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| BIOGRAPHICAL SKETCH Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2. Follow this format for each person.  **DO NOT EXCEED FOUR PAGES.** | | | | |
|  | | | | |
| NAME  George M. Church | | POSITION TITLE  Professor | | |
| eRA COMMONS USER NAME (credential, e.g., agency login)  GCHURCH | |
| EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)* | | | | |
| INSTITUTION AND LOCATION | DEGREE  *(if applicable)* | | MM/YY | FIELD OF STUDY |
|  |  | |  |  |
| Duke University, Durham, NC | B.A. | | 1974 | Zoology & Chemistry |
| Harvard University, Cambridge, MA | Ph.D. | | 1984 | Biochem. & Mol. Biology |
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**A. Personal statement**George Church in 1984 developed the first direct genomic sequencing method, molecular multiplexing tags, which led to automation and software used for the first commercial genome sequence of the pathogen Helicobacter in 1994. This multiplex solid-phase sequencing evolved into polonies (1999), ABI-SOLiD (2005), open-source Polonator.org (2007), and Complete Genomics (2008). Innovations in DNA reading, writing, and cell/tissue engineering led to consumer-directed genomics (23andme, Knome), synthetic biology (SynBERC, Joule, LS9) & new ethics, safety, and security strategies. He founded PersonalGenomes.org, which provides the world's only open-access source for human genomic, environmental, and trait data (GET). He is a member of National Academy of Sciences, Hoogendijk Prize awardee, and Franklin Laureate (Bower Prize) for Achievement in Science.

**B. Positions and Honors**

**Positions, Fellowships:**

1974-1975 National Science Foundation Predoctoral Fellow

1984 Scientist, Biogen Research Corporation, Cambridge, MA

1985-1986 Life Sciences Research Foundation Fellow, Anatomy, Univ. Calif., San Francisco, CA

1986-1997 Howard Hughes Medical Institute Investigator

1986-1998 Assistant/Associate Professor of Genetics, Harvard Medical School, Boston, MA

1998-present Professor of Genetics, Harvard Medical School, Boston, MA

1987-present Director of the DOE Technology development center

2004-present Director of NIH NHGRI Center of Excellence in Genomic Science

2005-present Director of the Personal Genome Project

2006-present Senior Associate of Broad Inst. of Harvard & MIT (1990 Genome Center Co-founder)

2008-present Wyss Institute for Biologically Inspired Engineering

**Scientific Review & Advisory Roles:**

1976 National Science Foundation Program Project Grant Review Committee Scientific Boards: LS9, 23andme, Knome, Genomatica, Joule, CGI, SIAL, Gen9

1988,1992,1994 Department of Energy Genome Project Grant Review Committee

1990 NIH Genome Study Section Grant Review

1994-1997 National Center for Human Genome Research Review Committee

2001-present NIH BISTI, Pioneer, grant review committees, NHLBI BEE, NAS committees

2005-present Editorial Boards Nature/EMBO-MSB, Scientific American

**Honors, Awards:**

2008 World Economic Forum Technology Pioneer Awards (LS9 & 23andme)

2009 American Society for Microbiology Biotechnology Research Award

2010 Consumer Genetics Champion & Public Initiative Awards

2010 US Presidential & EPA Green Chemistry Award (LS9)

2010 Triennial International Steven Hoogendijk Award

2011 Personalized Medicine World Conference Lifetime Achievement Award

2011 Franklin Institute Bower Prize for Achievement in Science

2011 National Academy of Sciences USA (Section 14: Chemistry)

2011 National Academy of Engineering USA (Bioengineering)

**C. Selected peer-reviewed publications.**

**C. Selected peer-reviewed publications.**

1. Gregg CJ, Lajoie MJ, Napolitano MG, Mosberg JA, Goodman DB, Aach J, Isaacs FJ, Church GM (2014) Rational Optimization of tolC as a Powerful Dual Selectable Marker for Genome Engineering. Nucleic Acids Research. PMID: 24452804

2. Lee J, Daugharthy E, Scheiman J, Kalhor R, Terry R, Yang JL, Li C, Amamoto R, Peters D, Ferrente TC, Marblestone A, Bernard A, Turczyk BM, Conway N, Inverso S, Levner D, Mali P, Rios X, Jeanty SSF, Jones AR, Aach J, Church GM (2014) Highly multiplexed three-dimensional subcellular transcriptome sequencing in situ. Science PMID: 24578530

3. Goodman DB, Church GM, Kosuri S (2013) Causes and effects of N-terminal codon bias in bacterial genes. Science. PMID: 24072823

4. Eroshenko N, Church GM (2013) Mutants of Cre recombinase with improved accuracy. Nature Communications 4:2509. PMID: 24056590

5. Li JF, Norville JE, Aach J, McCormack M, Zhang D, Bush J, Church GM, Sheen J (2013) Multiplex and homologous recombination-mediated genome editing in Arabidopsis and Nicotiana benthamiana using guide RNA and Cas9. Nat Biotechnol. 31(8):688-91. PMID: 23929339

6. DiCarlo JE, Conley A, Penttil M, Jantti J, Wang HH, Church GM (2013) Yeast Oligo-mediated Genome Engineering (YOGE). ACS Synthetic Biology. PMID: 24160921

7. Mali P, Esvelt KM, Church GM (2013) Cas9 as a Versatile Tool for Engineering Biology. Nature Methods 10:957-963.

8. Esvelt KM, Mali P, Braff J, Moosburner M, Yaung S, Church GM (2013) Orthogonal Cas9 proteins for RNA-guided gene regulation and editing. Nature Methods.

9. Kosuri S, Goodman DB, Cambray G, Mutalik VK, Gao Y, Arkin AP, Endy D, Church GM. (2013) Composability of regulatory sequences controlling transcription and translation in E. coli. PNAS. PMID: 23924614

10. Briggs AW, Rios X, Chari R, Yang L, Zhang F, Mali P, Church GM. (2012) Iterative capped assembly: rapid and scalable synthesis of repeat-module DNA such as TAL effectors from individual monomers. Nucleic Acids Res. PMID: 22740649

11. Chou MF, Prisic S, Lubner JM, Church GM, Husson RN, Schwartz D (2012) Using bacteria to determine protein kinase specificity and predict target substrates. PLoS One 7(12):e52747. PMID: 23300758

12. Mosberg Ja, Gregg CJ, Lajoie MJ, Wang HH, Church GM (2012) Improving Lambda Red Genome Engineering via Rational Removal of Endogenous Nucleases. PLoS One 7(9):e44638. PMID: 22957093

13. Lajoie MJ, Gregg CJ, Mosberg JA, Washington GC, Church GM (2012) Manipulating Replisome Dynamics to Enhance Lambda Red-Mediated Multiplex Genome Engineering Nucleic Acids Research 40(22):e170. PMID: 22904085

14. Shendure J, Porreca GJ, Reppas NB, Lin X, McCutcheon JP, Rosenbaum AM, Wang MD, Zhang K, Mitra RD, Church GM (2005) Accurate Multiplex Polony Sequencing of an Evolved Bacterial Genome. Science 309(5741):1728-32. PMID: 16081699

15. Mitra RD, Shendure J, Olejnik J, Olejnik EK, Church GM (2003) Fluorescent in situ Sequencing on Polymerase Colonies. Analyt. Biochem. 320:55-65

**D. Research Support:**

**DE-FG02-02ER63445**  12/1/2011– 11/30/2016

DOE

PI: Church

Title: Microbial Ecology, Proteogenomics & Computational Optima

**1P50 HG005550** 9/13/10-7/31/15

NIH- NHGRI (CEGS)

PI: Church

Title: Center for Causal Transcriptional Consequences of Human Genetic Variation

**SA5283-11210**  7/1/2006 – 6/30/2014

NSF-SynBERC

PI: Jay Keasling (UC Berkeley)

Title: Synthetic Biology Engineering Research Center

**MCB-1330914**  9/15/13-6/30/18

NSF

PI: Jay Keasling (Berkeley)

Title: Synthetic Biology for yeast

**HR0011-13-1-0002** 7/17/13- 9/16/14

Darpa (SGRO)

PI: George Church

Title: Safe Genomically Recoded Organisms

**RO1 MH103910-01** 9/26/13-8/31/18

NIH-NIMH

PI: Konrad Kording, Sub: Church

Title: Recording Neural Activities onto DNA

**RO1 HG007415** 9/1/13-7/31/16

NIH-NHGRI

PI: Jingyue Ju (Columbia U)

Title: An Integrated System for Single Molecule Electronic Sequencing by Synthesis

**N00014-10-1044** 7/1/11-9/30/14

ONR-MURI

PI: Jim Collins (BU), Sub: Church/Silver

Title: Utilizing Synthetic Biology to Create Programmable Micro-Bio-Robots

**N66001-11-1-4180** 11/1/11-10/31/15

DARPA-Sepsis

PI: Don Ingber (Wyss), Co-I: Church

Title: Sepsis-on-a-Chip Sepsis Therapeutics with Continuous Pathogen Detection

**HR0011-12-C-0057** 5/17/12-12/31/14

DARPA- (SAGE)

PI: Mark Horowitz (Stanford)

Title: SAGE: Software Actuated Genome Engineering on a Droplet Transport

**U01 MH098977**  9/19/12-5/31/17

NIH-NIMH (UO1)

PI: Kun Zhang, (UCSD)

Title: Single Cell Sequencing and *in situ* Mapping of Transcriptional Activities in Human Brain.

**DuPont** 12/10/12-12/09/14

PI: George Church

Title: Collaboration to Perform MAGE on Yeast

**Ginkgo: 6496788** 09/18/2013 - 09/17/2014   
PI: Church, George McDonald   
Sponsor: Ginkgo Bioworks  
Title: [ERC-Small Business: Development of a phage-resistant bacterial chassis](https://gmas.harvard.edu/gmas/project/SCR0104SegmentHome.jsp?segmentId=16132437)

**Completed:**

**N66001-12-C-4040** 3/5/12-2/4/13

DARPA-SIO

PI: George Church

Title: Safe Industrial Organisms

**HR0011-12-C-0068**  5/31/12-2/28/13

DARPA-Physiol

PI: Ed Boyden (MIT), Sub: Church

Title: Synthetic Physiology: High-speed Closed-Loop Control of Synthetic Biology Systems

**4U01AI089859**  1/1/12-12/31/13

NIH-NIAID

PI: Gregory Poland (Mayo Clinic)

Title: High Throughput immuunophenotypic analyses of humoral responses to West Nile virus

**FS 25555-UP**  7/1/11-12/31/13

BASF

PI: George Church

Title: Using Genome Engineering and Sensor Selector Technologies for *E.Coli* Biosynthesis of Cobalamin and Biotin

**CBET1033397** 1/1/11-12/31/13

NSF-U Colorado

PI: Ryan Gill (U. Colorado), Sub: Church

Title: A New Approach for Directed Genome Engineering