



NATIONAL INSTITUTE OF BIOMEDICAL IMAGING AND BIOENGINEERING

Grant Number: 5R01EB015611-06
FAIN: R01EB015611

Principal Investigator(s):
PETER V KOCHUNOV, PHD

Project Title: Solar-Eclipse Computational Tools for Imaging Genetics

Paffrath, Dennis Joseph
AVP, Sponsored Programs Administration
University of Maryland, Baltimore
620 West Lexington Street, 4129
Baltimore, MD 212011508

Award e-mailed to: nga@ordmail.umaryland.edu

Period Of Performance:

Budget Period: 08/01/2018 – 07/31/2019

Project Period: 08/01/2012 – 07/31/2020

Dear Business Official:

The National Institutes of Health hereby awards a grant in the amount of \$400,001 (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to UNIVERSITY OF MARYLAND BALTIMORE in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release, or other document about research supported by an NIH award must include an acknowledgment of NIH award support and a disclaimer such as "Research reported in this publication was supported by the National Institute Of Biomedical Imaging And Bioengineering of the National Institutes of Health under Award Number R01EB015611. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health." Prior to issuing a press release concerning the outcome of this research, please notify the NIH awarding IC in advance to allow for coordination.

Award recipients must promote objectivity in research by establishing standards that provide a reasonable expectation that the design, conduct and reporting of research funded under NIH awards will be free from bias resulting from an Investigator's Financial Conflict of Interest (FCOI), in accordance with the 2011 revised regulation at 42 CFR Part 50 Subpart F. The Institution shall submit all FCOI reports to the NIH through the eRA Commons FCOI Module. The regulation does not apply to Phase I Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) awards. Consult the NIH website <http://grants.nih.gov/grants/policy/coi/> for a link to the regulation and additional important information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Florence Turska
Grants Management Officer
NATIONAL INSTITUTE OF BIOMEDICAL IMAGING AND BIOENGINEERING

Additional information follows

SECTION I – AWARD DATA – 5R01EB015611-06**Award Calculation (U.S. Dollars)**

Salaries and Wages	\$116,623
Fringe Benefits	\$33,407
Personnel Costs (Subtotal)	\$150,030
Consultant Services	\$7,000
Materials & Supplies	\$3,500
Travel	\$3,500
Other	\$5,336
Subawards/Consortium/Contractual Costs	\$138,330

Federal Direct Costs	\$307,696
Federal F&A Costs	\$92,305
Approved Budget	\$400,001
Total Amount of Federal Funds Obligated (Federal Share)	\$400,001
TOTAL FEDERAL AWARD AMOUNT	\$400,001

AMOUNT OF THIS ACTION (FEDERAL SHARE) **\$400,001**

SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
6	\$400,001	\$400,001
7	\$400,001	\$400,001

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

Fiscal Information:

CFDA Name: Discovery and Applied Research for Technological Innovations to Improve Human Health
CFDA Number: 93.286
EIN: 1526002036A1
Document Number: REB015611B
PMS Account Type: P (Subaccount)
Fiscal Year: 2018

IC	CAN	2018	2019
EB	8015183	\$400,001	\$400,001

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

NIH Administrative Data:

PCC: HBIG / **OC:** 414E / **Released:** 08/08/2018
Award Processed: 08/08/2018 07:02:00 PM

eRA
Commons
User Name

SECTION II – PAYMENT/HOTLINE INFORMATION – 5R01EB015611-06

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

SECTION III – TERMS AND CONDITIONS – 5R01EB015611-06

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- The grant program legislation and program regulation cited in this Notice of Award.
- Conditions on activities and expenditure of funds in other statutory requirements, such as those included in appropriations acts.
- 45 CFR Part 75.

- d. National Policy Requirements and all other requirements described in the NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- e. Federal Award Performance Goals: As required by the periodic report in the RPPR or in the final progress report when applicable.
- f. This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm> for certain references cited above.)

Research and Development (R&D): All awards issued by the National Institutes of Health (NIH) meet the definition of "Research and Development" at 45 CFR Part § 75.2. As such, auditees should identify NIH awards as part of the R&D cluster on the Schedule of Expenditures of Federal Awards (SEFA). The auditor should test NIH awards for compliance as instructed in Part V, Clusters of Programs. NIH recognizes that some awards may have another classification for purposes of indirect costs. The auditor is not required to report the disconnect (i.e., the award is classified as R&D for Federal Audit Requirement purposes but non-research for indirect cost rate purposes), unless the auditee is charging indirect costs at a rate other than the rate(s) specified in the award document(s).

An unobligated balance may be carried over into the next budget period without Grants Management Officer prior approval.

This grant is subject to Streamlined Noncompeting Award Procedures (SNAP).

This award is subject to the requirements of 2 CFR Part 25 for institutions to receive a Dun & Bradstreet Universal Numbering System (DUNS) number and maintain an active registration in the System for Award Management (SAM). Should a consortium/subaward be issued under this award, a DUNS requirement must be included. See <http://grants.nih.gov/grants/policy/awardconditions.htm> for the full NIH award term implementing this requirement and other additional information.

This award has been assigned the Federal Award Identification Number (FAIN) R01EB015611. Recipients must document the assigned FAIN on each consortium/subaward issued under this award.

Based on the project period start date of this project, this award is likely subject to the Transparency Act subaward and executive compensation reporting requirement of 2 CFR Part 170. There are conditions that may exclude this award; see <http://grants.nih.gov/grants/policy/awardconditions.htm> for additional award applicability information.

In accordance with P.L. 110-161, compliance with the NIH Public Access Policy is now mandatory. For more information, see NOT-OD-08-033 and the Public Access website: <http://publicaccess.nih.gov/>.

In accordance with the regulatory requirements provided at 45 CFR 75.113 and Appendix XII to 45 CFR Part 75, recipients that have currently active Federal grants, cooperative agreements, and procurement contracts with cumulative total value greater than \$10,000,000 must report and maintain information in the System for Award Management (SAM) about civil, criminal, and administrative proceedings in connection with the award or performance of a Federal award that reached final disposition within the most recent five-year period. The recipient must also make semiannual disclosures regarding such proceedings. Proceedings information will be made publicly available in the designated integrity and performance system (currently the Federal Awardee Performance and Integrity Information System (FAPIIS)). Full reporting requirements and procedures are found in Appendix XII to 45 CFR Part 75. This term does not apply to NIH fellowships.

Treatment of Program Income:

SECTION IV – EB Special Terms and Conditions – 5R01EB015611-06

Clinical Trial Indicator: No

This award does not support any NIH-defined Clinical Trials. See the NIH Grants Policy Statement Section 1.2 for NIH definition of Clinical Trial.

CONSORTIUM/CONTRACTUAL COSTS

This award includes funds for consortium activity with:

- University of Texas Health Science Center at San Antonio
- University of Oxford, United Kingdom

Consortia are to be established and administered as described in the NIHGPS section 15 Consortium Agreements.

http://grants.nih.gov/grants/policy/nihgps/HTML5/section_15/15_consortium_agreements.htm

SALARY CAP

None of the funds in this award shall be used to pay the salary of an individual at a rate in excess of the current salary cap per year. Therefore, this award and/or future years are adjusted accordingly, if applicable. Current salary cap levels can be found at the following

URL's: <https://grants.nih.gov/grants/guide/notice-files/NOT-OD-18-137.html>

GRADUATE STUDENT COMPENSATION

The maximum amount NIH will award for compensation of a graduate student (salary, fringe benefits and tuition remission) receiving support from a research grant is the zero-level Kirschstein-NRSA stipend in effect when NIH issues the grant award (see current levels posted at <https://grants.nih.gov/grants/guide/notice-files/NOT-OD-18-175.html>)

The NIBIB home page is <http://www.nibib.nih.gov/>

STAFF CONTACTS

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

Grants Management Specialist: Angelos Bacas

Email: ab329b@nih.gov **Phone:** (301) 451-4785 **Fax:** (301) 451-5735

Program Official: Grace Peng

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SPREADSHEET SUMMARY

GRANT NUMBER: 5R01EB015611-06

INSTITUTION: UNIVERSITY OF MARYLAND BALTIMORE

Budget	Year 6	Year 7
Salaries and Wages	\$116,623	\$116,623
Fringe Benefits	\$33,407	\$33,407
Personnel Costs (Subtotal)	\$150,030	\$150,030
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Subawards/Consortium/Contractual Costs	\$138,330	\$138,330
TOTAL FEDERAL DC	\$307,696	\$307,696
TOTAL FEDERAL F&A	\$92,305	\$92,305
TOTAL COST	\$400,001	\$400,001

Facilities and Administrative Costs	Year 6	Year 7
F&A Cost Rate 1	54.5%	54.5%
F&A Cost Base 1	\$169,367	\$169,367
F&A Costs 1	\$92,305	\$92,305

A. COVER PAGE

Project Title: Solar-Eclipse Computational Tools for Imaging Genetics	
Grant Number: 5R01EB015611-06	Project/Grant Period: 08/01/2012 - 07/31/2020
Reporting Period: 08/01/2017 - 07/31/2018	Requested Budget Period: 08/01/2018 - 07/31/2019
Report Term Frequency: Annual	Date Submitted: 05/17/2018
Program Director/Principal Investigator Information: PETER V KOCHUNOV , MS MS PHD Phone number: (410) 402-6110 Email: <input type="text" value="Personal Info"/>	Recipient Organization: UNIVERSITY OF MARYLAND BALTIMORE UNIVERSITY OF MARYLAND BALTIMORE 620 W LEXINGTON ST, 4TH FL BALTIMORE, MD 212011508 DUNS: 188435911 EIN: 1526002036A1 RECIPIENT ID:
Change of Contact PD/PI: N/A	
Administrative Official: MARIE COOLAHAN 620 W. Lexington Street 4th. Floor Baltimore, MD 21201 Phone number: 410-706-0011 Email: m_coolahan@umaryland.edu	Signing Official: MARIE COOLAHAN 620 W. Lexington Street 4th. Floor Baltimore, MD 21201 Phone number: 410-706-0011 Email: m_coolahan@umaryland.edu
Human Subjects: No	Vertebrate Animals: No
hESC: No	Inventions/Patents: No

B. ACCOMPLISHMENTS

B.1 WHAT ARE THE MAJOR GOALS OF THE PROJECT?

Aim 1. To shift imaging genetics toward richer, higher resolution imaging analyses and denser genome examination through high performance computing. The shift in imaging genetics toward WGS genotyping and high-resolution multimodal imaging data necessitates improvement of computational efficiency of likelihood calculations. To speed calculations up by 105-6-fold we will implement high-performance computing: novel data decompositions and single-step algorithmic techniques and integration of Massive Universal Linear Model (MULM) GPU library of genetic tools for massively parallel genetic analyses. These developments will enable interactive WGS and GWAS analyses for Big Data project by implementing SOLAR-Eclipse in web-analyses portals such as HCP Dashboard and ENIGMAVis.

Aim 2. To accelerate data sharing and replication in imaging genetics. Demands for high-performance computing and greater reproducibility and transparency in scientific research require a new data format optimized for imaging genetics applications and easy sharing of provenance. Expanding on the work of the International Neuroinformatics Coordinating Facility's Neuroimaging Data Sharing Task Force, we have assembled a panel of community experts to develop a draft of imaging genetic format based on existing neuroimaging formats along with extending on-going provenance efforts to imaging genetic research. We will submit this format and API for formal registration with NIF.

Aim 3. To implement and exploit empirical kinship methods. Empirical kinship algorithms that directly measure the degree of shared genetic variance (such as those used in GCTA/ REACTA and MEGHA) will be integrated for performing polygenic and Quantitative Trait Loci Linkage (QTL-L) analyses in the related, unrelated and mega-genetic samples. We propose to re-invent the Quantitative Trait Loci Linkage (QTL-L) methods for localizing QTLs based on simple empirical similarity in larger (1cM) regions of DNA instead of per-locus GWA-SNP analysis. This will answer questions such as localization of chromosomal segments that are responsible for normal and disorder-related variability in neuroimaging traits. Empirical QTL-L analyses will power chromosomal localization studies with no sharing of raw genotypes for our Big Data partners.

Aim 4. Interactive improvement of developed tools in collaboration with 'big data' partners. Methods developed in Aims 1-3 will 'push' the scientific aims of our Big Data partners, who committed a large (N=10K) sample and effort for three collaborative studies. The high-performance imaging genetics computing and empirical QTL-L techniques (Aims 1 and 3) will be honed by performing the largest genetic localization analyses with ENIGMA, ACP and GOBS projects, and by integrating voxel-wise GWAS analyses in web-analysis portals. Likewise, the utility of new format for data and workflow sharing (Aim 2) will be honed for multi-site Big Data research. Finally, we will develop and rank pioneering resting-state FMRI endophenotypes for Big Data research by demonstrating consistent heritability across samples and pleiotropy with mental disorders. The feedback gathered from our partners will sharpen SOLAR-Eclipse tools for imaging genetics community. We will continue to develop annual workshop at Imaging Genetics Conference to educate our users and disseminate new methods.

B.1.a Have the major goals changed since the initial competing award or previous report?

No

B.2 WHAT WAS ACCOMPLISHED UNDER THESE GOALS?

File uploaded: GoalsAchieved.pdf

B.3 COMPETITIVE REVISIONS/ADMINISTRATIVE SUPPLEMENTS

For this reporting period, is there one or more Revision/Supplement associated with this award for which reporting is required?

No

B.4 WHAT OPPORTUNITIES FOR TRAINING AND PROFESSIONAL DEVELOPMENT HAS THE PROJECT PROVIDED?

NOTHING TO REPORT

B.5 HOW HAVE THE RESULTS BEEN DISSEMINATED TO COMMUNITIES OF INTEREST?

NOTHING TO REPORT

B.6 WHAT DO YOU PLAN TO DO DURING THE NEXT REPORTING PERIOD TO ACCOMPLISH THE GOALS?

We plan to continue development to support the large NIH-funded imaging genetic initiatives. Specifically, the empirical genetic analyses developed this period will be expanded to large genomic studies across diverse cohorts. We will be concentrating on updating our website with videos on the use and how-to documentations on starting genetic imaging analyses. The accelerated version of the SOLAR will form the basis for the genetic-calculator web-site – now in development to support research by ENIGMA, HCP and other large collaborations.

We made significant progress along all four specific aims. Activity on Aim 1 included in continues released development version of SOLAR-Eclipse (SE). In total, eleven incremental releases were made, each constituting a additional functionality, bug fixes and performance optimization change. All distribution was made through the NITRIC website https://www.nitrc.org/projects/se_linux/. NITRIC registered 13242 downloads for our tool and lists it as the top 22nd most downloaded resource. The current production version of SE is used for performing imaging genetic research at several centers, including UCLA, University of South California, Yale University and Human Connectome Project at Washington University. Several novel and important developments were accomplished. Overall, the research performed during this year was described in 20 peer-reviewed publications including publications in JAMA psychiatry, Biological Psychiatry, Molecular Psychiatry, Neuroimage, Human Brain Mapping and others. To-date, over 150 manuscripts acknowledged support of this R01. Dr. Kochunov used the momentum generated by this application to secure NIH funding for a large hybrid CPU/GPU computational cluster funded through a shared instrumentation grant (S10 OD023696 01A1). This cluster will lay the foundation for high-performance computing for the next generation of genetic imaging grants.

Two chief progress directions were continued development described in Specific Aims 1 and 3: accelerating genetic analyses for high-throughput imaging genetics applications and development of empirical approaches for measuring relatedness. The acceleration of additive genetic variance calculations that were published by our group in the last two years [1-3] is now complemented by accelerated GWAS approach. The manuscript describing this approach was accepted for publication in Nature Communications (impact factor =12.1). It is "Fast and Powerful Genome Wide Association Analysis of Dense Genetic Data with High Dimensional Imaging Phenotypes" and describes an approximation-based inference testing that can accelerate the GWAS analysis in related individuals by a factor of 10^3 . This approach is now implemented in the SOLAR-Eclipse using both CPU and GPU implementations. Implementation of this algorithm on GPU provided an additional 1,000 fold improvement when used on a K-80 GPU computer at the Human Connectome Project/ Washington University. We are now in the process of writing a manuscript tentatively titled " Accelerating imaging genetics approaches using algorithms and graphics processing units" where we will formally evaluate the accuracy and performance of accelerated and classical methods. This project will be performed in collaboration with HCP using the newly released genotyping data for this consortium. The second focus was on development of empirical approaches for measuring relatedness directly from the high-density genetic data as described in Specific Aim 3. Quantitative genetic analyses rely on the estimates of relatedness or shared genetic variance among subjects: coefficients of relationship (CR). CR can be inferred from self-reported degrees of relatedness to other study participants or estimated empirically using genome-wide scans of single nucleotide polymorphisms (SNP). In the first study we hypothesized that the empirical CR constructed using whole genome genotyping information may provide more accurate measurements of shared genetic variance among study participants drawn from the same geographical area when compared to self-reported CR. We evaluated the performance of 12 state-of-the-art pairwise relatedness inference methods using a data set with 2485 individuals contained in several large pedigrees that span up to six generations. We observed that all methods have high accuracy (92-99%) when detecting first-, second-and third-degree relationships. Their accuracy dwindle for the more distant relationships. The identical by descent (IBD) segment-based methods however the long running time 24-80 hours reduced their practicality[4]. Based on this evaluation, we chose two methods that provided the good CR accuracy/performance benchmark: The Kinship-based INference for Genome wide association study (KING) method was developed to closely approximate the self-reported CR values. It is frequently used to verify the self-reported relationships in family samples [5]. A second approach, the Weighted Allelic Correlation (WAC) approach, was developed to study "missing

heritability” of complex phenotypes; this refers to the fact that heritability values for some traits may appear to be lower studies in studies of unrelated individuals rather than family or twin-based studies [6]. Both methods were integrated natively in SOLAR-Eclipse. They take raw genotype files in plink format and produce a pedigree file that can read by SOLAR-Eclipse using “load pedi” command. We partnered with HCP to test the hypothesis that that heritability estimates obtained from chromosomal CR values may provide additional information on the genetic contribution to the variance in complex traits [7, 8]. We tested these hypotheses in a large dataset of seventeen quantitative brain-related traits from four phenotypic domains collected by HCP. We observed that the whole-genome heritability estimates were significantly higher ($p < 0.001$) using empirical relationships than these obtained based on self-reports. WAC with weighting on minor allele frequency produced the highest average heritability ($p < 10^{-6}$) estimates. Partitioning of shared variance into genetic and environmental components gave results that were independent of the CR approach. Chromosomal heritability estimates (the proportion of heritability arising from each chromosome) were significantly correlated with the length of the chromosome ($r \sim 0.7$). The patterns of per-chromosome heritability values were similar in traits from the same domain, among the traits that had significant genetic correlations and among the traits that described similar biological value but were not genetically correlated. Our findings suggest complex polygenic inheritance for quantitative traits. The manuscript describing the findings are now in submission to NeuroImage. The pedigree structures generated in these analyses are available through NITRC.

The work in Aim 2 included continued discussion with the International Neuroinformatics Coordinating Facility’s Neuroimaging Data Sharing Task Force on the standardizing the imaging genetic format. At present our team is evaluating several of the proposed data format solution. We have tested the HDF5 based format in the parallel computing environment and found it to perform well for both reading and writing large volumes of data and parallel access from multiple servers. In addition, SOLAR-Eclipse team participated in the development of a standardized rsfMRI pipeline for genetic analyses. We published the preliminary heritability study describing good agreement among additive genetic variance obtained in two independent cohorts[9]. We also developed a web-based 3D viewing software to demonstrate results of large collaborative genetic studies[10].

Progress on Aim 4 has led to acknowledgement of SOLAR-Eclipse in publications in high impact journals, including PNAS, Nature, JAMA Psychiatry, Biological Psychiatry, Neuroimage, Human Brain Mapping and others[11-30].

References

1. Ganjgahi, H., et al., *Fast and powerful heritability inference for family-based neuroimaging studies*. Neuroimage, 2015.
2. Winkler, A.M., et al., *Faster permutation inference in brain imaging*. Neuroimage, 2016. **141**: p. 502-516.
3. Winkler, A.M., et al., *Multi-level block permutation*. Neuroimage, 2016. **123**: p. 253-268.
4. Ramstetter, M.D., et al., *Benchmarking Relatedness Inference Methods with Genome-Wide Data from Thousands of Relatives*. Genetics, 2017. **207**(1): p. 75-82.
5. Manichaikul, A., et al., *Robust relationship inference in genome-wide association studies*. Bioinformatics, 2010. **26**(22): p. 2867-2873.
6. Manolio, T.A., et al., *Finding the missing heritability of complex diseases*. Nature, 2009. **461**(7265): p. 747-753.
7. Visscher, P.M., et al., *Assumption-Free Estimation of Heritability from Genome-Wide Identity-by-Descent Sharing between Full Siblings*. PLoS Genetics, 2006. **2**(3): p. e41.

8. Visscher, PeterÂ M., et al., *Genome Partitioning of Genetic Variation for Height from 11,214 Sibling Pairs*. American Journal of Human Genetics, 2007. **81**(5): p. 1104-1110.
9. Adhikari, B.M., et al., *Heritability estimates on resting state fMRI data using ENIGMA analysis pipeline*. Pacific Symposium on Biocomputing. Pacific Symposium on Biocomputing, 2017. **23**: p. 307-318.
10. Zhang, G., et al., *ENIGMA-Viewer: interactive visualization strategies for conveying effect sizes in meta-analysis*. BMC Bioinformatics, 2017. **18**(Suppl 6): p. 253.
11. Kochunov, P., et al., *Diffusion-weighted imaging uncovers likely sources of processing-speed deficits in schizophrenia*. Proc Natl Acad Sci U S A, 2016. **113**(47): p. 13504-13509.
12. Kochunov, P., et al., *Heritability of complex white matter diffusion traits assessed in a population isolate*. Hum Brain Mapp, 2015.
13. Kochunov, P., et al., *Heterochronicity of white matter development and aging explains regional patient control differences in schizophrenia*. Hum Brain Mapp, 2016.
14. Kochunov, P., et al., *Heritability of fractional anisotropy in human white matter: A comparison of Human Connectome Project and ENIGMA-DTI data*. Neuroimage, 2015. **111**: p. 300-311.
15. Kochunov, P., et al., *The common genetic influence over processing speed and white matter microstructure: Evidence from the Old Order Amish and Human Connectome Projects*. Neuroimage, 2015. **125**: p. 189-197.
16. Adams, H.H.H., et al., *Novel genetic loci underlying human intracranial volume identified through genome-wide association*. Nat Neurosci, 2016. **19**(12): p. 1569-1582.
17. Guadalupe, T., et al., *Human subcortical brain asymmetries in 15,847 people worldwide reveal effects of age and sex*. Brain Imaging and Behavior, 2016: p. 1-18.
18. Sprooten, E., et al., *A comprehensive tractography study of patients with bipolar disorder and their unaffected siblings*. Human Brain Mapping, 2016. **37**(10): p. 3474-3485.
19. Hodgson, K., et al., *Genome-wide significant loci for addiction and anxiety*. European Psychiatry, 2016. **36**: p. 47-54.
20. Rowland, L.M., et al., *Medial Frontal GABA is Lower in Older Schizophrenia: A MEGA-PRESS with Macromolecule Suppression Study*. Molecular psychiatry, 2016. **21**(2): p. 198-204.
21. Thompson, P.M., et al., *ENIGMA and the individual: Predicting factors that affect the brain in 35 countries worldwide*. Neuroimage, 2017. **145, Part B**: p. 389-408.
22. Kuehner, R.M., et al., *Cognitive profiles and heritability estimates in the Old Order Amish*. Psychiatric Genetics, 2016. **26**(4): p. 178-183.
23. Hibar, D.P., et al., *Common genetic variants influence human subcortical brain structures*. Nature, 2015.
24. Unpublished
25. Unpublished
26. Kochunov, P., et al., *Integration of routine QA data into mega€ analysis may improve quality and sensitivity of multisite diffusion tensor imaging studies*. Human Brain Mapping, 2018. **39**(2): p. 1015-1023.

27. Whelan, C.D., et al., *Structural brain abnormalities in the common epilepsies assessed in a worldwide ENIGMA study*. Brain, 2017. **141**(2): p. 391-408.
28. Ryan, M., et al., *Lipid Metabolism, Abdominal Adiposity and Cerebral Health in the Amish*. Obesity (Silver Spring, Md.), 2017. **25**(11): p. 1876-1880.
29. Ryan, M.C., et al., *Miniature pig model of human adolescent brain white matter development*. Journal of Neuroscience Methods, 2017. **296**: p. 99-108.
30. McGuire, S.A., et al., *Reproducibility of quantitative structural and physiological MRI measurements*. Brain and Behavior, 2017. **7**(9): p. e00759.
31. Jahanshad, N., et al., *Multi-site genetic analysis of diffusion images and voxelwise heritability analysis: A pilot project of the ENIGMA-DTI working group*. Neuroimage, 2013. doi:pii: S1053-8119(13)00408-4. 10.1016/j.neuroimage.2013.04.061.

C. PRODUCTS

C.1 PUBLICATIONS

Are there publications or manuscripts accepted for publication in a journal or other publication (e.g., book, one-time publication, monograph) during the reporting period resulting directly from this award?

Yes

Publications Reported for this Reporting Period

Public Access Compliance	Citation
Complete	Stein JL, Medland SE, Vasquez AA, Hibar DP, Senstad RE, Winkler AM, Toro R, Appel K, Bartecek R, Bergmann Ø, Bernard M, Brown AA, Cannon DM, Chakravarty MM, Christoforou A, Domin M, Grimm O, Hollinshead M, Holmes AJ, Homuth G, Hottenga JJ, Langan C, Lopez LM, Hansell NK, Hwang KS, Kim S, Laje G, Lee PH, Liu X, Loth E, Lourdasamy A, Mattingdal M, Mohnke S, Maniega SM, Nho K, Nugent AC, O'Brien C, Papmeyer M, Pütz B, Ramasamy A, Rasmussen J, Rijpkema M, Risacher SL, Roddey JC, Rose EJ, Rytén M, Shen L, Sprooten E, Strengman E, Teumer A, Trabzuni D, Turner J, van Eijk K, van Erp TG, van Tol MJ, Wittfeld K, Wolf C, Woudstra S, Aleman A, Alhusaini S, Almasy L, Binder EB, Brohawn DG, Cantor RM, Carless MA, Corvin A, Czisch M, Curran JE, Davies G, de Almeida MA, Delanty N, Depondt C, Duggirala R, Dyer TD, Erk S, Fagerness J, Fox PT, Freimer NB, Gill M, Göring HH, Hagler DJ, Hoehn D, Holsboer F, Hoogman M, Hosten N, Jahanshad N, Johnson MP, Kasperaviciute D, Kent JW Jr, Kochunov P, Lancaster JL, Lawrie SM, Liewald DC, Mandl R, Matarin M, Mattheisen M, Meisenzahl E, Melle I, Moses EK, Mühleisen TW, Nauck M, Nöthen MM, Olvera RL, Pandolfo M, Pike GB, Puls R, Reinvang I, Renteria ME, Rietschel M, Roffman JL, Royle NA, Rujescu D, Savitz J, Schnack HG, Schnell K, Seiferth N, Smith C, Steen VM, Valdés Hernández MC, Van den Heuvel M, van der Wee NJ, Van Haren NE, Veltman JA, Völzke H, Walker R, Westlye LT, Whelan CD, Agartz I, Boomsma DI, Cavalleri GL, Dale AM, Djurovic S, Drevets WC, Hagoort P, Hall J, Heinz A, Jack CR Jr, Foroud TM, Le Hellard S, Macciardi F, Montgomery GW, Poline JB, Porteous DJ, Sisodiya SM, Starr JM, Sussmann J, Toga AW, Veltman DJ, Walter H, Weiner MW, Bis JC, Ikram MA, Smith AV, Gudnason V, Tzourio C, Vernooij MW, Launer LJ, DeCarli C, Seshadri S, Andreassen OA, Apostolova LG, Bastin ME, Blangero J, Brunner HG, Buckner RL, Cichon S, Coppola G, de Zubicaray GI, Deary IJ, Donohoe G, de Geus EJ, Espeseth T, Fernández G, Glahn DC, Grabe HJ, Hardy J, Hulshoff Pol HE, Jenkinson M, Kahn RS, McDonald C, McIntosh AM, McMahon FJ, McMahon KL, Meyer-Lindenberg A, Morris DW, Müller-Myhsok B, Nichols TE, Ophoff RA, Paus T, Pausova Z, Penninx BW, Potkin SG, Sämann PG, Saykin AJ, Schumann G, Smoller JW, Wardlaw JM, Weale ME, Martin NG, Franke B, Wright MJ, Thompson PM. Identification of common variants associated with human hippocampal and intracranial volumes. <i>Nature genetics</i> . 2012 April 15;44(5):552-61. PubMed PMID: 22504417; PubMed Central PMCID: PMC3635491.
Complete	Blangero J. Complex rare variation and its role in endophenotypic variation in schizophrenia. <i>Biological psychiatry</i> . 2013 March 15;73(6):499-500. PubMed PMID: 23438633; PubMed Central PMCID: PMC4394644.
N/A: Not Peer Reviewed	Unpublished
Complete	Peralta JM, Almeida M, Kent JW Jr, Blangero J. A variance component-based gene burden test. <i>BMC proceedings</i> . 2014;8(Suppl 1 Genetic Analysis Workshop 18Vanessa Olmo):S49. PubMed PMID: 25519388; PubMed Central PMCID: PMC4143638.
Complete	Chouinard-Decorte F, McKay DR, Reid A, Khundrakpam B, Zhao L, Karama S, Rioux P, Sprooten E, Knowles E, Kent JW Jr, Curran JE, Göring HH, Dyer TD, Olvera RL, Kochunov P, Duggirala R, Fox PT, Almasy L, Blangero J, Bellec P, Evans AC, Glahn DC. Heritable changes in regional cortical thickness with age. <i>Brain imaging and behavior</i> . 2014 June;8(2):208-16. PubMed PMID: 24752552; PubMed Central PMCID: PMC4205107.
Complete	Kochunov P, Hong LE. Neurodevelopmental and neurodegenerative models of schizophrenia: white matter at the center stage. <i>Schizophrenia bulletin</i> . 2014 July;40(4):721-8. PubMed PMID: 24870447; PubMed Central PMCID: PMC4059450.

Complete	Wijtenburg SA, Gaston FE, Spieker EA, Korenic SA, Kochunov P, Hong LE, Rowland LM. Reproducibility of phase rotation STEAM at 3T: focus on glutathione. Magnetic resonance in medicine. 2014 September;72(3):603-9. PubMed PMID: 24151202; PubMed Central PMCID: PMC3995860.
Complete	Dager AD, McKay DR, Kent JW Jr, Curran JE, Knowles E, Sprooten E, Göring HH, Dyer TD, Pearlson GD, Olvera RL, Fox PT, Lovallo WR, Duggirala R, Almasy L, Blangero J, Glahn DC. Shared genetic factors influence amygdala volumes and risk for alcoholism. Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology. 2015 January;40(2):412-20. PubMed PMID: 25079289; PubMed Central PMCID: PMC4443955.
Complete	Glahn DC, Williams JT, McKay DR, Knowles EE, Sprooten E, Mathias SR, Curran JE, Kent JW Jr, Carless MA, Göring HH, Dyer TD, Woolsey MD, Winkler AM, Olvera RL, Kochunov P, Fox PT, Duggirala R, Almasy L, Blangero J. Discovering schizophrenia endophenotypes in randomly ascertained pedigrees. Biological psychiatry. 2015 January 1;77(1):75-83. PubMed PMID: 25168609; PubMed Central PMCID: PMC4261014.
Complete	Rao J, Chiappelli J, Kochunov P, Regenold WT, Rapoport SI, Hong LE. Is schizophrenia a neurodegenerative disease? Evidence from age-related decline of brain-derived neurotrophic factor in the brains of schizophrenia patients and matched nonpsychiatric controls. Neuro-degenerative diseases. 2015;15(1):38-44. PubMed PMID: 25531449; PubMed Central PMCID: PMC4348338.
Complete	Spieker EA, Kochunov P, Rowland LM, Sprooten E, Winkler AM, Olvera RL, Almasy L, Duggirala R, Fox PT, Blangero J, Glahn DC, Curran JE. Shared genetic variance between obesity and white matter integrity in Mexican Americans. Frontiers in genetics. 2015;6:26. PubMed PMID: 25763009; PubMed Central PMCID: PMC4327744.
Complete	Du X, Choa FS, Summerfelt A, Tagamets MA, Rowland LM, Kochunov P, Shepard P, Hong LE. Neural summation in human motor cortex by subthreshold transcranial magnetic stimulations. Experimental brain research. 2015 February;233(2):671-7. PubMed PMID: 25399245; PubMed Central PMCID: PMC4297236.
Complete	Knowles EE, McKay DR, Kent JW Jr, Sprooten E, Carless MA, Curran JE, de Almeida MA, Dyer TD, Göring HH, Olvera RL, Duggirala R, Fox PT, Almasy L, Blangero J, Glahn DC. Pleiotropic locus for emotion recognition and amygdala volume identified using univariate and bivariate linkage. The American journal of psychiatry. 2015 February 1;172(2):190-9. PubMed PMID: 25322361; PubMed Central PMCID: PMC4314438.
Complete	Ge T, Nichols TE, Lee PH, Holmes AJ, Roffman JL, Buckner RL, Sabuncu MR, Smoller JW. Massively expedited genome-wide heritability analysis (MEGHA). Proceedings of the National Academy of Sciences of the United States of America. 2015 February 24;112(8):2479-84. PubMed PMID: 25675487; PubMed Central PMCID: PMC4345618.
Complete	Gutman BA, Jahanshad N, Ching CR, Wang Y, Kochunov PV, Nichols TE, Thompson PM. Medial Demons Registration Localizes The Degree of Genetic Influence Over Subcortical Shape Variability: An N= 1480 Meta-Analysis. Proceedings. IEEE International Symposium on Biomedical Imaging. 2015 April;2015:1402-1406. PubMed PMID: 26413211; PubMed Central PMCID: PMC4578221.
Complete	Hibar DP, Stein JL, Renteria ME, Arias-Vasquez A, Desrivieres S, Jahanshad N, Toro R, Wittfeld K, Abramovic L, Andersson M, Aribisala BS, Armstrong NJ, Bernard M, Bohlken MM, Boks MP, Bralten J, Brown AA, Chakravarty MM, Chen Q, Ching CR, Cuellar-Partida G, den Braber A, Giddaluru S, Goldman AL, Grimm O, Guadalupe T, Hass J, Woldehawariat G, Holmes AJ, Hoogman M, Janowitz D, Jia T, Kim S, Klein M, Kraemer B, Lee PH, Olde Loohuis LM, Luciano M, Macare C, Mather KA, Mattheisen M, Milanese Y, Nho K, Papmeyer M, Ramasamy A, Risacher SL, Roiz-Santiañez R, Rose EJ, Salami A, Sämann PG, Schmaal L, Schork AJ, Shin J, Strike LT, Teumer A, van Donkelaar MM, van Eijk KR, Walters RK, Westlye LT, Whelan CD, Winkler AM, Zwiers MP, Alhusaini S, Athanasiu L, Ehrlich S, Hakobyan MM, Hartberg CB, Haukvik UK, Heister AJ, Hoehn D, Kasperaviciute D, Liewald DC, Lopez LM, Makkinje RR, Matarin M, Naber MA, McKay DR, Needham M, Nugent AC, Pütz B, Royle NA, Shen L, Sprooten E, Trabzuni D, van der Marel SS, van Hulzen KJ, Walton E, Wolf C, Almasy L, Ames D, Arepalli S, Assareh AA, Bastin ME, Brodaty H, Bulayeva KB, Carless MA, Cichon S, Corvin A, Curran JE, Czisch M, de Zubicaray GI, Dillman A, Duggirala R, Dyer TD, Erk S, Fedko IO, Ferrucci L, Foroud TM, Fox PT, Fukunaga M, Gibbs JR, Göring HH, Green RC, Guelfi S, Hansell NK, Hartman CA, Hegenscheid K, Heinz A, Hernandez DG, Heslenfeld DJ, Hoekstra PJ, Holsboer F, Homuth G, Hottenga JJ, Ikeda M, Jack CR Jr, Jenkinson M, Johnson R, Kanai R, Keil M, Kent JW Jr, Kochunov P, Kwok JB, Lawrie

	<p>SM, Liu X, Longo DL, McMahon KL, Meisenzahl E, Melle I, Mohnke S, Montgomery GW, Mostert JC, Mühleisen TW, Nalls MA, Nichols TE, Nilsson LG, Nöthen MM, Ohi K, Olvera RL, Perez-Iglesias R, Pike GB, Potkin SG, Reinvang I, Reppermund S, Rietschel M, Romanczuk-Seiferth N, Rosen GD, Rujescu D, Schnell K, Schofield PR, Smith C, Steen VM, Sussmann JE, Thalamuthu A, Toga AW, Traynor BJ, Troncoso J, Turner JA, Valdés Hernández MC, van &apos;t Ent D, van der Brug M, van der Wee NJ, van Tol MJ, Veltman DJ, Wassink TH, Westman E, Zielke RH, Zonderman AB, Ashbrook DG, Hager R, Lu L, McMahon FJ, Morris DW, Williams RW, Brunner HG, Buckner RL, Buitelaar JK, Cahn W, Calhoun VD, Cavalleri GL, Crespo-Facorro B, Dale AM, Davies GE, Delanty N, Depondt C, Djurovic S, Drevets WC, Espeseth T, Gollub RL, Ho BC, Hoffmann W, Hosten N, Kahn RS, Le Hellard S, Meyer-Lindenberg A, Müller-Myhsok B, Nauck M, Nyberg L, Pandolfo M, Penninx BW, Roffman JL, Sisodiya SM, Smoller JW, van Bokhoven H, van Haren NE, Völzke H, Walter H, Weiner MW, Wen W, White T, Agartz I, Andreassen OA, Blangero J, Boomsma DI, Brouwer RM, Cannon DM, Cookson MR, de Geus EJ, Deary IJ, Donohoe G, Fernández G, Fisher SE, Francks C, Glahn DC, Grabe HJ, Gruber O, Hardy J, Hashimoto R, Hulshoff Pol HE, Jönsson EG, Kloszewska I, Lovestone S, Mattay VS, Mecocci P, McDonald C, McIntosh AM, Ophoff RA, Paus T, Pausova Z, Ryten M, Sachdev PS, Saykin AJ, Simmons A, Singleton A, Soininen H, Wardlaw JM, Weale ME, Weinberger DR, Adams HH, Launer LJ, Seiler S, Schmidt R, Chauhan G, Satizabal CL, Becker JT, Yanek L, van der Lee SJ, Ebling M, Fischl B, Longstreth WT Jr, Greve D, Schmidt H, Nyquist P, Vinke LN, van Duijn CM, Xue L, Mazoyer B, Bis JC, Gudnason V, Seshadri S, Ikram MA, Martin NG, Wright MJ, Schumann G, Franke B, Thompson PM, Medland SE. Common genetic variants influence human subcortical brain structures. <i>Nature</i>. 2015 April 9;520(7546):224-9. PubMed PMID: 25607358; PubMed Central PMCID: PMC4393366.</p>
Complete	<p>Chiappelli J, Hong LE, Wijtenburg SA, Du X, Gaston F, Kochunov P, Rowland LM. Alterations in frontal white matter neurochemistry and microstructure in schizophrenia: implications for neuroinflammation. <i>Translational psychiatry</i>. 2015 April 14;5:e548. PubMed PMID: 25871973; PubMed Central PMCID: PMC4462606.</p>
Complete	<p>Acheson A, Tagamets MA, Winkler A, Rowland LM, Mathias CW, Wright SN, Hong LE, Kochunov P, Dougherty DM. Striatal activity and reduced white matter increase frontal activity in youths with family histories of alcohol and other substance-use disorders performing a go/no-go task. <i>Brain and behavior</i>. 2015 July;5(7):e00352. PubMed PMID: 26221573; PubMed Central PMCID: PMC4511289.</p>
Complete	<p>Ganjgahi H, Winkler AM, Glahn DC, Blangero J, Kochunov P, Nichols TE. Fast and powerful heritability inference for family-based neuroimaging studies. <i>NeuroImage</i>. 2015 July 15;115:256-68. PubMed PMID: 25812717; PubMed Central PMCID: PMC4463976.</p>
Complete	<p>Sprooten E, Gupta CN, Knowles EE, McKay DR, Mathias SR, Curran JE, Kent JW Jr, Carless MA, Almeida MA, Dyer TD, Göring HH, Olvera RL, Kochunov P, Fox PT, Duggirala R, Almasy L, Calhoun VD, Blangero J, Turner JA, Glahn DC. Genome-wide significant linkage of schizophrenia-related neuroanatomical trait to 12q24. <i>American journal of medical genetics. Part B, Neuropsychiatric genetics : the official publication of the International Society of Psychiatric Genetics</i>. 2015 December;168(8):678-86. PubMed PMID: 26440917; PubMed Central PMCID: PMC4639444.</p>
Complete	<p>Almeida M, Blondell L, Peralta JM, Kent JW Jr, Jun G, Teslovich TM, Fuchsberger C, Wood AR, Manning AK, Frayling TM, Cingolani PE, Sladek R, Dyer TD, Abecasis G, Duggirala R, Blangero J. Independent test assessment using the extreme value distribution theory. <i>BMC proceedings</i>. 2016;10(Suppl 7):245-249. PubMed PMID: 27980644; PubMed Central PMCID: PMC5133519.</p>
Complete	<p>Chiappelli J, Shi Q, Kodi P, Savransky A, Kochunov P, Rowland LM, Nugent KL, Hong LE. Disrupted glucocorticoid-Immune interactions during stress response in schizophrenia. <i>Psychoneuroendocrinology</i>. 2016 January;63:86-93. PubMed PMID: 26431803; PubMed Central PMCID: PMC4695263.</p>
Complete	<p>Li K, Laird AR, Price LR, McKay DR, Blangero J, Glahn DC, Fox PT. Progressive Bidirectional Age-Related Changes in Default Mode Network Effective Connectivity across Six Decades. <i>Frontiers in aging neuroscience</i>. 2016;8:137. PubMed PMID: 27378909; PubMed Central PMCID: PMC4905965.</p>
Complete	<p>Quillen EE, Blangero J, Almasy L. A variance component method for integrated pathway analysis of gene expression data. <i>BMC proceedings</i>. 2016;10(Suppl 7):337-342. PubMed PMID: 27980659; PubMed Central PMCID: PMC5133490.</p>

Complete	Rowland LM, Krause BW, Wijtenburg SA, McMahon RP, Chiappelli J, Nugent KL, Nisonger SJ, Korenic SA, Kochunov P, Hong LE. Medial frontal GABA is lower in older schizophrenia: a MEGA-PRESS with macromolecule suppression study. <i>Molecular psychiatry</i> . 2016 February;21(2):198-204. PubMed PMID: 25824298; PubMed Central PMCID: PMC4591074.
Complete	Hasan KM, Mwangi B, Cao B, Keser Z, Tustison NJ, Kochunov P, Frye RE, Savatic M, Soares J. Entorhinal Cortex Thickness across the Human Lifespan. <i>Journal of neuroimaging : official journal of the American Society of Neuroimaging</i> . 2016 May;26(3):278-82. PubMed PMID: 26565394; PubMed Central PMCID: PMC4826319.
Complete	Winkler TW, Justice AE, Graff M, Barata L, Feitosa MF, Chu S, Czajkowski J, Esko T, Fall T, Kilpeläinen TO, Lu Y, Mägi R, Mihailov E, Pers TH, Rüeger S, Teumer A, Ehret GB, Ferreira T, Heard-Costa NL, Karjalainen J, Lagou V, Mahajan A, Neinast MD, Prokopenko I, Simino J, Teslovich TM, Jansen R, Westra HJ, White CC, Absher D, Ahluwalia TS, Ahmad S, Albrecht E, Alves AC, Bragg-Gresham JL, de Craen AJ, Bis JC, Bonnefond A, Boucher G, Cadby G, Cheng YC, Chiang CW, Delgado G, Demirkan A, Dueker N, Eklund N, Eiriksdottir G, Eriksson J, Feenstra B, Fischer K, Frau F, Galesloot TE, Geller F, Goel A, Gorski M, Grammer TB, Gustafsson S, Haitjema S, Hottenga JJ, Huffman JE, Jackson AU, Jacobs KB, Johansson A, Kaakinen M, Kleber ME, Lahti J, Mateo Leach I, Lehne B, Liu Y, Lo KS, Lorentzon M, Luan J, Madden PA, Mangino M, McKnight B, Medina-Gomez C, Monda KL, Montasser ME, Müller G, Müller-Nurasyid M, Nolte IM, Panoutsopoulou K, Pascoe L, Paternoster L, Rayner NW, Renström F, Rizzi F, Rose LM, Ryan KA, Salo P, Sanna S, Scharnagl H, Shi J, Smith AV, Southam L, Stančáková A, Steinthorsdottir V, Strawbridge RJ, Sung YJ, Tachmazidou I, Tanaka T, Thorleifsson G, Trompet S, Pervjakova N, Tyrer JP, Vandenput L, van der Laan SW, van der Velde N, van Setten J, van Vliet-Ostaptchouk JV, Verweij N, Vlachopoulou E, Waite LL, Wang SR, Wang Z, Wild SH, Willenborg C, Wilson JF, Wong A, Yang J, Yengo L, Yerges-Armstrong LM, Yu L, Zhang W, Zhao JH, Andersson EA, Bakker SJ, Baldassarre D, Banasik K, Barcella M, Barlassina C, Bellis C, Benaglio P, Blangero J, Blüher M, Bonnet F, Bonnycastle LL, Boyd HA, Bruinenberg M, Buchman AS, Campbell H, Chen YI, Chines PS, Claudi-Boehm S, Cole J, Collins FS, de Geus EJ, de Groot LC, Dimitriou M, Duan J, Enroth S, Eury E, Farmaki AE, Forouhi NG, Friedrich N, Gejman PV, Gigante B, Glorioso N, Go AS, Gottesman O, Gräßler J, Grallert H, Grarup N, Gu YM, Broer L, Ham AC, Hansen T, Harris TB, Hartman CA, Hassinen M, Hastie N, Hattersley AT, Heath AC, Henders AK, Hernandez D, Hillege H, Holmen O, Hovingh KG, Hui J, Husemoen LL, Hutri-Kähönen N, Hysi PG, Illig T, De Jager PL, Jalilzadeh S, Jørgensen T, Jukema JW, Juonala M, Kanoni S, Karaleftheri M, Khaw KT, Kinnunen L, Kittner SJ, Koenig W, Kolcic I, Kovacs P, Krarup NT, Kratzer W, Krüger J, Kuh D, Kumari M, Kyriakou T, Langenberg C, Lannfelt L, Lanzani C, Lotay V, Launer LJ, Leander K, Lindström J, Linneberg A, Liu YP, Lobbens S, Luben R, Lyssenko V, Männistö S, Magnusson PK, McArdle WL, Menni C, Merger S, Milani L, Montgomery GW, Morris AP, Narisu N, Nelis M, Ong KK, Palotie A, Pérusse L, Pichler I, Pilia MG, Pouta A, Rheinberger M, Ribel-Madsen R, Richards M, Rice KM, Rice TK, Rivolta C, Salomaa V, Sanders AR, Sarzynski MA, Scholtens S, Scott RA, Scott WR, Sebert S, Sengupta S, Sennblad B, Seufferlein T, Silveira A, Slagboom PE, Smit JH, Sparsø TH, Stirrups K, Stolk RP, Stringham HM, Swertz MA, Swift AJ, Syvänen AC, Tan ST, Thorand B, Tönjes A, Tremblay A, Tsafantakis E, van der Most PJ, Völker U, Vohl MC, Vonk JM, Waldenberger M, Walker RW, Wennauer R, Widén E, Willemsen G, Wilsgaard T, Wright AF, Zillikens MC, van Dijk SC, van Schoor NM, Asselbergs FW, de Bakker PI, Beckmann JS, Beilby J, Bennett DA, Bergman RN, Bergmann S, Böger CA, Boehm BO, Boerwinkle E, Boomsma DI, Bornstein SR, Bottinger EP, Bouchard C, Chambers JC, Chanock SJ, Chasman DI, Cucca F, Cusi D, Dedoussis G, Erdmann J, Eriksson JG, Evans DA, de Faire U, Farrall M, Ferrucci L, Ford I, Franke L, Franks PW, Froguel P, Gansevoort RT, Gieger C, Grönberg H, Gudnason V, Gyllenstein U, Hall P, Hamsten A, van der Harst P, Hayward C, Heliövaara M, Hengstenberg C, Hicks AA, Hingorani A, Hofman A, Hu F, Huikuri HV, Hveem K, James AL, Jordan JM, Julia A, Kähönen M, Kajantie E, Kathiresan S, Kiemeny LA, Kivimäki M, Knekt PB, Koistinen HA, Kooner JS, Koskinen S, Kuusisto J, Maerz W, Martin NG, Laakso M, Lakka TA, Lehtimäki T, Lettre G, Levinson DF, Lind L, Lokki ML, Mäntyselkä P, Melbye M, Metspalu A, Mitchell BD, Moll FL, Murray JC, Musk AW, Nieminen MS, Njølstad I, Ohlsson C, Oldehinkel AJ, Oostra BA, Palmer LJ, Pankow JS, Pasterkamp G, Pedersen NL, Pedersen O, Penninx BW, Perola M, Peters A, Polašek O, Pramstaller PP, Psaty BM, Qi L, Quertermous T, Raitakari OT, Rankinen T, Rauramaa R, Ridker PM, Rioux JD, Rivadeneira F, Rotter JI, Rudan I, den Ruijter HM, Saltevo J, Sattar N, Schunkert H, Schwarz PE, Shuldiner AR, Sinisalo J, Snieder H, Sørensen TI, Spector TD, Staessen JA, Stefania B, Thorsteinsdottir U, Stumvoll M, Tardif JC, Tremoli E, Tuomilehto J, Uitterlinden AG, Uusitupa M, Verbeek AL, Vermeulen SH, Viikari JS, Vitart V, Völzke H, Vollenweider P,

	Waeber G, Walker M, Wallaschofski H, Wareham NJ, Watkins H, Zeggini E, Chakravarti A, Clegg DJ, Cupples LA, Gordon-Larsen P, Jaquish CE, Rao DC, Abecasis GR, Assimes TL, Barroso I, Berndt SI, Boehnke M, Deloukas P, Fox CS, Groop LC, Hunter DJ, Ingelsson E, Kaplan RC, McCarthy MI, Mohlke KL, O'Connell JR, Schlessinger D, Strachan DP, Stefansson K, van Duijn CM, Hirschhorn JN, Lindgren CM, Heid IM, North KE, Borecki IB, Kutalik Z, Loos RJ. Correction: The Influence of Age and Sex on Genetic Associations with Adult Body Size and Shape: A Large-Scale Genome-Wide Interaction Study. PLoS genetics. 2016 June;12(6):e1006166. PubMed PMID: 27355579; PubMed Central PMCID: PMC4927064.
Complete	Chiappelli J, Postolache TT, Kochunov P, Rowland LM, Wijtenburg SA, Shukla DK, Tagamets M, Du X, Savransky A, Lowry CA, Can A, Fuchs D, Hong LE. Tryptophan Metabolism and White Matter Integrity in Schizophrenia. Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology. 2016 September;41(10):2587-95. PubMed PMID: 27143602; PubMed Central PMCID: PMC4987857.
Complete	Sprooten E, Barrett J, McKay DR, Knowles EE, Mathias SR, Winkler AM, Brumbaugh MS, Landau S, Cyr L, Kochunov P, Glahn DC. A comprehensive tractography study of patients with bipolar disorder and their unaffected siblings. Human brain mapping. 2016 October;37(10):3474-85. PubMed PMID: 27198848; PubMed Central PMCID: PMC5496097.
Complete	Kochunov P, Rowland LM, Fieremans E, Veraart J, Jahanshad N, Eskandar G, Du X, Muellerklein F, Savransky A, Shukla D, Sampath H, Thompson PM, Hong LE. Diffusion-weighted imaging uncovers likely sources of processing-speed deficits in schizophrenia. Proceedings of the National Academy of Sciences of the United States of America. 2016 November 22;113(47):13504-13509. PubMed PMID: 27834215; PubMed Central PMCID: PMC5127361.
Complete	Du X, Choa FS, Summerfelt A, Rowland LM, Chiappelli J, Kochunov P, Hong LE. N100 as a generic cortical electrophysiological marker based on decomposition of TMS-evoked potentials across five anatomic locations. Experimental brain research. 2017 January;235(1):69-81. PubMed PMID: 27628235; PubMed Central PMCID: PMC5269602.
Complete	Hodgson K, Almasy L, Knowles EE, Kent JW Jr, Curran JE, Dyer TD, Göring HH, Olvera RL, Woolsey MD, Duggirala R, Fox PT, Blangero J, Glahn DC. The genetic basis of the comorbidity between cannabis use and major depression. Addiction (Abingdon, England). 2017 January;112(1):113-123. PubMed PMID: 27517884; PubMed Central PMCID: PMC5148647.
Complete	Wijtenburg SA, Wright SN, Korenic SA, Gaston FE, Ndubuizu N, Chiappelli J, McMahon RP, Chen H, Savransky A, Du X, Wang DJ, Kochunov P, Hong LE, Rowland LM. Altered Glutamate and Regional Cerebral Blood Flow Levels in Schizophrenia: A ¹ H-MRS and pCASL study. Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology. 2017 January;42(2):562-571. PubMed PMID: 27562377; PubMed Central PMCID: PMC5399238.
Complete	Thompson PM, Andreassen OA, Arias-Vasquez A, Bearden CE, Boedhoe PS, Brouwer RM, Buckner RL, Buitelaar JK, Bulayeva KB, Cannon DM, Cohen RA, Conrod PJ, Dale AM, Deary IJ, Dennis EL, de Reus MA, Desrivieres S, Dima D, Donohoe G, Fisher SE, Fouche JP, Francks C, Frangou S, Franke B, Ganjgahi H, Garavan H, Glahn DC, Grabe HJ, Guadalupe T, Gutman BA, Hashimoto R, Hibar DP, Holland D, Hoogman M, Pol HEH, Hosten N, Jahanshad N, Kelly S, Kochunov P, Kremen WS, Lee PH, Mackey S, Martin NG, Mazoyer B, McDonald C, Medland SE, Morey RA, Nichols TE, Paus T, Pausova Z, Schmaal L, Schumann G, Shen L, Sisodiya SM, Smit DJA, Smoller JW, Stein DJ, Stein JL, Toro R, Turner JA, van den Heuvel MP, van den Heuvel OL, van Erp TGM, van Rooij D, Veltman DJ, Walter H, Wang Y, Wardlaw JM, Whelan CD, Wright MJ, Ye J. ENIGMA and the individual: Predicting factors that affect the brain in 35 countries worldwide. NeuroImage. 2017 January 15;145(Pt B):389-408. PubMed PMID: 26658930; PubMed Central PMCID: PMC4893347.
Complete	Acheson A, Wijtenburg SA, Rowland LM, Winkler A, Mathias CW, Hong LE, Jahanshad N, Patel B, Thompson PM, McGuire SA, Sherman PM, Kochunov P, Dougherty DM. Reproducibility of tract-based white matter microstructural measures using the ENIGMA-DTI protocol. Brain and behavior. 2017 February;7(2):e00615. PubMed PMID: 28239525; PubMed Central PMCID: PMC5318368.

Complete	Du X, Kochunov P, Summerfelt A, Chiappelli J, Choa FS, Hong LE. The role of white matter microstructure in inhibitory deficits in patients with schizophrenia. Brain stimulation. 2017 March;10(2):283-290. PubMed PMID: 27867023; PubMed Central PMCID: PMC5316346.
Complete	Knowles EE, Meikle PJ, Huynh K, Göring HH, Olvera RL, Mathias SR, Duggirala R, Almasy L, Blangero J, Curran JE, Glahn DC. Serum phosphatidylinositol as a biomarker for bipolar disorder liability. Bipolar disorders. 2017 March;19(2):107-115. PubMed PMID: 28230325; PubMed Central PMCID: PMC5798864.
Complete	McGuire JA, Sherman PM, Dean E, Bernot JM, Rowland LM, McGuire SA, Kochunov PV. Utilization of MRI for Cerebral White Matter Injury in a Hypobaric Swine Model-Validation of Technique. Military medicine. 2017 May;182(5):e1757-e1764. PubMed PMID: 29087921; PubMed Central PMCID: PMC5664949.
Complete	Hodgson K, Carless MA, Kulkarni H, Curran JE, Sprooten E, Knowles EE, Mathias S, Göring HHH, Yao N, Olvera RL, Fox PT, Almasy L, Duggirala R, Blangero J, Glahn DC. Epigenetic Age Acceleration Assessed with Human White-Matter Images. The Journal of neuroscience : the official journal of the Society for Neuroscience. 2017 May 3;37(18):4735-4743. PubMed PMID: 28385874; PubMed Central PMCID: PMC5426566.
Complete	Kulkarni H, Mamtani M, Wong G, Weir JM, Barlow CK, Dyer TD, Almasy L, Mahaney MC, Comuzzie AG, Duggirala R, Meikle PJ, Blangero J, Curran JE. Genetic correlation of the plasma lipidome with type 2 diabetes, prediabetes and insulin resistance in Mexican American families. BMC genetics. 2017 May 19;18(1):48. PubMed PMID: 28525987; PubMed Central PMCID: PMC5438505.
Complete	Zhang G, Kochunov P, Hong E, Kelly S, Whelan C, Jahanshad N, Thompson P, Chen J. ENIGMA-Viewer: interactive visualization strategies for conveying effect sizes in meta-analysis. BMC bioinformatics. 2017 June 6;18(Suppl 6):253. PubMed PMID: 28617224; PubMed Central PMCID: PMC5471941.
Complete	Farook VS, Reddivari L, Mummidi S, Puppala S, Arya R, Lopez-Alvarenga JC, Fowler SP, Chittoor G, Resendez RG, Kumar BM, Comuzzie AG, Curran JE, Lehman DM, Jenkinson CP, Lynch JL, DeFronzo RA, Blangero J, Hale DE, Duggirala R, Vanamala JK. Genetics of serum carotenoid concentrations and their correlation with obesity-related traits in Mexican American children. The American journal of clinical nutrition. 2017 July;106(1):52-58. PubMed PMID: 28515064; PubMed Central PMCID: PMC5486195.
Complete	Mathias SR, Knowles EEM, Barrett J, Leach O, Buccheri S, Beetham T, Blangero J, Poldrack RA, Glahn DC. The Processing-Speed Impairment in Psychosis Is More Than Just Accelerated Aging. Schizophrenia bulletin. 2017 July 1;43(4):814-823. PubMed PMID: 28062652; PubMed Central PMCID: PMC5472152.
Complete	Kochunov P, Coyle TR, Rowland LM, Jahanshad N, Thompson PM, Kelly S, Du X, Sampath H, Bruce H, Chiappelli J, Ryan M, Fisseha F, Savransky A, Adhikari B, Chen S, Paciga SA, Whelan CD, Xie Z, Hyde CL, Chen X, Schubert CR, O'Donnell P, Hong LE. Association of White Matter With Core Cognitive Deficits in Patients With Schizophrenia. JAMA psychiatry. 2017 September 1;74(9):958-966. PubMed PMID: 28768312; PubMed Central PMCID: PMC5710230.
Complete	Ramstetter MD, Dyer TD, Lehman DM, Curran JE, Duggirala R, Blangero J, Mezey JG, Williams AL. Benchmarking Relatedness Inference Methods with Genome-Wide Data from Thousands of Relatives. Genetics. 2017 September;207(1):75-82. PubMed PMID: 28739658; PubMed Central PMCID: PMC5586387.
PMC Journal - In process	Chiappelli J, Shi Q, Wijtenburg SA, Quiton R, Wisner K, Gaston F, Kodi P, Gaudiot C, Kochunov P, Rowland LM, Hong LE. Glutamatergic Response to Heat Pain Stress in Schizophrenia. Schizophrenia bulletin. 2017 September 23. PubMed PMID: 29036718.
Complete	Ryan M, Kochunov P, Rowland LM, Mitchell BD, Wijtenburg SA, Fieremans E, Veraart J, Novikov DS, Du X, Adhikari B, Fisseha F, Bruce H, Chiappelli J, Sampath H, Ament S, O'Donnell J, Shuldiner AR, Hong LE. Lipid Metabolism, Abdominal Adiposity, and Cerebral Health in the Amish. Obesity (Silver Spring, Md.). 2017 November;25(11):1876-1880. PubMed PMID: 28834322; PubMed Central PMCID: PMC5667552.
PMC Journal - In process	Alexander-Bloch AF, Mathias SR, Fox PT, Olvera RL, Göring HHH, Duggirala R, Curran JE, Blangero J, Glahn DC. Human Cortical Thickness Organized into Genetically-

	determined Communities across Spatial Resolutions. Cerebral cortex (New York, N.Y. : 1991). 2017 November 28;;1-13. PubMed PMID: 29190330.
PMC Journal - In process	Hodgson K, Poldrack RA, Curran JE, Knowles EE, Mathias S, Göring HHH, Yao N, Olvera RL, Fox PT, Almasy L, Duggirala R, Barch DM, Blangero J, Glahn DC. Shared Genetic Factors Influence Head Motion During MRI and Body Mass Index. Cerebral cortex (New York, N.Y. : 1991). 2017 December 1;27(12):5539-5546. PubMed PMID: 27744290.
Complete	Adhikari BM, Jahanshad N, Shukla D, Glahn DC, Blangero J, Reynolds RC, Cox RW, Fieremans E, Veraart J, Novikov DS, Nichols TE, Hong LE, Thompson PM, Kochunov P. Heritability estimates on resting state fMRI data using ENIGMA analysis pipeline. Pacific Symposium on Biocomputing. Pacific Symposium on Biocomputing. 2018;23:307-318. PubMed PMID: 29218892; PubMed Central PMCID: PMC5728672.
Complete	Chavez S, Viviano J, Zamyadi M, Kingsley PB, Kochunov P, Strother S, Voineskos A. A novel DTI-QA tool: Automated metric extraction exploiting the sphericity of an agar filled phantom. Magnetic resonance imaging. 2018 February;46:28-39. PubMed PMID: 29054737; PubMed Central PMCID: PMC5800507.
Complete	Kochunov P, Dickie EW, Viviano JD, Turner J, Kingsley PB, Jahanshad N, Thompson PM, Ryan MC, Fieremans E, Novikov D, Veraart J, Hong EL, Malhotra AK, Buchanan RW, Chavez S, Voineskos AN. Integration of routine QA data into mega-analysis may improve quality and sensitivity of multisite diffusion tensor imaging studies. Human brain mapping. 2018 February;39(2):1015-1023. PubMed PMID: 29181875; PubMed Central PMCID: PMC5764798.
Complete	Whelan CD, Altmann A, Botia JA, Jahanshad N, Hibar DP, Absil J, Alhusaini S, Alvim MKM, Auvinen P, Bartolini E, Berge FPG, Bernardes T, Blackmon K, Braga B, Caligiuri ME, Calvo A, Carr SJ, Chen J, Chen S, Cherubini A, David P, Domin M, Foley S, França W, Haaker G, Isaev D, Keller SS, Kotikalapudi R, Kowalczyk MA, Kuzniecky R, Langner S, Lenge M, Leyden KM, Liu M, Loi RQ, Martin P, Mascalchi M, Morita ME, Pariente JC, Rodríguez-Cruces R, Rummel C, Saavalainen T, Semmler MK, Severino M, Thomas RH, Tondelli M, Tortora D, Vaudano AE, Vivash L, von Podewils F, Wagner J, Weber B, Yao Y, Yasuda CL, Zhang G, Bargalló N, Bender B, Bernasconi N, Bernasconi A, Bernhardt BC, Blümcke I, Carlson C, Cavalleri GL, Cendes F, Concha L, Delanty N, Depondt C, Devinsky O, Doherty CP, Focke NK, Gambardella A, Guerrini R, Hamandi K, Jackson GD, Kälviäinen R, Kochunov P, Kwan P, Labate A, McDonald CR, Meletti S, O'Brien TJ, Ourselin S, Richardson MP, Striano P, Thesen T, Wiest R, Zhang J, Vezzani A, Ryten M, Thompson PM, Sisodiya SM. Structural brain abnormalities in the common epilepsies assessed in a worldwide ENIGMA study. Brain : a journal of neurology. 2018 February 1;141(2):391-408. PubMed PMID: 29365066; PubMed Central PMCID: PMC5837616.
Complete	Puvvada KC, Summerfelt A, Du X, Krishna N, Kochunov P, Rowland LM, Simon JZ, Hong LE. Delta Vs Gamma Auditory Steady State Synchrony in Schizophrenia. Schizophrenia bulletin. 2018 February 15;44(2):378-387. PubMed PMID: 29036430; PubMed Central PMCID: PMC5814801.
Complete	Ryan MC, Sherman P, Rowland LM, Wijtenburg SA, Acheson A, Fieremans E, Veraart J, Novikov DS, Hong LE, Sladky J, Peralta PD, Kochunov P, McGuire SA. Miniature pig model of human adolescent brain white matter development. Journal of neuroscience methods. 2018 February 15;296:99-108. PubMed PMID: 29277719; PubMed Central PMCID: PMC5817010.
PMC Journal - In process	Kelly S, Jahanshad N, Zalesky A, Kochunov P, Agartz I, Alloza C, Andreassen OA, Arango C, Banaj N, Bouix S, Bousman CA, Brouwer RM, Bruggemann J, Bustillo J, Cahn W, Calhoun V, Cannon D, Carr V, Catts S, Chen J, Chen JX, Chen X, Chiapponi C, Cho KK, Ciullo V, Corvin AS, Crespo-Facorro B, Cropley V, De Rossi P, Diaz-Caneja CM, Dickie EW, Ehrlich S, Fan FM, Faskowitz J, Fatouros-Bergman H, Flyckt L, Ford JM, Fouche JP, Fukunaga M, Gill M, Glahn DC, Gollub R, Goudzwaard ED, Guo H, Gur RE, Gur RC, Gurholt TP, Hashimoto R, Hatton SN, Henskens FA, Hibar DP, Hickie IB, Hong LE, Horacek J, Howells FM, Hulshoff Pol HE, Hyde CL, Isaev D, Jablensky A, Jansen PR, Janssen J, Jönsson EG, Jung LA, Kahn RS, Kikinis Z, Liu K, Klauser P, Knöchel C, Kubicki M, Lagopoulos J, Langen C, Lawrie S, Lenroot RK, Lim KO, Lopez-Jaramillo C, Lyall A, Magnotta V, Mandl RCW, Mathalon DH, McCarley RW, McCarthy-Jones S, McDonald C, McEwen S, McIntosh A, Melicher T, Mesholam-Gately RI, Michie PT, Mowry B, Mueller BA, Newell DT, O'Donnell P, Oertel-Knöchel V, Oestreich L, Paciga SA, Pantelis C, Pasternak O, Pearson G, Pellicano GR, Pereira A, Pineda Zapata J, Piras F, Potkin SG, Preda A, Rasser PE, Roalf DR, Roiz R, Roos A,

Rotenberg D, Satterthwaite TD, Savadjiev P, Schall U, Scott RJ, Seal ML, Seidman LJ, Shannon Weickert C, Whelan CD, Shenton ME, Kwon JS, Spalletta G, Spaniel F, Sprooten E, Stäblein M, Stein DJ, Sundram S, Tan Y, Tan S, Tang S, Temmingh HS, Westlye LT, Tønnesen S, Tordesillas-Gutierrez D, Doan NT, Vaidya J, van Haren NEM, Vargas CD, Vecchio D, Velakoulis D, Voineskos A, Voyvodic JQ, Wang Z, Wan P, Wei D, Weickert TW, Whalley H, White T, Whitford TJ, Wojcik JD, Xiang H, Xie Z, Yamamori H, Yang F, Yao N, Zhang G, Zhao J, van Erp TGM, Turner J, Thompson PM, Donohoe G. Widespread white matter microstructural differences in schizophrenia across 4322 individuals: results from the ENIGMA Schizophrenia DTI Working Group. *Molecular psychiatry*. 2018 May;23(5):1261-1269. PubMed PMID: 29038599.

C.2 WEBSITE(S) OR OTHER INTERNET SITE(S)

Category	Explanation
Research Material, Research Material, Research Material	http://solar-eclipse-genetics.org/ is the main site for solar eclipse including manual page.

C.3 TECHNOLOGIES OR TECHNIQUES

NOTHING TO REPORT

C.4 INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES

Have inventions, patent applications and/or licenses resulted from the award during the reporting period? No

If yes, has this information been previously provided to the PHS or to the official responsible for patent matters at the grantee organization? No

C.5 OTHER PRODUCTS AND RESOURCE SHARING

Category	Explanation
Software	http://www.nitrc.org/projects/se_linux/ Is the main distribution point for the solar-eclipse software. It also provides the github link for source code and version references
Research Material	http://solar-eclipse-genetics.org/ is the main site for solar eclipse including manual page.
Data or Databases	http://enigma-viewer.org/ is the site for reporting results from large mega-analytical cohorts analyzed using solar-eclipse

D. PARTICIPANTS

D.1 WHAT INDIVIDUALS HAVE WORKED ON THE PROJECT?

Commons ID	S/K	Name	Degree(s)	Role	Cal	Aca	Sum	Foreign Org	Country	SS
KOCHUNOV	Y	KOCHUNOV, PETER V	MS,MS,P HD	PD/PI	EFFORT					NA

Glossary of acronyms:

S/K - Senior/Key

DOB - Date of Birth

Cal - Person Months (Calendar)

Aca - Person Months (Academic)

Sum - Person Months (Summer)

Foreign Org - Foreign Organization Affiliation

SS - Supplement Support

RE - Reentry Supplement

DI - Diversity Supplement

OT - Other

NA - Not Applicable

D.2 PERSONNEL UPDATES

D.2.a Level of Effort

Will there be, in the next budget period, either (1) a reduction of 25% or more in the level of effort from what was approved by the agency for the PD/PI(s) or other senior/key personnel designated in the Notice of Award, or (2) a reduction in the level of effort below the minimum amount of effort required by the Notice of Award?

No

D.2.b New Senior/Key Personnel

Are there, or will there be, new senior/key personnel?

No

D.2.c Changes in Other Support

Has there been a change in the active other support of senior/key personnel since the last reporting period?

No

D.2.d New Other Significant Contributors

Are there, or will there be, new other significant contributors?

No

D.2.e Multi-PI (MPI) Leadership Plan

Will there be a change in the MPI Leadership Plan for the next budget period?

NA

E. IMPACT

E.1 WHAT IS THE IMPACT ON THE DEVELOPMENT OF HUMAN RESOURCES?

Not Applicable

E.2 WHAT IS THE IMPACT ON PHYSICAL, INSTITUTIONAL, OR INFORMATION RESOURCES THAT FORM INFRASTRUCTURE?

NOTHING TO REPORT

E.3 WHAT IS THE IMPACT ON TECHNOLOGY TRANSFER?

Not Applicable

E.4 WHAT DOLLAR AMOUNT OF THE AWARD'S BUDGET IS BEING SPENT IN FOREIGN COUNTRY(IES)?

NOTHING TO REPORT

F. CHANGES

F.1 CHANGES IN APPROACH AND REASONS FOR CHANGE

Not Applicable

F.2 ACTUAL OR ANTICIPATED CHALLENGES OR DELAYS AND ACTIONS OR PLANS TO RESOLVE THEM

NOTHING TO REPORT

F.3 SIGNIFICANT CHANGES TO HUMAN SUBJECTS, VERTEBRATE ANIMALS, BIOHAZARDS, AND/OR SELECT AGENTS**F.3.a Human Subjects**

No Change

F.3.b Vertebrate Animals

No Change

F.3.c Biohazards

No Change

F.3.d Select Agents

No Change

G. SPECIAL REPORTING REQUIREMENTS

G.1 SPECIAL NOTICE OF AWARD TERMS AND FUNDING OPPORTUNITIES ANNOUNCEMENT REPORTING REQUIREMENTS

NOTHING TO REPORT

G.2 RESPONSIBLE CONDUCT OF RESEARCH

Not Applicable

G.3 MENTOR'S REPORT OR SPONSOR COMMENTS

Not Applicable

G.4 HUMAN SUBJECTS

G.4.a Does the project involve human subjects?

No

G.4.b Inclusion Enrollment Data

Not Applicable

G.4.c ClinicalTrials.gov

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

G.5 HUMAN SUBJECTS EDUCATION REQUIREMENT

Are there personnel on this project who are newly involved in the design or conduct of human subjects research?

G.6 HUMAN EMBRYONIC STEM CELLS (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 VERTEBRATE ANIMALS

Does this project involve vertebrate animals?

No

G.8 PROJECT/PERFORMANCE SITES

Organization Name:	DUNS	Congressional District	Address
Primary: University of Maryland, Baltimore	188435911	MD-07	UNIVERSITY OF MARYLAND BALTIMORE PO Box 21247 Baltimore MD 21228
University of Maryland, Baltimore	188435911	MD-007	UNIVERSITY OF MARYLAND BALTIMORE Office of Research and Development Baltimore MD 212011508
University of Texas Health Science Center at San Antonio	800772162	TX-021	7703 Floyd Curl Drive, Mail Code 7828 San Antonio TX 782293900

University of Warwick	231745683	00-000	University House Kirby Corner Road Coventry, West Midlands
University of Maryland Baltimore	188435911	MD-007	Maryland Psychiatric Research Center Grounds of Spring Grove Hospital Center Baltimore MD 212284663
UNIVERSITY OF MARYLAND, BALTIMORE, OFFICE OF RESEARCH AND DEVELOPMENT	188435911		UNIVERSITY OF MARYLAND BALTIMORE 620 W LEXINGTON ST, 4TH FL BALTIMORE MD 212011508
University of Maryland, Baltimore	188435911	MD-07	UNIVERSITY OF MARYLAND BALTIMORE PO Box 21247 Baltimore MD 212011508
University of Maryland, Baltimore	188435911	MD-007	UNIVERSITY OF MARYLAND BALTIMORE Office of Research and Development Baltimore MD 212011508
University of Texas Health Science Center at San Antonio	800772162	TX-021	7703 Floyd Curl Drive, Mail Code 7828 San Antonio TX 782293900
University of Warwick	231745683	00-000	University House Kirby Corner Road Coventry, West Midlands
University of Maryland Baltimore	188435911	MD-007	Maryland Psychiatric Research Center Grounds of Spring Grove Hospital Center Baltimore MD 212284663

G.9 FOREIGN COMPONENT

No foreign component

G.10 ESTIMATED UNOBLIGATED BALANCE**G.10.a** Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 PROGRAM INCOME

Is program income anticipated during the next budget period?

No

G.12 F&A COSTS

Is there a change in performance sites that will affect F&A costs?

No

QVR NIH Business System (NBS) Accounting Details

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PI: KOCHUNOV, PETER V FY: 2018

Total IMPACII Award Amt: \$400,001

Obligation Details for Project:

5R01EB015611-06

External Organization:

UNIVERSITY OF MARYLAND BALTIMORE

Accounting System Totals

PMS Account Type: Subaccount:domestic(P)
Award Document Number: REB015611B *Click hyperlink for accounting details for all projects with this document number*

TIMING INFORMATION: QVR gathers disbursement data from NBS/nVision on a nightly basis, however, PMS data in NBS may lag as much as 2 weeks.

				Accounting System			
IC	CAN	Budget FY	Obligated Dt	Last Disburse. Dt	NBS Obligated \$	NBS Disbursed \$	Obligated Balance
EB	8015183	2018	2018-08-08		\$ 400,001.00	\$ 0.00	\$ 400,001.00

Accounting System Transactions

Accounting System Transactions						
IC	CAN	OCC	NBS Doc Num	NBS Transact. Dt	Obligation Amt	Disbursement Amt
EB	8015183	414E	380REB015611B*10001	2018-08-08	\$ 400,001.00	\$ 0.00
Grand Totals:					\$ 400,001.00	\$ 0.00