结构域与肌动蛋白结合蛋白 1 LIM domain and actin binding 1
34:432311:450634	神经酰胺合成酶 5 ceramide synthase 5
34:451482:451640	细胞色素 c 氧化酶装配因子 COX14 COX14, cytochrome c oxidase assembly factor
34:454743:458081	甘油-3-磷酸脱氢酶 1 glycerol-3-phosphate dehydrogenase 1
34:458875:465939	SWI/SNF 相关、基质结合、肌动蛋白依赖性染色质调控因子亚家族 D 成员 1 SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily d, member 1
34:469266:475567	酸敏感离子通道亚基 1 acid sensing ion channel subunit 1
34:500559:507037	Rac GTP 酶激活蛋白 1 Rac GTPase activating protein 1
34:542160:582725	组蛋白去乙酰化酶 7 histone deacetylase 7
34:583611:589337	Twist 同源蛋白 3 Twist homlog 3
34:602180:612681	溶质载体家族 48 成员 1 solute carrier family 48 member 1
34:625759:635457	Rap 鸟苷酸交换因子 3 Rap guanine nucleotide exchange factor 3
34:637827:644511	多聚 U 特异性内切核酸酶 endonuclease, poly(U) specific
34:653065:659325	神经元分化蛋白 4 neuronal differentiation 4
34:671098:679860	胸腺细胞表达、正选择相关蛋白 1 thymocyte expressed, positive selection associated 1

34:683994:690582	蛋白磷酸酶 1 调控抑制亚基 1A protein phosphatase 1 regulatory inhibitor subunit 1A
34:693424:702611	磷酸二酯酶 1B phosphodiesterase 1B
34:708239:716946	NCK 相关蛋白 1 样 NCK associated protein 1 like
34:717942:719572	配子体特异因子 2 gametocyte specific factor 2
34:726765:741507	整合素 α 5 亚基 integrin subunit alpha 5
34:746438:749817	锌指蛋白 385A zinc finger protein 385A
34:751560:756004	被覆蛋白复合体 ζ 1 亚基 coatomer protein complex subunit zeta 1
34:758668:761523	红系核因子 2 nuclear factor, erythroid 2
34:762566:768226	异质核糖核蛋白 A1 heterogeneous nuclear ribonucleoprotein A1
34:768614:773977	染色质盒蛋白 5 chromobox 5
34:774939:778263	单链选择性单功能尿嘧啶 DNA 糖基化酶 1 single-strand-selective monofunctional uracil-DNA glycosylase 1
34:833220:836368	同源盒蛋白 C8 homeobox C8
34:844446:847613	同源盒蛋白 C9 homeobox C9
34:858026:862817	同源盒蛋白 C10 homeobox C10
34:872764:876520	同源盒蛋白 C11 homeobox C11
34:894619:896519	同源盒蛋白 C12 homeobox C12
34:905545:909448	同源盒蛋白 C13 homeobox C13
34:966075:967853	ATP 合酶 H ⁺ 转运线粒体 Fo 复合体 C2 亚基 ATP synthase, H ⁺ transporting, mitochondrial Fo complex subunit C2 (subunit 9)
34:968527:1013491	激活转录因子 7 activating transcription factor 7
34:1015578:1016445	神经肽 FF 酰胺前体 neuropeptide FF-amide peptide precursor
34:1016669:1021559	TARBP2 RISC 加载复合体 RNA 结合亚基 TARBP2, RISC loading complex RNA binding subunit
34:1023123:1032763	丝裂原活化蛋白激酶激酶激酶 12 mitogen-activated protein kinase kinase kinase 12
34:1033629:1048101	多聚 rC 结合蛋白 2 poly(rC) binding protein 2
34:1049885:1055219	抗穆勒管激素受体 2 型 anti-Mullerian hormone receptor type 2
34:1058714:1071033	Sp1 转录因子 Sp1 transcription factor
34:1088326:1094513	Aladin WD 重复核孔蛋白 aladin WD repeat nucleoporin
34:1095715:1098405	12 号染色体开放阅读框 10 同源蛋白 C12orf10 homolog
34:1098816:1115112	维生素 D 受体 vitamin D (1,25- dihydroxyvitamin D3) receptor
34:1132709:1138644	跨膜蛋白 106C transmembrane protein 106C
34:1153957:1166580	SUMO 特异性肽酶 1 SUMO specific peptidase 1
34:1167842:1174134	磷酸果糖激酶肌肉型 phosphofructokinase, muscle
34:1175351:1177400	含锚蛋白重复及 SOCS 盒蛋白 8 ankyrin repeat and SOCS box containing 8
34:1184988:1187690	预折叠蛋白亚基 5 prefoldin subunit 5
34:1188013:1198529	纺锤体极体样蛋白 1 separase extra spindle pole bodies like 1, separase
34:1205495:1209769	半胱氨酸酸脱羧酶 cysteine acid decarboxylase
34:1210595:1214408	锌指蛋白 740 zinc finger protein 740
34:1223170:1228865	ENSGALG00010024607
34:1231493:1234074	主要易化子超家族结构域蛋白 5 major facilitator superfamily domain containing 5
34:1236623:1240247	含 SPRY 结构域蛋白 3 SPRY domain containing 3
34:1240496:1251056	张力蛋白 2 tensin 2

34:1256271:1260303	AMP 活化蛋白激酶非催化 γ 1 亚基 protein kinase AMP-activated non-catalytic subunit gamma 1
34:1261960:1289951	赖氨酸甲基转移酶 2D lysine methyltransferase 2D
34:1293102:1296778	沙漠刺猬蛋白 desert hedgehog
34:1298306:1302199	肢体发育膜蛋白 1 样 limb development membrane protein 1 like
34:1313147:1318468	α 微管蛋白 1a tubulin alpha 1a
34:1329600:1331734	PYM 同源蛋白 1 外显子连接复合体相关因子 PYM homolog 1, exon junction complex associated factor
34:1333879:1339430	二酰甘油激酶 α diacylglycerol kinase alpha
34:1339431:1345613	前黑素体蛋白 premelanosome protein
34:1344374:1346995	细胞周期依赖性激酶 2 cyclin dependent kinase 2
34:1349792:1352365	RAB5B RAS 致癌基因家族成员 RAB5B, member RAS oncogene family
34:1353075:1356282	亚硫酸盐氧化酶 sulfite oxidase
34:1362024:1369806	IKAROS 家族锌指蛋白 4 IKAROS family zinc finger 4
34:1372166:1373113	核糖体蛋白 S26 ribosomal protein S26
34:1373721:1390651	erb-b2 受体型酪氨酸激酶 3 erb-b2 receptor tyrosine kinase 3
34:1391541:1400815	增殖相关蛋白 2G4 38kDa proliferation-associated 2G4, 38kDa
34:1405207:1415609	扩展突触结合蛋白 1 extended synaptotagmin 1
34:1417080:1419946	肌球蛋白轻链 6 碱性 平滑肌及非肌 myosin, light chain 6, alkali, smooth muscle and non-muscle
34:1419993:1429087	SWI/SNF 相关、基质结合、肌动蛋白依赖性染色质调控因子亚家族 C 成员 2 SWI/SNF related, matrix associated, actin dependent regulator of chromatin subfamily c member 2
34:1430222:1439422	环指蛋白 41 ring finger protein 41
34:1439483:1442652	核酸结合蛋白 2 nucleic acid binding protein 2
34:1442504:1447711	溶质载体家族 39 成员 5 solute carrier family 39 member 5
34:1456854:1470971	含锚蛋白重复结构域蛋白 52 ankyrin repeat domain 52
34:1472740:1475103	辅酶 Q10A coenzyme Q10A
34:1475326:1480430	FGF 信号调控蛋白 canopy 2 canopy FGF signaling regulator 2
34:1481170:1483067	PAN2 多聚 A 特异性核糖核酸酶亚基 PAN2 poly(A) specific ribonuclease subunit
34:1483462:1493444	白细胞介素 23 α 亚基 interleukin 23 subunit alpha
34:1494917:1497030	信号转导与转录激活因子 2 signal transducer and activator of transcription 2
34:1496526:1501901	载脂蛋白 F apolipoprotein F
34:1502320:1503473	昼夜节律蛋白 Timeless timeless circadian clock
34:1503885:1510643	晶状体纤维主要内在蛋白 major intrinsic protein of lens fiber
34:1511408:1512968	RNA 结合基序单链相互作用蛋白 2 RNA binding motif single stranded interacting protein 2
34:1516896:1520245	溴结构域邻近锌指结构域蛋白 2A bromodomain adjacent to zinc finger domain 2A
34:1535845:1538504	ATP 合酶 H ⁺ 转运线粒体 F1 复合体 β 亚基 ATP synthase, H ⁺ transporting, mitochondrial F1 complex, beta polypeptide
34:1539620:1542588	前列腺素 E 合成酶 3 prostaglandin E synthase 3
34:1543054:1546936	新生多肽相关复合体 α 亚基 nascent polypeptide-associated complex alpha subunit
34:1550833:1561154	DNA 引物酶亚基 1 primase (DNA) subunit 1
34:1561392:1564316	视黄醇脱氢酶 16 retinol dehydrogenase 16 (all-trans)
34:1564432:1566500	G 蛋白偶联受体 182 G protein-coupled receptor 182
34:1574898:1577145	含锌指及 BTB 结构域蛋白 39 zinc finger and BTB domain containing 39
34:1577247:1582167	速激肽 3 tachykinin 3

34:1582552:1583268	肌球蛋白 IA myosin IA
34:1585797:1593549	核膜整合膜蛋白 1 nuclear envelope integral membrane protein 1
34:1593931:1598346	NGFI-A 结合蛋白 2 NGFI-A binding protein 2
34:1600696:1603706	信号转导与转录激活因子 6 signal transducer and activator of transcription 6
34:1604155:1611164	低密度脂蛋白受体相关蛋白 1 LDL receptor related protein 1
34:1615997:1684411	ENSGALG00010025368
34:1691001:1698640	含 R3H 结构域蛋白 2 R3H domain containing 2
34:1698442:1721326	ENSGALG00010025506
34:1731255:1733487	抑制素 β E 亚基 inhibin beta E subunit
34:1737848:1740586	GLI 家族锌指蛋白 1 GLI family zinc finger 1
34:1748385:1758616	DnaJ 热休克蛋白家族成员 C14 DnaJ heat shock protein family (Hsp40) member C14
34:1761554:1763102	ORMDL 鞘脂生物合成调控蛋白 2 ORMDL sphingolipid biosynthesis regulator 2
34:1763118:1765342	含 SAP 结构域核糖核蛋白 SAP domain containing ribonucleoprotein
34:1765577:1785740	生长分化因子 11 growth differentiation factor 11
34:1796174:1804738	肌醇多磷酸-1-磷酸酶 inositol polyphosphate-1-phosphatase
34:1805362:1809221	CD63 分子 CD63 molecule
34:1811962:1813746	视黄醇脱氢酶 5 retinol dehydrogenase 5
34:1814053:1817309	溶酶体细胞器生成复合体 1 亚基 1 biogenesis of lysosomal organelles complex 1 subunit 1
34:1817120:1818704	整合素 α 7 亚基 integrin subunit alpha 7
34:1821137:1835158	微球蛋白 1 microspherule protein 1
34:1835460:1838327	精子发生相关丝氨酸富集蛋白 2 spermatogenesis associated serine rich 2
34:1838387:1860171	DnaJ 热休克蛋白家族成员 C22 DnaJ heat shock protein family (Hsp40) member C22
34:1860873:1863236	补体 C1q 样蛋白 4 complement C1q like 4
34:1869514:1873966	周围神经蛋白 peripherin
34:1876894:1880089	真核翻译起始因子 4B eukaryotic translation initiation factor 4B
34:1888753:1892195	角蛋白 18 keratin 18
34:1895373:1903183	角蛋白 8 keratin 8
34:1906474:1916008	II 型细胞骨架角蛋白 75 样蛋白 1 keratin, type II cytoskeletal 75-like 1
34:1934286:1939482	II 型细胞骨架角蛋白 75 样蛋白 2 KRT75L1 keratin, type II cytoskeletal 75-like 2
34:1943344:1955843	II 型细胞骨架角蛋白 75 样蛋白 4 keratin, type II cytoskeletal 75-like 4
34:2014937:2022169	角蛋白 3 keratin 3
34:2025849:2031895	角蛋白 5 keratin 5
34:2035371:2042420	角蛋白 6A keratin 6A
34:2048052:2053176	角蛋白 75 keratin 75
34:2056921:2060552	角蛋白 7 keratin 7
34:2076464:2106966	角蛋白 80 keratin 80
34:2099676:2115202	含 BCDIN3 结构域 RNA 甲基转移酶 BCDIN3 domain containing RNA methyltransferase
34:2134047:2138547	Fas 凋亡抑制分子 2 Fas apoptotic inhibitory molecule 2
34:2141508:2158096	水通道蛋白 2 aquaporin 2
34:2169432:2175042	水通道蛋白 5 aquaporin 5
34:2183542:2186127	溶质载体家族 4 成员 8 solute carrier family 4 member 8

34:2204873:2224885	多肽 N-乙酰半乳糖胺转移酶 6 polypeptide N-acetylgalactosaminyltransferase 6
34:2239707:2256058	胰凝乳蛋白酶样弹性蛋白酶家族成员 1 chymotrypsin like elastase family member 1
34:2257769:2261472	桥联整合蛋白 2 bridging integrator 2
34:2263804:2271735	小细胞黏附糖蛋白 small cell adhesion glycoprotein
34:2272878:2277652	DAZ 相关蛋白 2 DAZ associated protein 2
34:2278733:2282164	POU 6 类同源盒蛋白 1 POU class 6 homeobox 1
34:2304363:2305766	转录因子 CP2 transcription factor CP2
34:2307437:2318288	半胱氨酸和丝氨酸富集核蛋白 2 cysteine and serine rich nuclear protein 2
34:2326262:2332602	ENSGALG00010023931
34:2335287:2346957	溶质载体家族 11 成员 2 solute carrier family 11 member 2
34:2365882:2401545	动力蛋白复合体亚基 2 dynactin subunit 2
34:2425927:2434014	ENSGALG00010023638
34:2435389:2466643	磷脂酰肌醇-5-磷酸 4-激酶 2 γ 型 phosphatidylinositol-5-phosphate 4-kinase type 2 gamma
34:2473227:2478352	ENSGALG00010023833