

Keith Eliot Whitener, Jr.

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Education

May 2010: Yale University; Ph.D., Chemistry
December 2007: Yale University; M.S., Chemistry
May 2005: University of North Carolina at Chapel Hill; B.S., Chemistry

Research Experience

January 2015-present
Research Chemist
Code 6177, U.S. Naval Research Laboratory, Washington D.C.

December 2011-January 2015
NRC Research Associate
U.S. Naval Research Laboratory, Washington D.C.
Principal Investigator: Paul Sheehan

June 2010 - September 2011
Postdoctoral Researcher
University of Colorado at Boulder, Boulder, CO
Advisor: Josef Michl

March 2006 - May 2010
Graduate Researcher
Yale University, New Haven, CT
Advisor: R. James Cross, Jr.
Thesis: Structure and Dynamics of Fullerene-Enclosed Small Molecules

March 2004 - May 2005
Undergraduate Researcher
University of North Carolina at Chapel Hill, Chapel Hill, NC
Advisor: Roger Miller

Publications

- 1) Daniels, G. C.; **Whitener, K. E., Jr.**; Smith, C. D.; Giordano, B. C.; Collins, G. E. "Assessment of opioid surrogates for spectroscopic testing (Part III)." *Forensic Chem.*, **2022**, *30*, 100443. [PDF SI](#)
- 2) **(Invited)** Langston, X.; **Whitener, K. E., Jr.** "Graphene Transfer: A Physical Perspective." *Nanomaterials* **2021**, *11*, 2837. <https://doi.org/10.3390/nano11112837> [PDF](#)

- 3) **(Invited)** Lee, W.-K.; Robinson, J. T.; **Whitener, K. E., Jr.** “Graphene-enabled block copolymer lithography transfer to arbitrary substrates.” *Nano Ex.* **2021**, 2, 014009. [PDF SI](#)
- 4) Haridas, D.; Yoseph, S. P.; So, C. R.; **Whitener, K. E., Jr.** “Transfer of printed electronic structures using graphene oxide and gelatin enables reversible and biocompatible interface with living cells.” *Mater. Sci. Eng. C* **2021**, 120, 111685. [PDF SI](#)
- 5) Lee, W.-K.; **Whitener, K. E., Jr.**; O’Shaughnessy, T. J.; Robinson, J. T.; Sheehan, P. E. “Transferring electronic devices with hydrogenated graphene.” *Adv. Mater. Interfaces* **2019**, 6, 1801974. [PDF SI](#)
- 6) **(Invited)** **Whitener, K. E., Jr.** “Hydrogenated Graphene: A User’s Guide.” *J. Vac. Sci. Technol. A* **2018**, 36, 05G401. [PDF](#)
- 7) **(Invited Book Chapter)** Sheehan, P.; Boris, D. R.; Dev, P.; Hernández, S. C.; Lee, W.-K.; Mulvaney, S.; Reinecke, T. L.; Robinson, J. T.; Tsoi, S.; Walton, S. G.; **Whitener, K.** “Surface Engineering with Chemically Modified Graphene.” In *2D Materials: Characterization, Production and Applications*. Banks, C. E.; and Brownson, D. A. C., eds. CRC Press, chap. 10, pp. 197-233, **2018**. [PDF](#)
- 8) **(Invited)** **Whitener, K. E., Jr.**; Lee, W.-K.; O’Shaughnessy, T. J.; Robinson, J. T.; Sheehan, P. E. “Hydrogen-assisted graphene transfer: surface engineering for chemical, electronic, and biological applications.” *Proc. SPIE* **2018**, 10638, 1063815. [PDF](#)
- 9) Brintlinger, T. H.; Bassim, N. D.; Winterstein, J.; Ng, A.; Lodge, M. S.; Ishigami, M.; **Whitener, K.**; Sheehan, P.; Stroud, R. M.; Robinson, J. T. “Characterizing Multi-layer Pristine Graphene, Its Contaminants, and Their Origin Using Transmission Electron Microscopy.” *Microsc. Microanal.* **2017**, 23 (Suppl. 1), 1740.
- 10) **Whitener, K. E.**; Robinson, J. T.; Sheehan, P. E. “Protection from below: stabilizing hydrogenated graphene using graphene underlayers.” *Langmuir* **2017**, 33, 13749. [PDF SI](#)
- 11) **Whitener, K. E., Jr.** “Surface fouling as a mechanism for chemotaxis in isotropic catalytic swimmers.” *Phys. Chem. Chem. Phys.* **2017**, 19, 25207. [PDF SI](#)
- 12) **Whitener, K. E., Jr.**; Lee, W. K.; Stine, R.; Tamanaha, C. R.; Kidwell, D. A.; Robinson, J. T.; Sheehan, P. E. “Activation of Radical Addition to Graphene by Chemical Hydrogenation.” *RSC Adv.* **2016**, 6, 93356. [PDF SI](#)
- 13) **(Invited)** **Whitener, K. E., Jr.**; “Rapid synthesis of thin amorphous carbon films by sugar dehydration and dispersion.” *AIMS Mater. Sci.* **2016**, 3, 1309. [PDF](#)
- 14) Friedman, A. L.; van ‘t Erve, O. M. J.; Robinson, J. T.; **Whitener, K. E., Jr.**; Jonker, B. T. “Homoepitaxial graphene tunnel barriers for spin transport.” *AIP Adv.* **2016**, 6, 056301. [PDF](#)
- 15) **Whitener, K. E., Jr.**; Lee, W.-K.; Bassim, N. D.; Stroud, R. M.; Robinson, J. T.; Sheehan, P. E. “Transfer of chemically modified graphene with retention of functionality for surface engineering.” *Nano Lett.* **2016**, 16, 1455. [PDF SI](#)
- 16) Friedman, A. L.; van ‘t Erve, O. M. J.; Robinson, J. T.; **Whitener, K. E., Jr.**; Jonker, B. T. “Hydrogenated Graphene as a Homoepitaxial Tunnel Barrier for Spin and Charge Transport in Graphene.” *ACS Nano* **2015**, 9, 6747. [PDF](#)
- 17) **Whitener, K. E., Jr.**; Stine, R.; Robinson, J. T.; Sheehan, P. E. “Graphene as Electrophile: Reactions of Graphene Fluoride.” *J. Phys. Chem. C* **2015**, 119, 10507. [PDF SI](#)
- 18) Lee, W.-K.; **Whitener, K. E., Jr.**; Robinson, J. T.; Sheehan, P. E. “Patterning Magnetic Regions in Hydrogenated Graphene via E-Beam Irradiation.” *Adv. Mater.* **2015**, 27, 1774. [PDF SI](#)
- 19) Felts, J. R.; Oyer, A. J.; Hernandez, S. C.; **Whitener, K. E., Jr.**; Robinson, J. T.; Walton, S. G.; Sheehan, P. E. “Direct Mechanochemical Cleavage of Functional Groups from Graphene.” *Nat. Commun.* **2015**, 6, 6467. [PDF SI](#) [Supplemental Movie](#)

- 20) **(Invited Book Chapter) Whitener, K. E., Jr.** “Reversible Graphene Functionalization for Electronic Applications: A Review.” In *The Science and Function of Nanomaterials*. Harper-Leatherman, A. S.; and Solbrig, C. M., eds. ACS Symposium Series, Vol. 1183, chap. 3, pp. 41-54, 2014. [PDF](#)
- 21) **(Invited Thematic Review) Whitener, K. E., Jr.;** Sheehan, P. E. “Graphene Synthesis.” *Diam. Relat. Mater.* **2014**, 46C, 25. [PDF](#)
- 22) **Whitener, K. E., Jr.;** Lee, W.-K.; Robinson, J. T.; Sheehan, P. E. “Chemical Hydrogenation of Single-Layer Graphene Enables Completely Reversible Removal of Electrical Conductivity.” *Carbon* **2014**, 72, 348. [PDF](#) [SI](#)
- 23) Stine, R.; Lee, W.-K.; **Whitener, K. E., Jr.;** Robinson, J. T.; Sheehan, P. E. “Chemical Stability of Graphene Fluoride Produced by Exposure to XeF₂.” *Nano Lett.* **2013**, 13, 4311. [PDF](#) [SI](#)
- 24) Lee, W.-K.; Tsoi, S.; **Whitener, K. E.;** Robinson, J. T.; Tobin, J. S.; Weerasinghe, A.; Sheehan, P. E.; Lyuksyutov, S. F. “Robust Reduction of Graphene Fluoride using an Electrostatically Biased Scanning Probe.” *Nano Res.* **2013**, 6, 767. [PDF](#) [SI](#)
- 25) **Whitener, K. E., Jr.** “Theoretical Studies of CH₄ Inside an Open-Cage Fullerene: Translation-Rotation Coupling and Thermodynamic Effects.” *J. Phys. Chem. A.* **2010**, 114, 12075. [PDF](#) [SI](#)
- 26) **Whitener, K. E., Jr.;** Cross, R. J.; Saunders, M.; Iwamatsu, S.; Murata, S.; Mizorogi, N.; Nagase, S. “Methane in an Open-Cage [60]Fullerene.” *J. Am. Chem. Soc.* **2009**, 131, 6338. [PDF](#) [SI](#)
- 27) **Whitener, K. E., Jr.;** Frunzi, M.; Iwamatsu, S. -i.; Murata, S.; Cross, R. J.; Saunders, M. “Putting Ammonia into a Chemically Opened Fullerene.” *J. Am. Chem. Soc.* **2008**, 130, 13996. [PDF](#)

Patents and Patent Applications

- 1) **Whitener, K. E.;** Lee, W. K.; Robinson, J. T.; Bassim, N. D.; Stroud, R. M.; Sheehan, P. E. “Graphene surface functionality transfer.” U.S. Patent 9,895,870, **2018**.
- 2) Friedman, A. L.; van ‘t Erve, O. M. J.; Robinson, J. T.; **Whitener, K. E.;** Jonker, B. T. “Process for forming homoepitaxial tunnel barriers with hydrogenated graphene-on-graphene for room temperature electronic device applications.” U.S. Patent 10,128,357, **2018**.
- 3) Lee, W. K.; **Whitener, K. E.;** Sheehan, P. E. “Magnetic graphene.” U.S. Patent 10,134,434, **2018**.
- 4) Friedman, A. L.; van ‘t Erve, O. M. J.; Robinson, J. T.; Jonker, B. T.; **Whitener, K. E.** “Homoepitaxial tunnel barriers with hydrogenated graphene-on-graphene for room temperature electronic device applications.” U.S. Patent 10,236,365, **2019**.
- 5) Lee, W. K.; **Whitener, K. E.;** Sheehan, P. E. “Magnetic graphene.” U.S. Patent 10,762,925, **2020**.
- 6) **(Application) Whitener, K. E.;** Lee, W.-K. “Graphene-enabled Block Copolymer Lithography Transfer to Arbitrary Surfaces.” U.S. Patent Application 20210208501, Filed December 8, 2020.

Program Management

- Karles Fellowship. “Kinetics and Stabilization of Chemical Groups on Graphene.” FY15, 1 performer.

- ONR/NRL Chemistry Division Base Program. “Transferrable Active Chemical Structures to Control Intercellular Communication at the Single-Cell Level.” FY19-22, 5 performers.
- ONR/NRL Chemistry Division Base Program. “Mucin Mimic Mediated Microbial Dormancy in Skin Wounds.” FY23-25, 4 performers.
- ESTCP, “Classification of Underwater UXO from Dynamic EMI Survey Data.” FY22-23, 5 performers.

Honors and Awards

- 2021 NRL Press Release: 50-21R, “NRL Researchers Target Cells for Tissue Engineering”
- May 2019: Adv. Mater. Interfaces cover article, “Transferring electronic devices with hydrogenated graphene.”
- Jul. 2018: JVSTA Invited review article selected as Editor’s Pick
- Apr. 2016: Invited poster presentation at NISE expo, Pentagon, Arlington, VA.
- Jan. 2016: Karles fellowship chosen as one of the Top 2 achievements in the Directorate
- 2015 NRL Press Release: “NRL Researchers Pattern Magnetic Graphene” 17-15r
- 2015 NRL Press Release: “NRL Scientists Develop New Homoepitaxial Graphene Tunnel Barrier/Transport Channel Spintronic Device” 58-15r
- Jan. 2015-Jan. 2016: Jerome and Isabella Karle Distinguished Scholar Fellowship
- Feb. 9, 2015 C&E News: Science & Technology Concentrates article on magnetic graphene
- 2015 NRL Review Featured Research Article: “Patterning magnetic regions in hydrogenated graphene via e-beam irradiation.”
- Dec. 2011-Jan. 2015: NRC Research Associateship at the Naval Research Laboratory
- Mar. 2010-Mar. 2012: Sponsored membership in the AAAS by Dean Robert Harper-Mangels, Yale University
- Sep. 2009-Sep. 2010: Sponsored membership in the New York Academy of Sciences
- 2008-2010: Robert B. Flint Fellowship at Yale University

Presentations

Talks

- (*Upcoming*) Sep. 2022: DoD 6.1 Basic Research Conference, Arlington, VA
- Feb. 2022: Biophysical Society Annual Meeting, San Francisco, CA
- (*Invited*) Dec. 2021: DoD Biotechnology CoI semi-monthly meeting, virtual
- Oct. 2021: AVS national Meeting, virtual
- (*Invited*) Oct. 2021: NanoWorld Boston, virtual
- Oct. 2021: TechConnect World Innovation Conference & Expo, National Harbor, MD
- Apr. 2021: MRS Spring Meeting, virtual.
- Apr. 2021: Spring ACS National Meeting, virtual.
- (*Invited*) Mar. 2021: DTRA-RISE Workshop, virtual.
- Mar. 2020: Spring ACS National Meeting, Virtual symposium.
- Jul. 2019: Advances in Functional Materials, Washington, DC
- Mar. 2019: ACS National Meeting, Orlando, FL
- (*Invited*) Apr. 2018: Nanoworld Conference, San Francisco, CA

- **(Invited)** Apr. 2018: SPIE Defense + Security, Orlando, FL
- Oct. 2017: AVS National Meeting, Tampa, FL
- Aug. 2017: ACS National Meeting, Washington, DC
- Mar. 2016: ACS National Meeting, San Diego, CA
- **(Invited)** Sep. 2015: Crystal & Graphene Symposium, Cambridge, MA
- Dec. 2013: MRS Fall Meeting, Boston, MA
- Oct. 2013: ACS Northeast Regional Meeting, New Haven, CT
- Aug. 2011: ACS National Meeting, Denver, CO
- Aug. 2011: Naval Research Laboratory, Washington, DC
- May 2010: Yale Student Physical Chemistry Seminar, New Haven, CT
- Sep. 2008: Yale Bristol-Myers-Squibb Symposium, New Haven, CT

Posters

- **(Upcoming)** Sep. 2022: MHSRS Annual Meeting, Kissimmee, FL
- Feb. 2020: Third Semiannual Government Workshop on 2D Materials, Gaithersburg, MD.
- Mar. 2019: 2019 Washington DC Government Workshop on 2D Materials Beyond Graphene, Arlington, VA.
- **(Invited)** Apr. 2016: Naval Innovative Science and Engineering (NISE) expo, Pentagon, Arlington, VA.
- Nov. 2012: Sigma Xi Postdoctoral Poster Session, NRL, Washington, DC.
- Jun. 2011: CU-NPA Future Leaders of Research, Boulder, CO
- Sep. 2009: Yale Bristol-Myers-Squibb Symposium, New Haven, CT

Teaching and Mentoring Experience

U.S. Naval Research Laboratory

- Summer 2021: Research mentor for 1 undergraduate—HBCU/MI program
 - Co-authored review article, *Nanomaterials*
- Summer 2019: Research mentor for 1 undergraduate—HBCU/MI program
 - Outstanding presentation award at ABRCMS
 - Co-authored paper, *Mater. Sci. Eng. C*
- Summer 2018: Research mentor for 1 undergraduate—HBCU/MI program
 - Poster presentations at SACNAS, ABRCMS

University of Colorado at Boulder, Boulder, CO

- Spring 2011: Research mentor for 2 undergraduate students: Michl Lab

Wilbur Cross High School, New Haven, CT

- Spring 2008-Fall 2008: Guest Teacher, AP Chemistry, 2 semesters

Yale University, New Haven, CT

- Fall 2007: Teaching assistant, Physical Chemistry Lab
- Spring 2007: Teaching assistant, General Chemistry
- Fall 2006: Teaching assistant, Honors General Chemistry

- Spring 2006: Teaching assistant, Physical Chemistry Lab
- Fall 2005: Teaching assistant, General Chemistry Lab

University of North Carolina at Chapel Hill, Chapel Hill, NC

- Summer 2005 (two sessions): Teaching assistant, Organic Chemistry Lab
- Fall 2003-Spring 2005: Teaching assistant, General Chemistry Lab

Professional Activities

Memberships

- Biophysical Society: Oct. 2021-present
- Materials Research Society: Dec. 2013-present
- American Chemical Society: Feb. 2011-present
- American Association for the Advancement of Science: Mar. 2010-present
- American Vacuum Society: Oct. 2017-present
- New York Academy of Sciences: Sep. 2009-Sep. 2010

Grant Reviewing Duties

- Office of Naval Research
- Department of Energy
- NDSEG Fellowship
- National Science Foundation

Journal Reviewing Duties (selected list)

- Science
- Journal of the American Chemical Society
- Advanced Materials
- Advanced Functional Materials
- Journal of Physical Chemistry
- Nano Letters
- Physical Chemistry Chemical Physics
- Chemistry of Materials
- ACS Applied Materials & Interfaces
- Carbon
- Scientific Reports
- Applied Physics Letters
- Colloids and Surfaces A: Physicochemical and Engineering Aspects

Committees

- 2022-2023: NRL Chemistry Division Colloquium Committee
- Feb. 2022: Session Co-chair, BPS Annual Meeting
- 2021-2022: AVS 2D Materials Focus Topic program committee
- 2019: NRL Safety Investigation Board: subject matter expert
- 2018-present: NRL Chemistry Division Safety Working Group

- Aug. 2017: Session Chair, ACS National Meeting
- Fall 2008-Spring 2009: Organizer, 2009 Student-Invited Lecture in Physical Chemistry at Yale
- Fall 2007-Spring 2008: Joint Manager of the Student Physical Chemistry Seminar series at Yale
- Fall 2006: Co-Chair, planning committee, 9th Annual Yale University/Bristol-Myers-Squibb Symposium

Miscellaneous

7-time regular season Jeopardy! Champion

1st Runner-up in 2013 Jeopardy! Tournament of Champions

Participant in invite-only Jeopardy! Battle of the Decades

Creator and maintainer of science and history blog “How Do We Know It?”

website: www.howdoweknowit.com; Twitter feed: @HDWKI