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Assessing the molecular genetics of attention networks

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family die ha e al lG hG n ha lGme *unaffected* fi deg ee ela i e lGf chi lG h enic a ien hG im ai ed e fGmance in a a lGf a di lG a en ilGn and lG king memlG [9]. Thi gge ha defici in a en ilGnal e fGmance ma dGn ib e lG he gene ic ce ibili lG liabili [10] lGf dGm le chia ic di lGde .

ClGn i en i h hi nG ilGn, a en ilGnal e fGmance in *normal subjects* a ea lGbe infl enced b gene ic fac lG . S die ing he ClGn in lG Pe fGmance Ta k (CPT) ha e hG n ha he *d* ignal de ec ilGn dGm lGnen (a mea e lGf hG eadil a ignal can be de ec ed ab lG e backg lG nd nGi e) lGf CPT e fGmance ha a he i abili amlGng nG mal bjec lGf 04 9 [11]. The S an lGf A e hen ilGn a k (SPA), a i al ea ch a k, ha been hG n lG ha e an he i abili amlGng nG mal bjec lGf 0.65 [12] and he P/ a ilGlGf he S lGn ane lG Selec i e A en ilGn Ta k (SSAT) a hG n lG ha e an he i abili amlGng nG mal bjec lGf 04 1 [13]. T in die ing nG mal dGn lGl in hG ha a ial lG king memlG , di ided a en ilGn, chGice eac ilGn ime and elec i e a en ilGn [14] and a en ilGnal e hif ing [15] a e nde lain b in he i ed fac lG . S die lGn infan gge ha effG f l dGn lGl and d a ilGn lGf lG ien ing a e he i able a ell [16]. La l , mGlec la gene a lGcia ilGn die lGn nG mal lG la ilGn ha e hG n ha lG ien ing lGf i al a en ilGn i a lGcia ed i h a ia ilGn in he APOE gene [17] and ha ma e nal a ing lGf a en ilGn in child en a e a lGcia ed i h he DRD4 gene [18]. The e lGf he e endG henG ic mea e a e lG en iall ad an ageG fG gene ic die ince he ma hG inc ea ed en i i i lG ecif ic dimen ilGn ela ed lG dGm le chia ic di lGde .

Attention Network Task (ANT) as a suitable endophenotype for genetic studies

While each lGf he a en ilGnal mea e de c ibed ab lG e i ell i ed fG gene ic die , e ha e chG en an al e na e a a fG gene ic die lGf a en ilGn. O a lGach i ba ed f nc ilGnal ne lGimaging die hich ha e ielded e idence lGn ne al a ea in lGl ed in a ec lGf a en ilGn [19,20]. Imaging da a ha e lG ed he e ence lGf h ee ne lG k ela ed lG diffe en a ec lGf a en ilGn. The e ne lG k ca lG he f nc ilGn lGf ale ing, lG ien ing and e ec i e dGn lGl [21,22]. Ale ing i defined a achie ing and main aining a a e lGf high en i i i lG indGming im li; lG ien ing i he elec ilGn lGf inf lG ma ilGn f lGm en lG in ; and e ec i e dGn lGl i defined a in lGl ing he mechani m fG e lGl ing dGn flic amlGng hG gh , feeling and e lGn e . F nc ilGnal imaging die ha e hG n ha main aining an ale a e in lGl e ac i a ilGn lGf igh f lGn al and a ie al lG be hile lG ien ing lG i al im li ac i a e a ea lGf he l ina , e ilG dGllic l and lG e ilG a ie al lG be. E ec i e f nc ilGn a k ac i a e f lGn al a ea ch a he an e ilG cing la e dG e and la e al ef lGn al dG e , an a ea fG hich ce ain ana lGmical a ec ha e been hG n lG be highl he i able [23]. Recen l , e de c ibed he A en ilGn e lG k Te (A T) ha mea e he effi cienc lGf he e h ee maj lG ne al ne lG k [24]. The A T i ad an ageG fG gene ic die , in lGfa a i di in g i he be een e a a e f nc ilGn lGf a en ilGn (ale ing, lG ien ing and e ec i e) ha a e dG ela ed i h he ac i a ilGn lGf he e ecific ne lGana lGmical ci c i . The he i abili lGf he A T ha been e amined in a elimina in d ing nG mal ad l in [25]. The efficienc lGf he e ec i e ne lG k a fG nd lG be highl he i able (h_F^2 = 0.89) hile lG e he i abili ie e e lGb e ed fG ale ing and median eac ilGn ime (h_F^2 = 0.18 and 0.16 e ec i el). The he i abili ie lGf he e mea e gge ha candida e gene a lGcia ilGn die a e ea lGnable lG e. I emain an lG en e ilGn hG e e, he he ch candida e gene ill ela e lGlG e all a en ilGnal e fGmance and eac ilGn ime, lG he he he candida e gene ill hG ecific a lGcia ilGn i h ecific ne al ne lG k .

A an ini ial a e men lGf hi a lGach, e ch G e fG candida e gene (DRD4 , DAT1, COMT and MAOA) ha a e amlGng he mG idel died and e ea edl a lGcia ed Tc0.15lGn( )-6( )]TJ(a)-6

HD. Ba ed [illegible] 7 ca e [illegible] die (4 [illegible] e) and 4 famil -ba ed die (9 [illegible] e), he me a anal i [illegible] cl ded ha a "... a i icall ignifican a [illegible] be-

< 0.1). P ic e lc lf e diffe ence in COMT e e ic n - lcnl . lc ignifican main effec lc end a lcb e ed fc ei he MAOA lcl mc hi m and lc e all eac ic n ime. A hc n in Fig e 3A, he MAO-LPR hc ed a ignifican infl ence lcn ale ing (P < 0.01) and lcn e ec i e a en- ic n (P < 0.05) a een in Fig e 3B. The C# 60T lcl mc- hi m hc ed nc ignifican a lccia ic n i h ale ing, b hc a mcde a lccia ic n i h e ec i e a en ic n (P < 0.05). When he e ec i e a en ic n dc e fc b-

je31(n 6.1(nc)6 h)64 (a4 ())10c i25.3( )-6(-)]T i(P)-5.7(ic)64 (n)

in h man [77] a ell a effec lcf gende lcn-beha ic in COMT lc -lcf-f nc ic n-mc e mcdel [78] and e lc lcf efe en ial an mi ic n-lcf he lc ac i i Me hic nine allele in female i h OCD [79] gge ed ha gende dc ld in e ac i h A T e fc mance. When male and fe- male e e anal ed a inde enden lc la ic n , nc ig- nifican a lccia ic n e e een fc c e all eac ic n ime- an lcf he ne lc k dc e fc ei he male lc female . Fe- male hc mc gc fc he lc ac i i Me hic nine allele did hc e e , hc he highe e ec i e a en ic n dc e amc ng all (Se × Genc ic) cla e .

DAT1

The 10- e ea allele a e en a a f e enc lcf 0.75 and he 9- e ea allele a 0.23. A hc n in Fig e 2B, bjec hc mc gc fc he a e 9- e ea allele hc ed mc de l lc e dc e han he lcdded dc e fc he mc e dc mmc n 10- e ea hc mc gc e and 9/10 he e lc gc e . lc end e e een fc acc ac , mean RT and/lc he effi- cienc lcf ale ing.

MAOA

Genc e lcb ained a he lc mc e e ea (LPR) lcl - mc hi m hc ed f e encie lcf 04 2 (3- e ea) and 0.53 4 - e ea) and genc e a he C# 60T lcl mc- hi m hc ed f e encie lcf 0.55 (C allele) and 04 5 (T allele). Since MAOA i lcca ed lc n he X-ch lc mc lc me, male a e gene icall hemi gc and female a e f nc- ic nall hemi gc d e lc and lcm X-inac i a ic n. Fc hi ea lc n, he e lc gc female e e e cl ded f lc m he anal i . Thi e mi ed a dc m a i c n lcf hemi gc male and hc mc gc female 3- e ea . 4 - e ea cla e

[illegible] significan[illegible] end[illegible] e e[illegible]b e[illegible] ed f[illegible] DAT[illegible] COMT in

Conclusions

Mlde a i ical a lcia iln lf a ia iln in e ec i e a - en iln e e lb e ed i h gene ic l l mle hi m in candida e gene ha affec dle amine gic ignalling. The e a lcia iln e e nle een fle glblbal mea e lf e - fle mance ch a eac iln ime, b a he fle he efficien - c lf ecific, ana lmicall cha ac e i ed ne al ne le k . Thi gge ha he A T i a i able endle henle ic a a fle f he la ge cale die ln he gene ic lf e ec - i e a en iln.

Methods

Subjects

S bjec e e ec i ed in he icini lf e Yle k Hle i - al ia ne a e ad e i emen . 25 bjec hle e e e - c i ed fln m he icini lf Peking Uni e i and a ici a ed in a e ile he i abili d e e al le in - cl ded. Paid l n ee a eled le he De a men lf P - chia le nde gle a e- e in e ie . S bjec i h a hi le lf chle a hllglg and/le aking medica iln e e e cl ded. A le al lf 220 ad l bjec , age 18/ 50 ea l ld me incl iln c i e ia. All a ici an e le ed nle mal le de ec ed le nle mal i iln. While mlking efe ence a edle ded, lnl 2 bjec e le ed mlk - ing eg la l .

Behavioral data

The A T a e fle med a e ile l de c ibed [1]. B ief - l , a ici an ie ed he im li and e ln e e e dll - lec ed ia le mle e b ln . S im li dln i ed l a le lf 5 i all e en ed hle i ln al black line , i h a le - head lin ing lef a d le igh a d, again a g a back - g le nd he e he a ge a a lef a d le igh a d a le head a he cen e . Thi a ge a flanked ln ei he ide b le a le in he ame di ec iln (dlng en dln - di iln), le in he le le i e di ec iln (indlng en dln di - iln), le b line (ne al dln di iln).

The a ici an a k a le iden if he di ec iln lf he cen all e en ed a le b e ing lne b ln fle he lef di ec iln and a ed nd b ln fle he igh di ec iln. C e dln i ed l a 100 m ec a e i k e en ed 400 m ec bef e he a ge . The e e e fle c e dln di iln : (1) nle c e, a ici an e e hle n a c le hich a he ame a he fi fi a iln fle 100 m ; (2) cen al-c e, hich a a he cen al fi a iln lin ; (3) dle ble-c e, in hich c e

a -dCdlCn a de c ibed in [89], e ed FlC a d: 5 -GTT-
GTCTGTCTTTTCTCATTGTTTCCATTG-3 Re e e 5 -
GAAGGAGCAGGCACCGTGAGC-3 ime . FlC genlC-
ing lCf he DRD4 C lCT change a lC i ilCn -521 a de-
c ibed in [3]. FlC a d: 5 -
CGGGGGCTGAGCACCAGAGGCTGCT-3 and Re e e 5 -
GCATCGACGCCAGCGCCATCCTACC-3 e e ed flCl-
lC ed b dige ilCn i h F I. FlC genlC ing lCf he DAT1
4 0 b - e ea (V TR) lCl mlC hi m in he 3 n an la ed
egilCn a de c ibed in [90], FlC a d: 5 -TGTGGTGTAG-
GGAACGGCCTGAG-3 Re e e 5 -CTTCCTGGAGGT-
CACGGCTCAAGG-3 ime e e ed. FlC genlC ing
lCf he COMT Val lC Me change a lC i ilCn 108 a de-
c ibed in [91], FlC a d: 5 -ACTGTGGCTACTCAGCT-
GTG-3 and Re e e 5 -CCTTTTTCCAGGTCTGACAA-3
ime e e ed flClC ed b e ic ilCn dige ilCn i h
laIII. FlC genlC ing lCf he MAOA 30-b e ea in lC-
mlClC a de c ibed (55 T [(GT)5.9I5.9(]TTT*.3(g)-12.8(e)64 6cT)5.9I5ee 108 a3( )dCeec c ( )-6( )-5.8(.8(e)6:9)6.eCG C4 8

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