

NICHOLAS A GRAHAM

**Associate Professor of Chemical Engineering and Materials Science and
Leonard Davis School of Gerontology**

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EDUCATION

California Institute of Technology, Pasadena, CA (2004 – 2007)

- *Ph.D.* in Chemical Engineering
- *Dissertation:* Crosstalk between soluble factors and cell-cell interactions: Implications for cell cycle control and tumor development
- *Advisor:* Prof. Anand R. Asthagiri

California Institute of Technology, Pasadena, CA (2001 – 2004)

- *M.S.* in Chemical Engineering

Washington University in St. Louis, St. Louis, MO (1997 – 2001)

- *B.S.* (Magna cum laude) in Chemical Engineering and French
- Minor in History

PROFESSIONAL EXPERIENCE

Associate Professor of Chemical Engineering and Materials Science (02/2023 – present)
University of Southern California, Los Angeles, CA

Associate Professor of Gerontology (courtesy) (02/2023 – present)
University of Southern California, Los Angeles CA

Assistant Professor of Chemical Engineering and Materials Science (01/2015 – 02/2023)
University of Southern California, Los Angeles, CA

Assistant Professor of Gerontology (courtesy) (05/2019 – 02/2023)
University of Southern California, Los Angeles CA

Assistant Project Scientist (09/2013 – 12/2014)
University of California, Los Angeles, CA
Mentor: Prof. Thomas Graeber (Molecular and Medical Pharmacology)

Post-doctoral Fellow (10/2007 – 08/2013)
University of California, Los Angeles, CA
Mentor: Prof. Thomas Graeber (Molecular and Medical Pharmacology)

Visiting Post-doctoral Fellow (05/2007 – 08/2007)
Simon Fraser University, Burnaby, BC, Canada
Mentor: Prof. Dipankar Sen (Molecular Biology and Biochemistry)

Visiting Graduate Research Assistant (06/2006 – 08/2006)
Yonsei University, Seoul, South Korea
Mentor: Prof. Kang-Yell Choi (Biotechnology)

Graduate Research Assistant – Chemical Engineering (10/2001 – 05/2007)
California Institute of Technology, Pasadena, CA
Advisor: Anand R Asthagiri (Chemical Engineering, Now at Northeastern University)

HONORS AND AWARDS

After Joining USC:

- NSF CAREER award (2022)
- AACR-Bayer Innovation and Discovery Grant (2020)
- Selected participant in Japan-America Frontiers of Engineering (JAFOE) Symposium (2018)
- Rose Hills Innovator Grant Program (2015)

Before USC:

- Best postdoctoral poster presentation, Department of Molecular and Medical Pharmacology Annual Retreat, UCLA (2013)
- Best postdoctoral oral presentation, Crump Institute for Molecular Imaging Research Seminar, UCLA (2013)
- Scholars in Oncologic Molecular Imaging Postdoctoral Fellowship, National Cancer Institute Cancer Education and Career Development Program R25TCA098010 (2012-2014)
- Best postdoctoral oral presentation, Department of Molecular and Medical Pharmacology Annual Retreat, UCLA (2011)
- Axel Ullrich Scholar-in-Training award for American Association for Cancer Research-National Cancer Institute Conference on Systems Biology (2011)
- Tumor Cell Biology Postdoctoral Fellowship, Ruth L. Kirschstein Institutional National Research Service Award T32CA009056 (2009-2012)
- NSF East Asia and Pacific Summer Institute (2006)
- National Defense Science and Engineering Graduate Fellowship (2001-2004)
- Procter and Gamble Senior Scholar Award, Washington University in St. Louis (2001)
- Klemm Outstanding Junior Award, Washington University in St. Louis (2000)
- Stanley C. Pace Undergraduate Fellowship, Washington University in St. Louis (1997-2001)
- National Merit Scholar, Washington University in St. Louis (1997-2001)

RESEARCH INTERESTS

Systems biology, Mass spectrometry, Metabolomics, Proteomics, Bioinformatics, Protein post-translational modifications, Phosphorylation, Arginine methylation, Stable isotope tracing, Cancer, Aging, Senescence, Diabetes.

PEER REVIEWED JOURNAL PUBLICATIONS

Web of science/Publons: **ResearcherID: X-2738-2019** citations: 1,978; h-index: 21;
Google Scholar citations: 2,778; h-index: 23

Complete List of Published Work in NCBI MyBibliography:

<https://www.ncbi.nlm.nih.gov/myncbi/1PWhapeNnRa/bibliography/public/>

Note: My name is highlighted in bold and my students' names have * after them, corresponding authors are underlined. Hyperlinks provided where available.

Preprints:

1. D. Zheng*, P.E. Gelbach, K. Burdsall*, C. Hanson, K. Villers, R.C. Stephens, S.E. Fraser, K.L. White, S.D. Finley, and **N.A. Graham**. “Metabolomics reveals that aspartate and asparagine are metabolic coupling factors for insulin secretion in pancreatic β cells”, *in preparation*.

[**Contributions:** *Corresponding author.* Directed the research, designed the experiments, and am co-writing the article. Zheng (my graduate student) designed and performed the experimental work, analyzed data, and is co-writing the manuscript. Burdsall (my undergraduate student, co-supervised by Stevens) also performed some experiments.]

2. B. Wilkinson, J. Li, N. Hartel*, I. Flores, J. Jiang, S. Myhailov, V. Clementel, S. Ultanir, **N.A. Graham**, **M.P. Coba**. “TNIK and PSD signaling networks in human models of neuronal development”, *under review at Science Signaling*.

[**Contributions:** Designed and supervised the proteomic experiments. Hartel (my graduate student) performed the proteomic experiments and analyzed data.]

3. M.A. MacMullan*, Z.S. Dunn, Y. Qu, **P. Wang**†, and **N.A. Graham**†. “Phospho-proteomic analysis of CAR-T cell signaling following activation by antigen-presenting cancer cells”, *under review at Molecular and Cellular Proteomics*. †Co-corresponding authors.

[**Contributions:** *Co-corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the manuscript. MacMullan (my graduate student, co-supervised by Wang) designed and performed the experimental work and co-wrote the manuscript.]

Journal Publications:

At USC:

1. S.J. Kim, B. Miller, N.G. Hartel*, R. Ramirez II, R. Gonzalez Braniff, N. Leelaprachakul, A. Huang, Y. Wang, T. Em Arpawong, E.M. Crimmins, P. Wang, X. Sun, C. Liu, D. Levy, K. Yen, G.M. Petzinger, **N.A. Graham**, M.W. Jakowec, and **P. Cohen**. “A naturally occurring variant of SHLP2 is a protective factor in Parkinson’s disease”, *Molecular Psychiatry (2024)*.

Impact Factor: 13.437

[**Contributions:** Designed and supervised the proteomic experiments, analyzed data, and co-wrote the manuscript. Hartel (my graduate student) performed the proteomic experiments, analyzed data, and co-wrote the manuscript.]

2. B.G. Garana*, J.H. Joly*, A. Delfarah*, H. Hong, and **N.A. Graham**. “Drug mechanism enrichment analysis improves prioritization of therapeutics for repurposing”, *BMC Bioinformatics, 24:215 (2023)*.

Impact Factor: 3.327

[**Contributions:** Corresponding author. Directed the research, designed the bioinformatic analysis, and co-wrote the article. Garana (my graduate student) designed and performed the bioinformatic analysis and co-wrote the manuscript. Delfarah and Joly (my graduate students) also performed experimental and bioinformatic analysis.]

3. S.A. Jami, B.J. Wilkinson, R. Guglietta, N.G. Hartel*, W.E. Babiec, **N.A. Graham**, **M.P. Coba**, and **T.J. O’Dell**. “Functional and Phosphoproteomic Analysis of β -Adrenergic Receptor Signaling at Excitatory Synapses in the CA1 Region of the Ventral Hippocampus”, *Scientific Reports, 13:7493 (2023)*.

Impact Factor: 4.379

[**Contributions:** Designed and supervised the proteomic experiments. Hartel (my graduate student) performed the proteomic experiments and analyzed data.]

4. P.E. Gelbach, D. Zheng*, S.E. Fraser, K.L. White, **N.A. Graham**, and **Finley SD**. “Kinetic and data-driven modeling of pancreatic β -cell central carbon metabolism and insulin secretion”, *PLoS Computational Biology, 18(10): e1010555 (2022)*.

Impact Factor: 4.428

[**Contributions:** Analyzed published metabolomic data to inform the computational model. Zheng (my graduate student) also provided expertise in metabolomic analysis.]

5. T.L. vanLieshout, D.W. Stouth, N.G. Hartel*, G. Vasam, S.Y. Ng, E.K. Webb, I.A. Rebalka, **N.A. Graham**, K.J. Menzies, T.J. Hawke, V. Ljubicic. “The CARM1 transcriptome and arginine methylproteome mediate skeletal muscle integrative biology”, [Molecular Metabolism, 64:101555 \(2022\)](#).

Impact Factor: 8.568

[**Contributions:** Designed and supervised the proteomic experiments, analyzed data, and co-wrote the manuscript. Hartel (my graduate student) performed the proteomic experiments, analyzed data, and co-wrote the manuscript.]

6. M.A. MacMullan*, P. Wang, and **N.A. Graham**. “Phospho-proteomics reveals that RSK signaling is required for proliferation of natural killer cells stimulated with IL-2 or IL-15”, [Cytokine, 157:155958 \(2022\)](#).

Impact Factor: 3.9

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the manuscript. MacMullan (my graduate student, co-supervised by Wang) designed and performed the experimental work and co-wrote the manuscript.]

7. C. Qin, Y. Rao, H. Yuan, T.Y. Wang, J. Zhao, B. Espinosa, Y. Liu, S. Zhang, A.C. Savas, Q. Liu, M. Zarinfar, M. Tian, S. Rice, J. Henley, L. Comai, **N.A. Graham**, C. Chen, C. Zhang, and P. Feng. “SARS-CoV-2 Couples Evasion of Inflammatory Response to Activated Nucleotide Synthesis,” [Proceedings of the National Academy of Sciences \(USA\), 119\(26\):e2122897119 \(2022\)](#).

Impact Factor: 11.2

[**Contributions:** Analyzed metabolomic data.]

8. M. Kilinc, V. Arora, T.K. Creson, C. Rojas, A.A. Le, J. Lauterborn, B. Wilkinson, N. Hartel*, **N.A. Graham**, A. Reich, G. Gou, Y. Araki, À. Bayés, M. Coba, G. Lynch, C.A. Miller, G. Rumbaugh. “Endogenous *Syngap1* alpha splice forms promote cognitive function and seizure protection”, [eLife, 11:e75707 \(2022\)](#).

Impact Factor: 8.14

[**Contributions:** Designed and supervised the proteomic experiments. Hartel (my graduate student) performed the proteomic experiments and analyzed data.]

9. T. Xu, J.A. Junge, A. Delfarah*, Y.T. Lu, C. Arnesano, K. Delijani, M. Iqbal, H.H. Mehta, P. Cohen, **N.A. Graham**, S.E. Fraser, A. Goldkorn. “Bladder cancer cells can shift rapidly to a drug resistant state marked by mitochondrial oxidative phosphorylation that is trackable in real time”, [Scientific Reports, 12\(1\):5518 \(2022\)](#).

Impact Factor: 4.379

[**Contributions:** Designed and supervised the metabolomic experiments, analyzed data, and co-wrote the manuscript. Delfarah (my graduate student) performed the metabolomic experiments, analyzed data, and co-wrote the manuscript.]

10. V. Lu, J.J. Roy, A. Torres Jr., J.H. Joly*, F.M. Ahsan, **N.A. Graham**, and M.A. Teitell. “Glutamine-dependent signaling controls pluripotent stem cell fate”, [Developmental Cell, 57\(5\):610-623.e8 \(2022\)](#).

Impact Factor: 10.09

[**Contributions:** Bioinformatic analysis of RNA sequencing data. Joly (my graduate student) designed and performed the bioinformatic analysis.]

11. B.B. Garana* and **N.A. Graham**. “Metabolomics paves the way for improved drug target identification”, [Molecular Systems Biology, 18:e10914 \(2022\)](#). [Invited News and Views].

Impact Factor: 11.43

[**Contributions:** *Corresponding author.* Co-wrote the article with Garana (my graduate student).]

12. J. Wang, A. Delfarah*, P.E. Gelbach, E. Fong, P. Macklin, S.M. Mumenthaler, **N.A. Graham**, and **S.D. Finley**. “Elucidating Tumor-stromal Metabolic Crosstalk in Colorectal Cancer through Integration of Constraint-Based Models and LC-MS Metabolomics”, [*Metabolic Engineering*, 69:175-187 \(2022\)](#).

Impact Factor: 7.808

[**Contributions:** Designed and supervised the metabolomics experiments, analyzed data, and co-wrote the article. Delfarah (my graduate student) performed experimental work and analyzed data.]

13. A. Delfarah*, N.G. Hartel*, D. Zheng*, J. Yang*, and **N.A. Graham**. “Identification of a Proteomic Signature of Senescence in Primary Human Mammary Epithelial Cells”, [*Journal of Proteome Research*, 20\(11\):5169-5179 \(2021\)](#).

Impact Factor: 4.466

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the article. Delfarah (my graduate student) designed and performed the experimental work and analyzed data. Hartel and Zheng (my graduate students) and Yang (my undergraduate student) performed some experiments.]

14. B. Raveh, L. Sun, K.L. White, T. Sanyal, J. Tempkin, D. Zheng*, K. Bharat, J. Singla, C. Wang, J. Zhao, A. Li, **N.A. Graham**, C. Kesselman, R.C. Stevens, and **A. Sali**. “Bayesian metamodeling of complex biological systems across varying representations”, [*Proceedings of the National Academy of Sciences \(USA\)*, 118\(35\):e2104559118 \(2021\)](#).

Impact Factor: 11.2

[**Contributions:** Designed and supervised the metabolomics experiments. Zheng (my graduate student) performed the experimental work and analyzed data.]

15. J.H. Joly*, B.T.L. Chew*, and **N.A. Graham**. “The landscape of metabolic pathway dependencies in cancer cell lines”, [*PLoS Computational Biology*, 17\(4\): e1008942 \(2021\)](#).

Impact Factor: 4.428

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the article. Joly (my graduate student) designed and performed the bioinformatic analysis, analyzed data, and co-wrote the article. Chew (my undergraduate student) performed some of the bioinformatic work.]

16. J. Reynolds, R.W. Lai, J.S.T. Woodhead, J.H. Joly*, C.J. Mitchell, D. Cameron-Smith, R. Lu, P. Cohen, **N.A. Graham**, B.A. Benayoun, T.L. Merry, and **C. Lee**. “MOTS-c is an Exercise-Induced Mitochondrial-Encoded Regulator of Age-Dependent Physical Decline and Muscle Homeostasis”, [*Nature Communications*, 12, 470 \(2021\)](#).

Impact Factor: 14.92

[**Contributions:** Designed and supervised the metabolomics experiments, analyzed data, and co-wrote the article. Joly (my graduate student) performed the metabolomics experiments, analyzed data, and co-wrote the article.]

17. J.H. Joly*, W.E. Lowry, and **N.A. Graham**. “Differential Gene Set Enrichment Analysis: A statistical approach to quantify the relative enrichment of two gene sets”, [*Bioinformatics*, 36\(21\):5247-5254 \(2021\)](#).

Impact Factor: 6.937

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the article. Joly (my graduate student) designed and performed the bioinformatic analysis, analyzed data, and co-wrote the article.]

18. Z.P. Seidel, X. Zhang, M.A. MacMullan*, **N.A. Graham**, P. Wang, and **C.T. Lee**. “Photo-Triggered Delivery of siRNA and Paclitaxel into Breast Cancer Cells Using Catanionic Vesicles”. [*ACS Applied Biomaterials*, 3\(11\), 7388-7398 \(2020\)](#).

Impact Factor: 3.25

[**Contributions:** Designed and supervised the Western blotting experiments. MacMullan (my graduate student, co-advised with Wang) performed the Western blotting experiments.]

19. N.G. Hartel*, C.Z. Liu*, and **N.A. Graham**. “Improved discrimination of asymmetric and symmetric arginine dimethylation by optimization of the normalized collision energy in LC-MS proteomics”, [*Journal of Proteome Research*, 19\(8\):3123-3129 \(2020\)](#).

Impact Factor: 4.466

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the article. Hartel (my graduate student) designed and performed the experimental work, analyzed data, and co-wrote the article. Liu (my undergraduate student) performed some of the experimental work.]

20. J. Zhao, M. Tian, S. Zhang, A. Delfarah*, R. Gao, Y. Rao, A. Can Savas, A. Lu, L. Bubb, X. Lei, R. Moshirian, W. Zhu, C. Peng, T. Jiang, L. Chen, **N.A. Graham**, and **P. Feng**. “Deamidation Shunts RelA from Mediating Inflammation to Aerobic Glycolysis”, [*Cell Metabolism*, 31\(5\):937-955 \(2020\)](#).

Impact Factor: 27.29

[**Contributions:** Designed and supervised the metabolomics experiments, analyzed data, and edited the article. Delfarah (my graduate student) performed the metabolomics experiments, analyzed data, and edited the article.]

21. D. Zheng*, J.H. Sussman*, M.P. Jeon*, S. Parrish*, A. Delfarah*, and **N.A. Graham**. “AKT but not MYC promotes reactive oxygen species-mediated cell death in oxidative culture”, [*Journal of Cell Science*, 133\(7\) \(2020\)](#).

Impact Factor: 5.285

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the article. Zheng (my graduate student) designed and performed the experimental work, analyzed data, and co-wrote the article. Delfarah (my graduate student) and Sussman, Jeon, and Parrish (my undergraduate students) performed some of the experimental work.]

22. L. Wang, N.G. Hartel*, K. Ren, **N.A. Graham**, **N. Malmstadt**. “Effect of protein corona on nanoparticle-plasma membrane and nanoparticle-biomimetic membrane interactions”, [*Environmental Science: Nano*, 7\(3\):963–974 \(2020\)](#).

Impact Factor: 8.131

[**Contributions:** Designed and supervised the proteomic experiments and edited the article. Hartel (my graduate student) designed and performed the proteomic experiments and analyzed data]

23. J.H. Joly*, A. Delfarah*, P.S. Phung*, S. Parrish*, and **N.A. Graham**. “A synthetic lethal drug combination mimics glucose deprivation-induced cancer cell death in the presence of glucose”, [*Journal of Biological Chemistry*, 295 \(5\), 1350-1365 \(2020\)](#).

Impact Factor: 5.157

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the article. Joly (my graduate student) designed and performed the experimental work, analyzed data, and co-wrote the article. Delfarah (my graduate student) and Phung and Parrish (my undergraduate students) performed some of the experimental work.]

24. N.G. Hartel*, B. Chew*, J. Qin, J. Xu, and **N.A. Graham**. “Deep protein methylation profiling by mass spectrometry through combined chemical and immunoaffinity enrichment”, [*Molecular and Cellular Proteomics*, 10.1074/mcp.RA119.001625 \(2019\)](#).

Impact Factor: 5.911

[**Contributions:** *Corresponding author.* Designed and supervised the research, analyzed data, and co-wrote the article. Hartel (my graduate student) designed and performed the experimental work, analyzed data, and co-wrote the article. Chew (my undergraduate student) performed some of the experimental work.]

25. M.A. MacMullan*, Z.S. Dunn*, **N.A. Graham**, L. Yang, and P. Wang. “Quantitative Proteomics and Metabolomics Reveal Biomarkers of Disease as Potential Immunotherapy Targets and Indicators of Therapeutic Efficacy”, *Theranostics*, **9** (25):7872-7888 (2019).
Impact Factor: 11.56
[**Contributions**: Edited the review article. MacMullan (my graduate student, co-supervised by Wang) co-wrote this review article.]
26. A. Delfarah*, S. Parrish*, J.A. Junge, S. Yang, F. Seo, S. Li, P. Wang, S.E. Fraser, and **N.A. Graham**. “Inhibition of nucleotide synthesis promotes replicative senescence of human mammary epithelial cells”, *Journal of Biological Chemistry*, **294** (27), 10564-10578 (2019).
Impact Factor: 5.157
[**Contributions**: *Corresponding author*. Designed and supervised the research, analyzed data, and co-wrote the article. Delfarah (my graduate student) designed and performed the experimental work, analyzed data, and co-wrote the article. Parrish (my undergraduate student) performed some of the experimental work.]
27. A. Flores, S. Sandoval-Gonzalez, R. Takahashi, A. Krall, L. Sathe, L. Wei, C. Radu, J.H. Joly*, **N.A. Graham**, H.R. Christofk, and W.E. Lowry. “Increased lactate dehydrogenase activity is dispensable in squamous carcinoma cells of origin”, *Nature Communications*, **10**, 91 (2019).
Impact Factor: 14.92
[**Contributions**: Bioinformatic analysis of RNA sequencing data. Joly (my graduate student) designed and performed the bioinformatic analysis and analyzed data.]
28. B. Wilkinson, O. Evgrafov, D. Zheng*, N. Hartel*, J. Knowles, **N.A. Graham**, J. Ichida, and M.P. Coba. “Endogenous Cell Type-Specific DISC1 Interactomes Reveal Protein Networks Associated to Neurodevelopmental Disorders”, *Biological Psychiatry*, **85**(4):305-316 (2019).
Impact Factor: 13.38
[**Contributions**: Designed and supervised proteomics experiments. Zheng and Hartel (my graduate students) performed proteomic experiments.]
29. J.A. Rohrs, D. Zheng*, **N.A. Graham**, P. Wang, S.D. Finley. “Computational model of chimeric antigen receptors explains site-specific phosphorylation kinetics”, *Biophysical Journal*, **115**(6):1116-1129 (2018).
Impact Factor: 4.033
[**Contributions**: Designed and supervised the proteomics experiments and analyzed data. Zheng (my graduate student) performed the proteomics experiments and analyzed data.]
30. L.C. Cheng, Z. Li, T.G. Graeber, **N.A. Graham**, and J.M. Drake. “Phosphopeptide enrichment coupled with label-free quantitative mass spectrometry to investigate the phosphoproteome in prostate cancer”, *Journal of Visualized Experiments*, (138):57996 (2018).
Impact Factor: 1.4
[**Contributions**: Co-wrote the article.]
31. A. Flores, J. Schell, A. Krall, D. Jelinek, M. Miranda, M. Grigorian, D. Braas, A. White, J. Zhou*, **N.A. Graham**, T.G. Graeber, P. Seth, D. Evseenko, H. Coller, J. Rutter, H.R. Christofk, and W.E. Lowry, “Lactate production drives hair follicle stem cell activation. *Nature Cell Biology*”, **19**(9), 1017-1026 (2017).
Impact Factor: 28.82
[**Contributions**: Bioinformatic analysis of RNA sequencing data. Zhou (my undergraduate student) performed the bioinformatic analysis.]
32. **N.A. Graham**†, A. Minasyan†, A. Lomova, A. Cass, N. Balanis, M. Friedman, S. Chan, S. Zhao, A. Delgado, J. Go, L. Beck, C. Hurtz, C. Ng, R. Qiao, J. ten Hoeve, N. Palaskas, H. Wu, M. Muschen, E. Port, S. Larson, N. Schultz, D. Brass, H.R. Christofk, I.K. Mellinghoff, and T.G. Graeber, “Recurrent aneuploidy patterns enable fitness gains in tumor metabolism”, *Molecular Systems Biology*, **13**:914 (2017). (†denotes equal contribution).

Impact Factor: 11.43

[**Contributions:** Designed and performed the experimental work, data analysis, supervised undergraduate researchers, and co-wrote the article.]

Pre-USC:

33. J.M. Drake, E.O. Paull, **N.A. Graham**, J.K. Lee, B.A. Smith, B. Titz, T. Stoyanova, C.M. Faltermeier, V. Uzunangelov, D.E. Carlin, D.T. Fleming, C.K. Wong, Y. Newton, S. Sudha, A.A. Vashisht, J. Huang, J.A. Wohlschlegel, T.G. Graeber, O.N. Witte, and J.M. Stuart. “Phosphoproteome Integration Reveals Patient-Specific Networks in Prostate Cancer”, [*Cell*, 166\(4\), 1041-54 \(2016\)](#).

Impact Factor: 41.58

[**Contributions:** Experimental work to generate phospho-proteomic data, data analysis.]

34. C.S. Hong, **N.A. Graham**, W. Gu, C.E. Camacho, V. Mah, E.L. Maresh, M. Alavi, L. Bagryanova, P.A.L. Krotee, B.K. Gardner, I.S. Behbahan, S. Horvath, D. Chia, I.K. Mellinghoff, S.A. Hurvitz, S.M. Dubinett, S.E. Critchlow, S.K. Kurdistani, L. Goodglick, D. Braas, T.G. Graeber, and H.R. Christofk. “MCT1 modulates cancer cell pyruvate export and growth of tumors that co-express MCT1 and MCT4”, [*Cell Reports*, 14\(7\), 1590-601 \(2016\)](#).

Impact Factor: 9.423

[**Contributions:** Bioinformatic analysis of transcriptomic data and manuscript writing/editing.]

35. J.F. Goodwin, V. Kothari, J.M. Drake, S. Zhao, E. Dylgjeri, J.L. Dean, M.J. Schiewer, C. McNair, J.K. Jones, A. Aytes, M.S. Magee, A.E. Snook, Z. Zhu, R.B. Den, R.C. Birbe, L.G. Gomella, **N.A. Graham**, A.A. Vashisht, J.A. Wohlschlegel, T.G. Graeber, R.J. Karnes, M. Takhar, E. Davicioni, S.A. Tomlins, C. Abate-Shen, N. Sharifi, O.N. Witte, F.Y. Feng, and K.E. Knudsen. “DNA-PKcs mediated transcriptional regulation drives prostate cancer progression and metastasis”, [*Cancer Cell*, 28\(1\), 97-113 \(2015\)](#).

Impact Factor: 31.74

[**Contributions:** Experimental work to generate phospho-proteomic data.]

36. M. Thai, **N.A. Graham**, D. Braas, M. Nehil, E. Komisopoulou, S.K. Kurdistani, F. McCormick, T.G. Graeber, and H.R. Christofk. “Adenovirus E4ORF1-induced MYC activation promotes host cell anabolic glucose metabolism and virus replication”, [*Cell Metabolism*, 19\(4\), 694-701 \(2014\)](#).

Impact Factor: 27.29

[**Contributions:** Bioinformatic analysis of transcriptomic data and manuscript writing/editing.]

37. **N.A. Graham** and T.G. Graeber. “Complexity of metastasis-associated SDF-1 ligand signaling in breast cancer stem cells”, [*Proceedings of the National Academy of Sciences \(USA\)*, 111\(21\):7503-4 \(2014\)](#). (Invited Commentary)

Impact Factor: 11.2

[**Contributions:** Co-wrote the article.]

38. J.M. Drake, **N.A. Graham**, J.K. Lee, T. Stoyanova, C.M. Faltermeier, S. Sudha, B. Titz, J. Huang, K.J. Pienta, T.G. Graeber and O.N. Witte. “Metastatic castration-resistant prostate cancer reveals intrapatient similarity and interpatient heterogeneity of therapeutic kinases”, [*Proceedings of the National Academy of Sciences \(USA\)*, 110\(49\), E4762-9 \(2013\)](#).

Impact Factor: 11.2

[**Contributions:** Experimental work to generate phospho-proteomic data, bioinformatic analysis of phospho-proteomic data, and manuscript writing/editing.]

39. **N.A. Graham**, M. Tahmasian, B. Kohli, E. Komisopoulou, M. Zhu, I. Vivanco, M.A. Teitell, H. Wu, A. Ribas, R.S. Lo, I.K. Mellinghoff, P.S. Mischel, and T.G. Graeber. “Glucose deprivation activates a metabolic and signaling amplification loop leading to cell death”, [*Molecular Systems Biology*, 8:589 \(2012\)](#). (Highlighted in accompanying News & Views)

Impact Factor: 11.43

[**Contributions:** Designed and performed the experimental work, data analysis, supervised undergraduate researchers, and co-wrote the article.]

40. R.C. Koya, S. Mok, N. Otte, K.J. Blaketer, B. Comin-Anduix, P.C. Tume, A. Minasyan, **N.A. Graham**, T.G. Graeber, T. Chodon, A. Ribas. “BRAF Inhibitor Vemurafenib Improves the Antitumor Activity of Adoptive Cell Immunotherapy”, [*Cancer Research*, 72\(16\), 3928-37 \(2012\)](#).

Impact Factor: 12.7

[**Contributions:** Bioinformatic analysis of DNA copy number data and manuscript writing/editing.]

41. J.M. Drake, **N.A. Graham**, T. Stoyanova, A. Sedghi, A.S. Goldstein, H. Cai, D.A. Smith, H. Zhang, E. Komisopoulou, J. Huang, T.G. Graeber, and O.N. Witte. “Oncogene-specific activation of tyrosine kinase networks during prostate cancer progression”, [*Proceedings of the National Academy of Sciences \(USA\)*, 109\(5\), 1643-8 \(2012\)](#).

Impact Factor: 11.2

[**Contributions:** Experimental work to generate phospho-proteomic data, bioinformatic analysis of phospho-proteomic data, and manuscript writing/editing.]

42. P.D. Tume, R.C. Koya, T. Chodon, **N.A. Graham**, T.G. Graeber, B. Comin-Anduix, and A. Ribas. “The impact of *ex vivo* clinical grade activation protocols on human T-cell phenotype and function for the generation of genetically modified cells for adoptive cell transfer therapy”, [*The Journal of Immunotherapy*, 33\(8\), 759-68 \(2010\)](#).

Impact Factor: 5.422

[**Contributions:** Bioinformatic analysis and manuscript writing/editing.]

43. J. Sun†, M. Masterman-Smith†, **N.A. Graham**†, J. Jiao†, J. Mottahedeh, D.R. Laks, M. Ohashi, J. DeJesus, K. Kamei, K.B. Lee, H. Wang, Z.T. Yu, Y.T. Lu, S. Hou, K. Li, M. Liu, N. Zhang, S. Wang, B. Angenieux, E. Panosyan, E.R. Samuels, J. Park, D. Williams, V. Konkankit, D. Nathanson, R.M. van Dam, M.E. Phelps, H. Wu, L.M. Liao, P.S. Mischel, J.A. Lazareff, H.I. Kornblum, W.H. Yong, T.G. Graeber, and H.R. Tseng. “A microfluidic platform for systems pathology: multiparameter single-cell signaling measurements of clinical brain tumor specimens”, [*Cancer Research*, 70\(15\), 6128-38 \(2010\)](#). (†denotes equal contribution)

Impact Factor: 12.7

[**Contributions:** Designed and performed the bioinformatic analysis, co-wrote the manuscript.]

44. J.H. Kim, K. Kushiro, **N.A. Graham**, A.R. Asthagiri. “Tunable Interplay between epidermal growth factor and cell-cell contact governs the spatial dynamics of epithelial growth”, [*Proceedings of the National Academy of Sciences \(USA\)*, 106\(27\), 11149-53 \(2009\)](#).

Impact Factor: 11.2

[**Contributions:** Performed experimental work in collaboration with lead author.]

45. M.D. Pope, **N.A. Graham**, B.K. Huang, and A.R. Asthagiri. “Automated quantitative analysis of epithelial cell scatter”, [*Cell Adhesion & Migration*, 2\(2\), 110-6 \(2008\)](#).

Impact Factor: 4.405

[**Contributions:** Performed experimental work in collaboration with lead author.]

46. **N.A. Graham**, M.D. Pope, T. Rimchala, B.K. Huang, and A.R. Asthagiri. “A microtiter assay for quantifying protein-protein interactions associated with cell-cell adhesion”, [*The Journal of Biomolecular Screening*, 12\(5\), 683-93 \(2007\)](#).

Impact Factor: 2.355

[**Contributions:** Designed and performed the experimental work, data analysis, and co-wrote the article.]

47. **N.A. Graham** and A.R. Asthagiri. “EGF-mediated Tcf/Lef transcriptional activity is essential, but not sufficient, for cell cycle progression in non-transformed mammary epithelial cells”, [*The Journal of Biological Chemistry*, 279\(22\), 23517-24 \(2004\)](#).

Impact Factor: 5.157

[**Contributions:** Designed and performed the experimental work, data analysis, and co-wrote the article.]

THESIS

- N.A. Graham, *Crosstalk between soluble factors and cell-cell interactions: Implications for cell cycle control and tumor development* (Doctoral dissertation, California Institute of Technology, 2007).

INVITED TALKS AND SEMINARS

Conferences:

1. “Systems Biology Approaches to Drug Discovery and Repurposing”, American Institute of Chemical Engineers (AIChE) Annual Meeting – Nov. 9, 2023
2. “Metabolomics approaches to understand aging and to design combinatorial cancer drugs”, University of Southern California, Infection and Immunity Metabolism Symposium – March 27, 2020 (canceled due to COVID-19)
3. “Metabolomics approaches to understand aging and to design combinatorial cancer drugs”, SoCal Systems Biology Meeting – Feb. 01, 2020.
4. “Proteomic and metabolomic approaches to decode cell phenotypes”, SoCal Systems Biology Meeting – Feb. 09, 2019
5. “Defining cellular metabolic states through data integration with LC-MS metabolomics”, Thermo Scientific Global Metabolomics Seminar Tour – Sept. 13, 2017.
6. “Data-driven integration across proteomic and metabolic networks”, University of Southern California, Da Vinci Convergent Science Symposium – March 3, 2017.
7. Los Angeles Tissue Engineering Initiative – Dec. 2006.

Departmental/academic/research seminars:

8. “Systems Biology Approaches to Drug Discovery and Repurposing”, University of California, Irvine – Dec. 6. 2023
9. “Leveraging Systems Biology for Drug Discovery”, SynBio Young Speaker Series – Feb. 23, 2023 (online).
10. “An engineering approach to drug discovery using systems biology”, University of Southern California, Mork Family Department of Chemical Engineering and Materials Science – Aug. 30, 2022.
11. “Studying the post-translational modifications arginine methylation and phosphorylation with proteomics”, University of California, Los Angeles, Biochemistry, Molecular, and Structural Biology Seminar Series – Feb. 4, 2022.
12. “An engineering approach to drug discovery using systems biology”, Washington University in St. Louis, Dept. of Energy, Environmental, and Chemical Engineering – Dec. 3, 2021 (online).
13. “An engineering approach to drug discovery using systems biology”, Vanderbilt University, Dept. of Chemical and Biomolecular Engineering – Oct. 25, 2021 (online).
14. “An engineering approach to drug discovery using systems biology”, University of Virginia, Dept. of Chemical Engineering – Sept. 23, 2021 (online).
15. “An engineering approach to drug discovery using systems biology”, Carnegie Mellon University, Dept. of Chemical Engineering – Sept. 21, 2021 (online).

16. “Systems biology approaches to drug discovery for cancer and aging”, University of Michigan, Dept. of Biomedical Engineering – Sept. 16, 2021 (online).
17. “Post-Translational Modifications and Sub-Proteome Enrichment”, Stanford University, BIOS Lecture Series – March 10, 2021 (online).
18. “Metabolomic approaches to understand replicative senescence”, University of Southern California, Leonard Davis School of Gerontology – Jan. 29, 2021 (online).
19. “Designing drug therapies for cancer and aging using systems biology approaches”, Rice University, Department of Chemical and Biomolecular Engineering – Sept. 24, 2020 (online).
20. “Systems biology approaches to decode cellular phenotypes”, University of Southern California, Division of Periodontology, Diagnostic Sciences & Dental Hygiene Section of Infection & Immunity, Ostrow School of Dentistry – Oct. 21, 2019.
21. “Systems biology approaches to decode cellular behaviors”, California State University, Los Angeles, Department of Physics – March 14, 2019.
22. “Systems biology approaches for linking high-content data to cellular phenotypes”, Kyoto University, Institute for Integrated Cell-Material Sciences – June 22, 2018.
23. “Systems biology approaches for linking high-content molecular data to cancer phenotypes”, University of Southern California, Department of Chemistry – Sept. 02, 2015.
24. “Systems biology approaches for linking high-content molecular data to cancer phenotypes”, The Ohio State University, Lowrie Department of Chemical and Biomolecular Engineering – March 31, 2014.
25. “Systems biology approaches for linking high-content molecular data to cancer phenotypes”, University of Southern California, Mork Family Department of Chemical Engineering and Materials Science – March 28, 2014.
26. “Systems biology approaches for linking high-content molecular data to cancer phenotypes”, Virginia Commonwealth University, Department of Chemical and Life Science Engineering – Feb. 18, 2014.
27. “Systems biology approaches for linking high-content molecular data to cancer phenotypes”, Arizona State University, Department of Chemical Engineering – Jan. 21, 2014.
28. University of California, Los Angeles, Chemistry-Biology Interface Training Program – Feb. 2014.
29. California Institute of Technology, Department of Biology BioLunch Seminar – Nov. 2006.
30. California Institute of Technology, Department of Chemical Engineering Graduate Student Seminar Series – 2004.

CONTRIBUTED CONFERENCE PRESENTATIONS

Note: My name is highlighted in bold, and the presenting author is underlined.

- B.B. Garana and **N.A. Graham**. “The landscape of drug sensitivity in cancer cell lines reveals effective drug combinations for cancer”, American Institute of Chemical Engineers (AIChE) Annual Meeting, Nov. 2022.
- M.A. MacMullan, Z.S. Dunn, Y. Qu, P. Wang, and N.A. Graham. “Phospho-proteomic analysis of CAR-T cell signaling following activation by antigen-presenting cancer cells”, AIChE Annual Meeting, Nov. 2022.
- B.B. Garana, M.P. Jeon, J.H. Joly, and **N.A. Graham**. “DrugSEA: A Bioinformatic Tool to Identify Classes of Drugs with Differential Sensitivity”, AIChE Annual Meeting, Nov. 2021.

- **N.A. Graham**. “Deep Protein Arginine Methylation Profiling by LC-MS Proteomics”, SoCal Science @Home Lollapalooza Mass Spectrometry Symposium, Dec. 2020 (online).
- **N.G. Hartel**, C.Z. Liu, and **N.A. Graham**. “Improved Discrimination of Asymmetric and Symmetric Arginine Dimethylation By Optimization of the Normalized Collision Energy in LC-MS Proteomics”, AIChE Annual Meeting, Nov. 2020 (online).
- **A. Delfarah**, D. Zheng, J. Yang, and **N.A. Graham**. “Proteomic Profiling Identifies Novel Biomarkers of Aging and Potential Senolytic Therapeutic Targets”, AIChE Annual Meeting, Nov. 2020 (online).
- **J.H. Joly**, A. Delfarah, S. Parrish, P. Phung, and **N.A. Graham**. “A Synthetic Lethal Drug Combination Mimics Glucose Deprivation–Induced Cancer Cell Death in the Presence of Glucose”, AIChE Annual Meeting, Nov. 2020 (online).
- **D. Zheng**, J.H. Sussman, A. Delfarah, M.A. MacMullan, S. Parrish, and **N.A. Graham**. “Multi-Omics Reveals That AKT but Not MYC Promotes Reactive Oxygen Species-Mediated Cell Death in Oxidative Culture”, AIChE Annual Meeting, Nov. 2020 (online).
- **J.H. Joly**, W.E. Lowry, and **N.A. Graham**. “Differential Gene Set Enrichment Analysis: A Statistical Approach to Quantify the Relative Enrichment of Two Gene Sets”, Biomedical Engineering Society (BMES) Annual Meeting, Oct. 2020 (online).
- **N.G. Hartel**, B. Chew, J. Qin, J. Xu, and **N.A. Graham**. “Discovery of Novel Protein Methylation Targets through Unbiased, Global Methyl-Proteomics”, AIChE Annual Meeting, Nov. 2019.
- A. Delfarah, S. Parrish, J. Yang, F. Seo, S. Li, P. Wang, and **N.A. Graham**. “Inhibition of Nucleotide Synthesis Mediates Replicative Senescence Of Human Mammary Epithelial Cells,” BMES Annual Meeting, Oct. 2019.
- N.G. Hartel, B. Chew, J. Qin, J. Xu, and **N.A. Graham**. “Deep Protein Methylation Profiling by Combined Chemical and Immunoaffinity Approaches Reveals Novel PRMT1 Targets”, BMES Annual Meeting, Oct. 2019.
- **M. Tian**, S. Zhang, Y. Rao, J. Zhao, A. Delfarah, **N.A. Graham**, and P. Feng. “Protein Deamidation Mediated Metabolic Reprogramming During KSHV Lytic Replication”, 22nd International Workshop on Kaposi’s Sarcoma Herpesvirus and Related Agents, July 2019.
- **J. Zhao**, M. Tian, R. Gao, A. Delfarah, **N.A. Graham**, and P. Feng “KSHV hijacks CAD-mediated RelA deamidation to Promote Glycolysis and Cell Proliferation”, 22nd International Workshop on Kaposi’s Sarcoma Herpesvirus and Related Agents, July 2019.
- **J.H. Joly**, J.H. Sussman, D. Zheng, and **N.A. Graham**. “Using phospho-proteomics to identify synthetic lethal interactions with glucose deprivation”, Systems Approaches to Cancer Biology, Nov. 2018.
- **A. Delfarah**, S. Parrish, J. Yang, F. Seo, S. Li, P. Wang, and **N.A. Graham**. “Metabolomics Reveals That Inhibition of Nucleotide Synthesis Underlies Senescence of Human Mammary Epithelial Cells”, AIChE Annual Meeting, Nov. 2018.
- **J.A. Rohrs**, **N.A. Graham**, P. Wang, and S.D. Finley. “Kinetic Analysis of CD3 ζ and CD28 Chimeric Antigen Receptor T Cell Activation”, AIChE Annual Meeting, Nov. 2017.
- **N.A. Graham**, A. Minasyan, A. Lomova, A. Cass, N. Balanis, M. Friedman, S. Chan, S. Zhao, A. Delgado, J. Go, L. Beck, C. Hurtz, C. Ng, R. Qiao, J. ten Hoeve, N. Palaskas, H. Wu, M. Muschen, E. Port, S. Larson, N. Schultz, D. Brass, H.R. Christofk, I.K. Mellingshoff, and T.G. Graeber. “Recurrent Patterns of DNA Copy Number Alterations in Tumors Reflect Metabolic Selection Pressures”, AIChE Annual Meeting, Nov. 2016.
- **N.A. Graham**, J.M. Drake, J.K. Lee, T. Stoyanova, C.M. Faltermeier, S. Sudha, B. Titz, J. Huang, K.J. Pienta, O.N. Witte, and T.G. Graeber. “Phospho-proteomics reveals oncogenic phospho-tyrosine signaling networks in cancers lacking mutated or amplified tyrosine kinases”, AIChE Annual Meeting, Nov. 2013.

- **N.A. Graham**, J.M. Drake, J.K. Lee, T. Stoyanova, C.M. Faltermeier, S. Sudha, B. Titz, J. Huang, K.J. Pienta, O.N. Witte, and T.G. Graeber. “Oncogenic phospho-tyrosine signaling in the absence of mutated or amplified tyrosine kinases, BMES Annual Meeting, Sept. 2013.
- **N.A. Graham**, M. Tahmasian, B. Kohli, E. Komisopoulou, M. Zhu, I. Vivanco, M.A. Teitell, H. Wu, A. Ribas, R.S. Lo, I.K. Mellinghoff, P.S. Mischel, and T.G. Graeber. “Glucose deprivation activates a metabolic and signaling amplification loop leading to cell death”, Society for Melanoma Research Congress, Nov. 2012.
- **N.A. Graham**, J. Sun, M. Masterman-Smith, J. Jiao, J. Mottahedeh, D.R. Laks, M. Ohashi, J. DeJesus, K. Kamei, K.B. Lee, H. Wang, Z.T. Yu, YT Lu, S. Hou, K. Li, M. Liu, N. Zhang, S. Wang, B. Angenieux, E. Panosyan, E.R. Samuels, J. Park, D. Williams, V. Konkankit, D. Nathanson, R.M. van Dam, M.E. Phelps, H. Wu, L.M. Liau, P.S. Mischel, J.A. Lazareff, H.I. Kornblum, W.H. Yong, and H.R. Tseng, and T.G. Graeber. “Analysis and Visualization of Multiparameter, Single-Cell Data Using Self-Organizing Maps”, AIChE Annual Meeting, Nov. 2012.
- **N.A. Graham**, M. Tahmasian, B. Kohli, E. Komisopoulou, M. Zhu, I. Vivanco, M.A. Teitell, H. Wu, A. Ribas, R.S. Lo, I.K. Mellinghoff, P.S. Mischel, and T.G. Graeber. “Phospho-proteomics reveals a metabolic and signaling amplification loop leading to cell death following glucose deprivation”, AIChE Annual Meeting, Nov. 2012.
- **N.A. Graham**, M. Tahmasian, B. Kohli, E. Komisopoulou, M. Zhu, I. Vivanco, M.A. Teitell, H. Wu, A. Ribas, R.S. Lo, I.K. Mellinghoff, P.S. Mischel, and T.G. Graeber. “Glucose deprivation activates a metabolic and signaling amplification loop leading to cell death”, BMES Annual Meeting, Oct. 2012.
- **N.A. Graham** and A.R. Asthagiri. “Parsing the crosstalk between prominent oncogenic signaling pathways,” AIChE Annual Meeting, Nov. 2006.
- **N.A. Graham** and A.R. Asthagiri. “Parsing the crosstalk between prominent oncogenic signaling pathways”, Society for Biological Engineering’s International Conference on Bioengineering and Nanotechnology, Sept. 2006.
- **N.A. Graham** and A.R. Asthagiri. “Topology and dynamics of pro-mitogenic β -catenin signaling in mammary epithelial cells”, AIChE Annual Meeting, Nov. 2005.
- **N.A. Graham** and A.R. Asthagiri. “Antagonistic signaling between cell-cell contact and EGF regulates contact-inhibition of proliferation”, California Tissue Engineering Meeting, Sept. 2005.
- **N.A. Graham** and A.R. Asthagiri. “Intercellular contact inhibits proliferation by regulating intracellular signals, UCLA Biomedical Engineering Conference, Jan. 2005.
- **N.A. Graham** and A.R. Asthagiri. “Intercellular contact inhibits proliferation by restricting spatial localization of pro-mitogenic intracellular signals”, AIChE Annual Meeting, Nov. 2004