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uro a n Data A qu s t on

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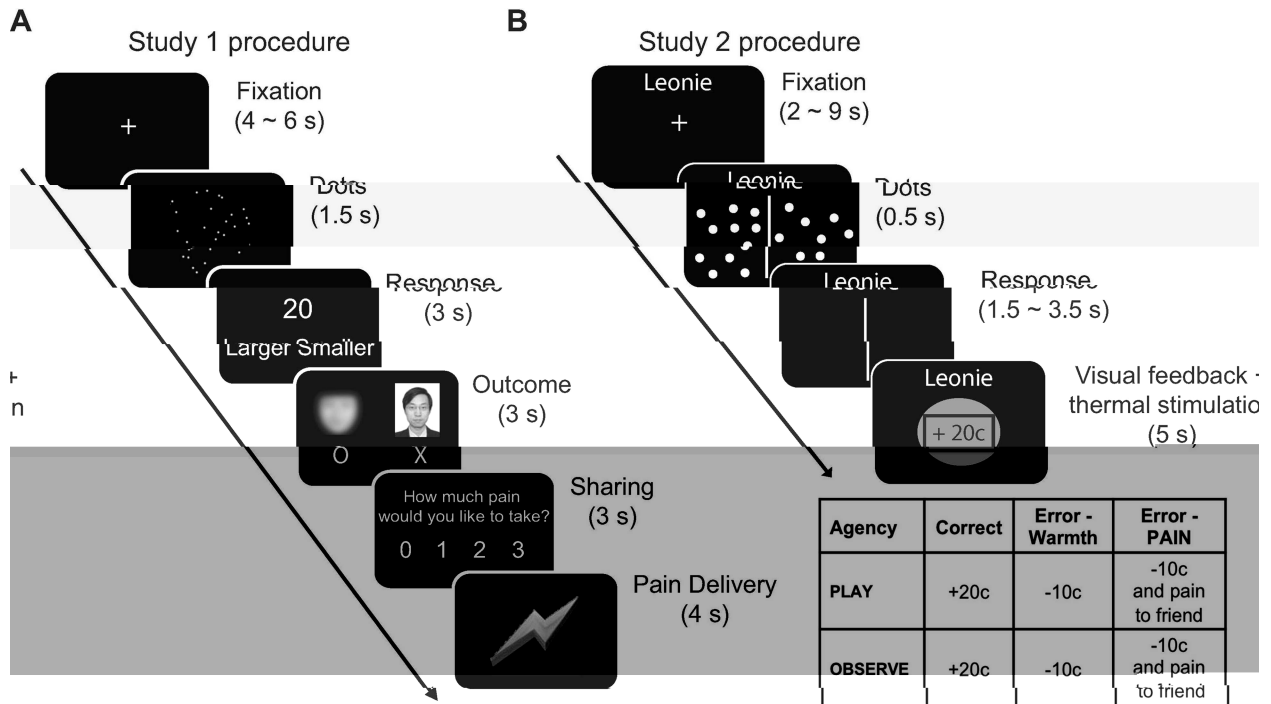
uro a n Data Ana ys s

Preprocessing and Univariate GLM Analyses

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Bot s p o n s " t o n t o n n t p r t n r o n
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Bot Corr t" A s o n u r r r r s s o r s o n o n t r s t u
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o n n u o r t n o For tu t r n t
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o n t o n n t s r o n t o n o n t r s
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s n r t r t n u s or t r n n n t s t n t
u t r t p t t m n s s

Guilt Pattern Classification

t r n n r [unclear] p r t r C = s o s n a p r i o r i t o s r n t " n s p o n s " u t o s n t s s t o n r s u s " n Bot s p o n s " u t o s n t s s t o n o n t o n s n t u t o n s u t o u t r o s s t o n p r o u r [unclear] n t r t o o t r t o n o t r n n t s s r t o s r n t t s t o t o n t o n s t o o s u s s p o s s t s s r p t u r n p r o s s s t t r n o t s s n t or t t n u t For p s s r t r n t o s r n t t " n s p o n s " n t " n r t n r s p o n s " o n t o n s o u n o t o n p t u r t r s p o n s t o t p r t p n t n u s n p n u t o u s o p t u r r n s n t o u o o p r t p n t s



From your own perspective, in this experiment, you will be asked to choose between two options: 'PLAY' and 'OBSERVE'. In the 'PLAY' condition, you will receive a reward of 20c and your friend will receive 10c of pain. In the 'OBSERVE' condition, you will receive a reward of 20c and your friend will receive 10c of pain. The amount of pain your friend receives is determined by the amount of pain you choose to take. The amount of pain you choose to take is determined by the amount of pain you choose to take. The amount of pain you choose to take is determined by the amount of pain you choose to take.

proportion of correct responses. In this experiment, you will be asked to choose between two options: 'PLAY' and 'OBSERVE'. In the 'PLAY' condition, you will receive a reward of 20c and your friend will receive 10c of pain. In the 'OBSERVE' condition, you will receive a reward of 20c and your friend will receive 10c of pain. The amount of pain your friend receives is determined by the amount of pain you choose to take. The amount of pain you choose to take is determined by the amount of pain you choose to take.

the amount of pain your friend receives is determined by the amount of pain you choose to take. The amount of pain you choose to take is determined by the amount of pain you choose to take. The amount of pain you choose to take is determined by the amount of pain you choose to take. The amount of pain you choose to take is determined by the amount of pain you choose to take.

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Guilt Pattern Expression

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Comparison with Other Brain Signatures

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Testing the Sensitivity and Generalizability of the GRBS

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A Guilt-related Brain Signature (GRBS)

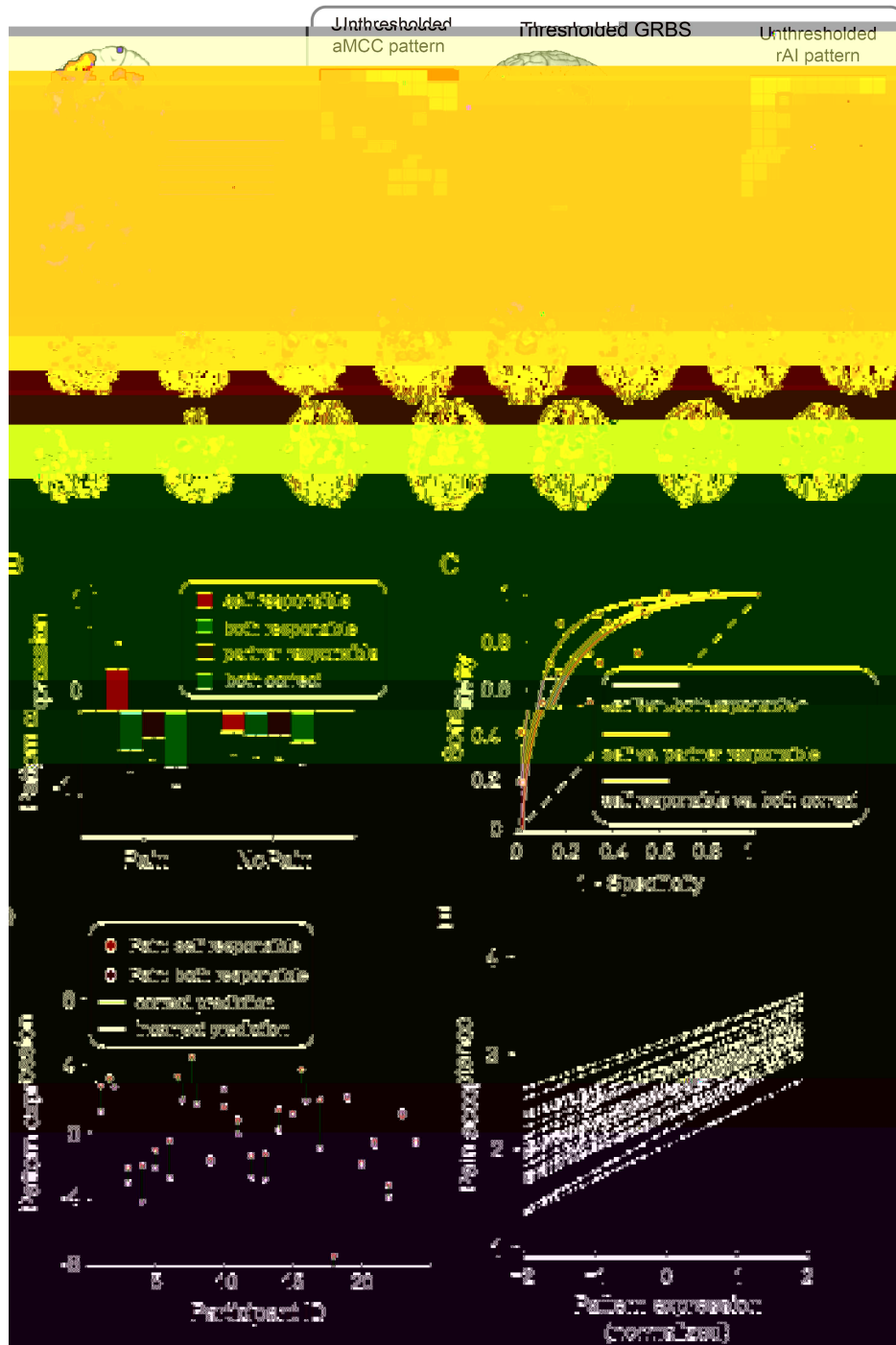
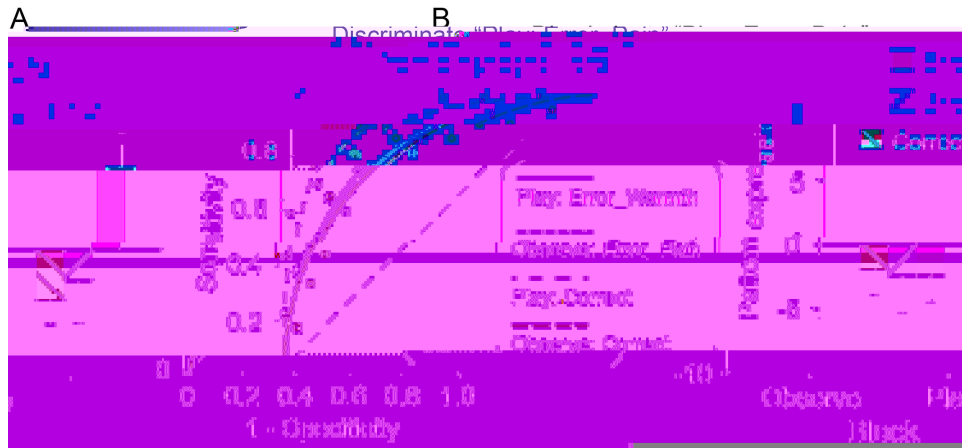


Figure 1. Guilt-related Brain Signature (GRBS). **A** Brain maps showing unthresholded aMCC pattern, thresholded GRBS, and unthresholded rAI pattern. **B** Bar charts showing patient depression (top) and diagnosis (bottom) for Pain and No Pain groups. The top chart compares self-responsible (red), both responsible (green), partner responsible (blue), and both correct (purple). The bottom chart compares Pain self-responsible (red circle), Pain both responsible (green circle), correct prediction (black line), and incorrect prediction (grey line). **C** ROC curve (top) showing sensitivity vs. 1-specificity for self vs. both responsible (red), self vs. partner responsible (green), and self responsible vs. both correct (blue). The scatter plot (bottom) shows Pain expression (corrected) vs. Patient ID.



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Testing the Specificity of the GRBS

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D on

C r tr n o sp ot ons r n r t n
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A. Physical pain

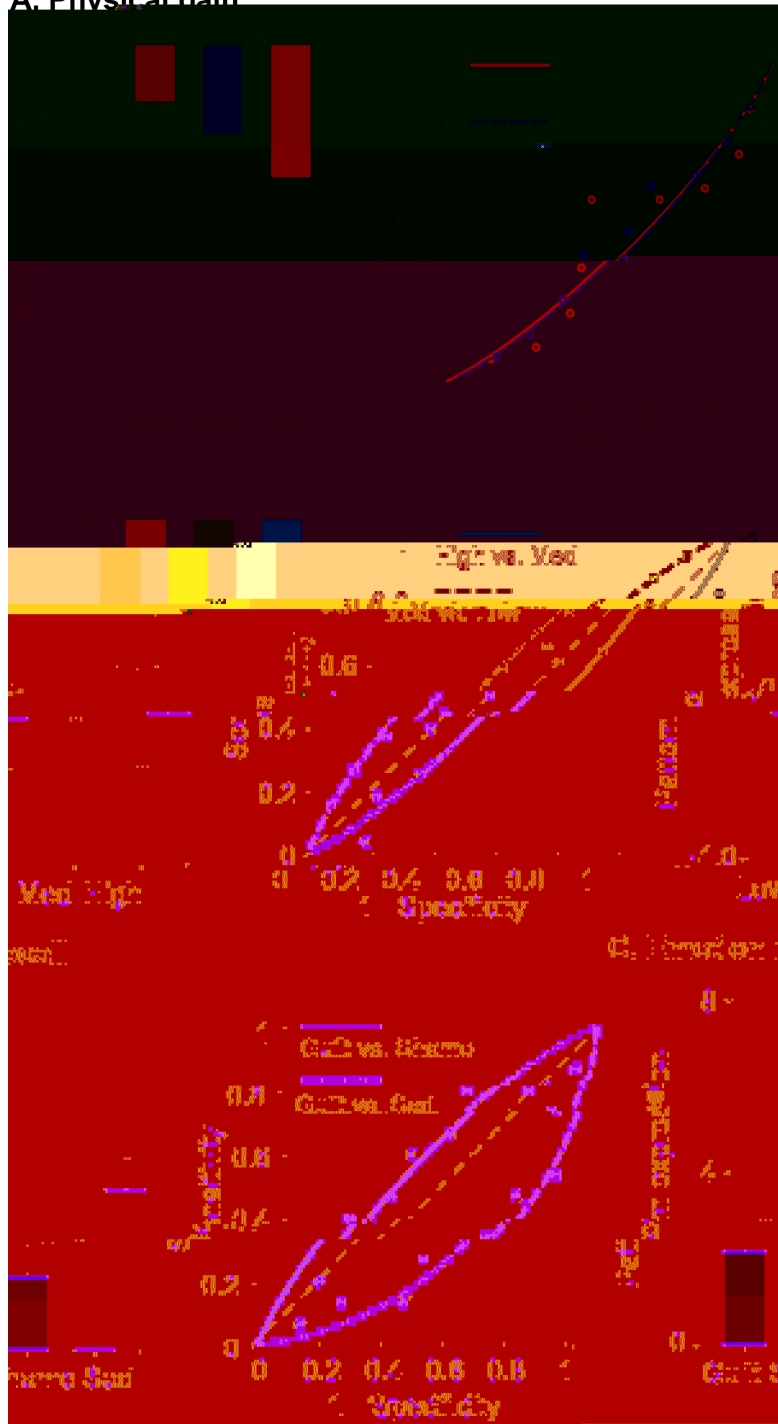


Figure 1. Behavioral and neural data for physical pain. Top: Behavioral responses for three conditions (red, blue, red). Middle: Heatmap of neural activity. Bottom: Scatter plots of specificity vs. probability for 'High vs. Med' and 'Med vs. High' conditions. Error bars represent standard error.

Behavioral responses for three conditions (red, blue, red). Heatmap of neural activity. Scatter plots of specificity vs. probability for 'High vs. Med' and 'Med vs. High' conditions. Error bars represent standard error.

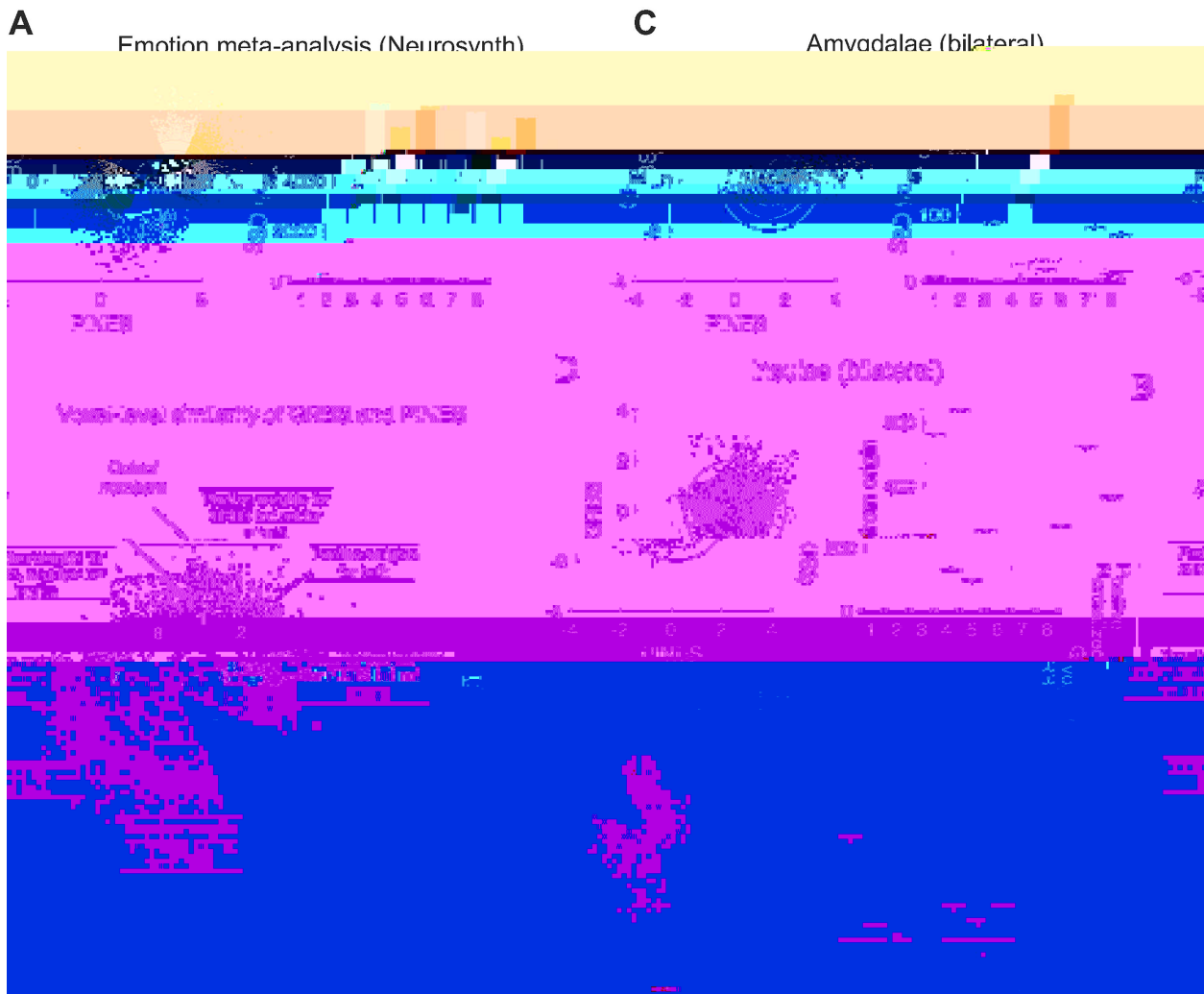


Figure 1. Functional connectivity maps. **A**, Functional connectivity map for emotion meta-analysis (Neurosynth). **B**, Functional connectivity map for bilateral amygdalae. The maps show significant clusters in red and yellow, indicating areas of functional connectivity. Anatomical labels include Caudate nucleus, Nucleus accumbens, and Hippocampus. The sagittal views show the location of the clusters within the brain.

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 n ur ns un r n ut n ton nt n s r s
 s too or utur stu st t t n pu t n n or
 sur n ut n r n t n ron nts n popu tons
 r t C n t r s n n t
 Int rp rson ut r t t t to t t n r spon
 to stu ton r so on s s r n n
 on s st sour o t t r Boon n st p
 o ut st ou t to r t or nt n n so nor s
 n nt rp rson r tons ps u str t nt
 trns r ssors s ur t t t n su stu ton n

r t n pprop r t o st tor stor t r put ton n
 so r tons p t t t r tr pro t Yu t
 n ot rr nt n us nt so nt or
 n r tr pro t n so t ms n rrott
 or o r t rns r ssors pr ss on o ut n on tor
 stur sr r t n po rot o t so nor s
 n o p ns t t oss o t t r
 r n n ppro us or ot r so t pro
 ss s oo t r s n n t us on
 I t to ss t pr sn rsus sn o t or
 ppr s o ut n on sr spon t n us n r to
 not r G B oo ross t pr t ur
 n s n nt pr t o p ns ton or
 t us n n ont r n pro ss s to r nt or
 out o s Furt r t G B s o ur on

o p t n p n n t t s t r o r n t or tor
 n utur onstr t n tsro usn ssto r t ons n pr
 nt s t n s n utur ont t
 s s n tur n str ut p t t r n ross
 t ntr "E ot on" n t or Y r on t ts ts
 st pr t t n t CC n r t AI A
 At ou t s p o spr t pr ous un r t
 n s s o n t Four t Yu t Cu
 t t n r t ss ontr ut n p n nt tot
 un rst n n o t n uro ont ns o t t n
 on str ns r ss on n r t n or n ut r t
 n s s r s t p t t ptur st or pro ss s
 un r n nt rp rson tr ns r ss on n ut s str t
 t p n t n pp ton o s r t ons ro t
 s or r n t t s t s s s s n s t t sp t
 n n r ton r t p n t
 o s to t CC n AI t ns r s r n un
 t o s o our o n s onstr t t o un ton
 sp t n t s r s us n n uro n t n s s
 n ut r t p t t r n n s s n qu st t
 r t Y r on t so ru n
 pro n t t ut r t p t t r t t t
 n su r s o r s r t r un ton sp t t n s p
 nt r p r t n o r p p n t ton r t For
 p n r t noun t t CC ont ns
 popu ton ut r t r p r s n t ton p t t r t
 top n t t n r s ross t p s o so t p n st
 ross stu s ut s not s r n s on t
 ot ont s s or n s o ont ontro t s s ru
 t t ut r t p t t r n n s s or s us t p s up
 to so r on r n t p t t r n s o t ton ross
 n ur popu tons n ro su tur t t r un n
 str ut ross o s or r n s us s on s r
 t
 upport n t not on o st n t ut r t p t t r n s or
 r n t t pro ss soun on or r tons
 t n t GB n ot r p n n ot on r t r n
 p t t r n s u s t I E Furt r n o p t t r n s n
 ot on r t r s n u n t ACC n nsu s o
 on t s r r n t n t GB n t I E
 Int r st n t p t t r n s o s r rsus un qu ts or
 t t o s n tur s r st n t ross t t r r ons o
 n t r st nsu s o so n o o on post
 ts or ot GB n I E s n n t p r t
 s r pro ss s In ontr st n ACC o s t
 post ts or on s n tur r ot n n r ro or
 n n t ts n t ot r s n tur su st n r
 st n t o ntr ut on s tot o r p t t r n s
 or o r n t ur n t stu t s n tur s r
 ro s p o C n s p r t p n t s st As n utur n
 t pr t po ro t sp t t r n n p r t n r
 to s p o C u s n p r t p n t s st m utur
 su st n t t t or un r n n uro ont pro ss s
 s r n ross r n t utur s n p r n t
 s tup GB s s o s n s t tot s o ut s
 n pu t r s p n s t or not r s p n n t n r
 t ton on t o r n t s Y t t s n tur not s r
 n t so t r p s p n r n p n u s t u
 ton r s n n t or rous p n o s r n ot rs
 r n p n u s t u ton r s n n t F A C
 r ot rous n rs s n t p r n s Int r
 st n t s n tur not s r n t ut r t
 or s ro ot r t p o n t ot on or t r

DF or so ut p s o s n o r on ton
 o on s us t not r s s u r n ut o not n o
 t pro ss so t t n n r s p o n n to su o pon n t s
 nt r n no so ont t n
 n to t r our n n s s u s t t t n n nt rp rson
 tr ns r ss on ont t t tr ns r s sors r n o s not on
 ptur t str s s u ons qu n o ot rs per se s n t
 s o p r n n rous p n ut so t s st
 ttr ut on o t r n n on s o n r s p o n s t s
 on r s o tor s p o n ton nt poo
 s n n to t r t t pr t po ro t GB
 n tr n r p r ton or o p n s ton su sts
 t t r n t ton p t t r n s nt r pr r
 p t t p t o ut r t p p r s on s u s qu nt
 or r s p o n s n n t t not on t t ot ons
 s r to u pt or s n n r t or r s p o n
 t on t n n s s s t s s n t n r ut
 t us pr u n su s s u o n o GB n t s on ton
 Furt r not t t n u r n s n GB
 r s p o n s s r not pr t o ut r t n s n t r t s t
 n p n ton s t t t r t n s o su t n s o
 ut r o t t r t t s n t s n n r n t u s r
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 n un ot r tors su s o r s n n
 our s p un r p o r to t t s t n
 p rson or r tons Futur stu s t s ut n ous r or
 In or s n s t on n sur so ot on n o
 ut p t t r n s n on ut n s Yu t
 to por GB s r o s n t t por un o n o
 ut p r n n t t n t p r s n o ont
 nt n t s o ut n o n ut n s s p r n
 t n nt rp rson tr ns r ss on n p r t n
 ton nt o o n ut o o t or ro
 t ut r t p p r o n n or our un rst n n o t
 n ur s s o so on ton op n r n s n tur s
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 ou tor stru tur our un rst n n o s o
 on ton ont s s o un r n r n r p r s n t ons
 A on ptu r ton out ut n r s p o n s t s
 ort not n Int s p p r "u t" r s to onst ton o
 ont t pro ss s n r s p o n s to nt rp rson tr ns
 r ss on n r t t n r n s s n n r s p o n s
 s t r t r t n s p t n p r n t o pon nt
 o t s onst ton o pro ss s n t s on ptu ton o
 ut r on n on s us r s p o n s t s n n t r p r t
 o ut s ort n t r n o n s r t r
 t n n n p n nt pro ss t t s p r to ut t st
 n ost s tu tons r t ss no t t t s n
 n t r st n n port nt pr qu st on s to t r
 ut n s n r s n r t n p o p u tons or ru st n s
 t out o t us r s p o n s t n nt rp rson r
 For p sur or s o s s t r or tro t s s o t r port
 t t p r n "u t" n s t o r ot r t s o
 su r u or t n t o s p t t t t r not
 us r s p o n s or ot r t s s u r n n poss
 ps o o n s un r n su "sur or ut" s
 t t sur or s s ttr ut r s p o n s t o ot rs su r n
 tot s s Connor t r "st n t" ut
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 n p r n p op t r t n t p o p r s s on

s s to r suto usor p r p t o n s o r s p o n s t
 t Con rs so n u s t o s
 n p s o p t C t t t r u t o n o
 r s p o n s t o r r t o u t n u t u t s n
 t u r o u s s t o o t p r t s t s p o t
 s s n o r t u n t r t t s o t s n t r s t n p o s s t s
 r o n t s o p o t s p p r n t u r t r s t u s
 s n o r t s p u r o s
 It r u t t t r " u t " s n o t u s q u n t
 r o s s C n s n s s u t u r s n n u s s s r t
 t o o r p r o u n s s u s t o o o u n o t r
 o r n o t p o p n n r n t u t u r s n s p n r n t
 n u s r p r n n t s " n " o o t o n n
 t t t r n u t C n s o r s u
 G r n o r o u p r n o r n u C n s I n t s s t u
 o p t t s s u p t o n t t " u t " r s t o t o r o
 o t o n s t t s u n r r n t r n t s o u t r
 s p s t r n t s p n n t u r s o r r n t
 s p t p o u t t t n s t t n t s s t u s
 r u s n t o r t t u r s u s t r
 t n o n s r o n n r
 o o r n o r s t p n o n r t o n o t r n
 t t r u n u s r s p o n s t n s u o t o n t o n s
 s t o t u r s n o n s t r t o r o n
 t n t n t s o u t n o t s t m n E s t A s n u t u r s
 n t r s n n r B o r n H n
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 n u u t n o t s t m s t n t C r o t
 o n t r C r o s o t n E s t
 A s n p r t p n t s n t F u r u t Y u
 t Z u t I n n t t s t o r t n
 p r o r s u t t s t o n n t u r s o u t
 n t t s s o o u r t r n n t s t t s t s I p o r n t t
 s n o t r q u r t t p r t p n t s r o u t u r s p r n
 t s t p o u t t o t s r n r s p o n s t o t s
 s t u t o n s u r n s s r q u r o n t t t s p r n t o
 s o r p r t p n t s r o s s u t u r s s o t t
 t u t r t p t t m n t s n p r s r
 r o s s u t u r t s t n t o n t o u r s t u t r p r o
 n p r s u p p o r t o r o n r o s s u t u r r n p r o
 s s s n n t n s t o o n t n t o n t
 t p r o s s s u n r n u t t o t o p r t
 s r o n t t p r o s s s u n r n u t n t s
 r n o r r t s r o s s u t u r s n o n t t l t s n n t r s t
 n n p o r t n t p r q u s t o n o r u t u r s r s t o
 t t n t t s s n t u r o u s r n t r n t r n t s
 o u t o t t n n r o s s u t u r s u s n p s
 r r s u s o r u s n r t o r n r s u s
 s t r n r
 o s u r r n o t t r s t t o p o r o o t o n s r s
 r t n p p r s t o r t p t t m r o n t o n n s s o
 u n n u r o n t o r r s A o p s For
 p r n s o t t s r t o t o n t
 o r s t p o p s s n t o n o t o n t n n t n
 u r t p r t s t o s t r t u r s o t n t s
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n s n r n t u r s p o r n
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 s o s t o n s t n t t o r n t o u t F u t u r
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 n t r n s t o n " n s r r o s s u t u r t u r t o n o
 t F s
 n r t o t G B t o t u s s t I n
 p r t u r t r n t n t p t t m p r s s o n o t
 " E r r o r n " o n t o n n t t o t " E r r o r r t "
 o n t o n s t t r n s t n p r t u t o
 t s s p s o t u A n o t r o n t u r s t t
 n t t t s s r s t r n t o s r n t o n s u s
 r s p o n s t n n t r p r s o n r t t o r s n s
 t n t t n r n s n r s p o n s t t n n t t n
 r n s n t s r t o r r s s s u p p o r t t
 t t t s n t u r r s p o n o r s t n t o "
 E r r o r n " r s u s " s r E r r o r n " t o o n t o n s t t
 r o n n p p r s o r s p o n s t u t n o t n s r t o
 r r o r n o t t o u r o o o p n
 s n s t s p n n r r n s n t u r o u t s
 t t o u u t t p r s n t u t r t
 p t t m s o t u s u n r t o t t n s t p p n s t o n
 t o r s s t u s t t o u r q u r t o p r o r o r
 n t n t o n o r o s s u t u r n u r p r s n t o n s
 o u t F u t u r s t u s r n t o t s o n r
 s p s n t o n o r p o r t o r n r n n p u t o n o
 u t r s p o n s t s r t o r r r t o n s p t n
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 s o n o s u s o u r s t o r r n o p r
 t s u r s n o t r o n s t t n o n p r t
 t n o r t s p t t F o r p
 r t t t s r o u t n n t n n I n n u s
 n n s p t o t t o n o t o n o t s p t t o s
 n t t n u n t s p t o t n r r
 o t " u s o r r " t s r o u t n u s t o n r t
 p r s t n o r t r p r s n t t o n s n o r n o r
 D r u n D E s p o s t o s o n o s t
 o n t r o r o n t t t n t o n Y u n t
 n o t r s E n r t o r t s p t s r s o n
 o r u s o n I p t t m o r u r t r t s t n t o u t
 s o o n s o u s t u t o n s s s
 I n s r n t r r r o r r s n n
 t t r s n s t n s p u t n o r t
 n o s t u o n r s n o r t o n I n t s s p r t o u r u t
 r t p t t m o n r s n o r t o n u s s n
 r n s u r o r p r o s o n n r n r n o p r s o n s
 n u r t r t s t n n t o n o n t r n s s o s o
 o t o n s
 o n u o p n u r s n t u r t G B
 t t s s n s t n s p t o t r t p p r s s u n r
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 r o n n o n s r s p o n s t n u s n o t r s u r n
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 t o r o r o u t o s t r s p o n s o t s s n t u r
 p r t s t o n n t s o n s o o n t r n s s o n n t r
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or spons t upport n ts sr n t t t G B
 notr spon to ut or sor or so ot rn t
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 un ton r t tur o t r n Curr Opin Neurobiol
 B st n C H rr son B D CG o tt F
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Cr o E D s t C Br ss n our rror o s
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