# Hongchen Shen

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## PROFESSIONAL

*2016-Present* Graduate Research Assistant, **The George Washington University**
Department of Civil and Environmental Engineering

*2013-2016* Graduate Research Assistant, **Tianjin University**
Department of Biological Engineering

## EDUCATION

*2016* **Tianjin University**, P. R. China
M.E. in Biological Engineering

*2013* **Tianjin University**, P. R. China
B.E. in Biological Engineering

## REFEREED JOURNAL PUBLICATIONS

In Preparation

[1] **Shen H.**, Han M., Shen Y., Shuai D. Electrospun Nanofibrous Membranes for Controlling Airborne Viruses: Present Status, Standardization of Aerosol Filtration Tests, and Future Development. Invited for Submission to *ACS Environ. Au*

[2] **Shen H.**, Zhou Z., Wang H., Zhang M., Han M., Chen J., Shuai D., Shen Y. Photosensitized Electrospun Nanofibrous Filters for Capturing and Killing Airborne Coronaviruses under Visible Light Irradiation. *Environ. Sci. Technol.* (Under Revision for Resubmission)

[3] **Shen H.**, Gulbrandson A. J., Li M., Shuai D., Trulove P. C., Durkin D. P. Fabrication of Antimicrobial Textiles through Natural Fiber Welding of Cotton Cloth with Silver Nanoparticles.

Published

[1] **Shen H.**, Zhou Z., Wang H., Zhang M., Han M., Durkin D. P., Shuai D., Shen Y. Development of Electrospun Nanofibrous Filters for Controlling Coronavirus Aerosols. *Environ. Sci. Technol. Lett.* **2021**, 8, 7, 545-550.

[2] Li M., Liu D., Chen X., Yin Z., **Shen H.**, Aiello A., McKenzie Jr. K. R., Jiang N., Li X., Wagner M. J., Durkin D. P., Chen H., Shuai D. Radical-Driven Decomposition of Graphitic Carbon Nitride Nanosheets: Light Exposure Matters. *Environ. Sci. Technol.* **2021**, 55, 18, 12414-12423.

[3] **Shen H.**, Durkin D. P., Aiello A., Diba T., Lafleur J., Zara J. M., Shen Y., Shuai D. Photocatalytic Graphitic Carbon Nitride-Chitosan Composites for Pathogenic Biofilm Control under Visible Light Irradiation. *J. Hazard. Mater.* **2020**, 124890.

[4] **Shen H.**, López-Guerra E. A., Zhu R., Diba T., Zheng Q., Solares S. D., Zara J. M., Shuai D., Shen Y. Visible-Light-Responsive Photocatalyst of Graphitic Carbon Nitride for Pathogenic Biofilm Control. *ACS Appl. Mater. Interfaces*. **2018**, 11 (1), 373-84.

[5] Zhang C., Li Y., **Shen H.**, Shuai D. Simultaneous Coupling of Photocatalytic and Biological Processes: A Promising Synergistic Alternative for Enhancing Decontamination of Recalcitrant Compounds in Water. *Chem. Eng. J.* **2020**, 126365.

[6] Zheng Q., Aiello A., Choi Y. S., Tarr K., **Shen H.**, Durkin D. P., Shuai D. 3D Printed Photoreactor with Immobilized Graphitic Carbon Nitride: A Sustainable Platform for Solar Water Purification. *J. Hazard. Mater.* **2020**, 123097.

[7] López-Guerra E. A., **Shen H.**, Solares S. D., Shuai D. Acquisition of Time–Frequency Localized Mechanical Properties of Biofilms and Single Cells with High Spatial Resolution. *Nanoscale*. **2019**, 11 (18), 8918-8929.

[8] Zheng Q., **Shen H.**, Shuai D. Advances and Challenges of Graphitic Carbon Nitride as a Visible-Light-Responsive Photocatalyst for Sustainable Water Purification. *Environ. Sci.: Water Res. Technol.* **2017**, 3, 982-1001. (Selected for Outside Front Cover)

[9] **Shen H.**, Ding J., Li L., Liu F. Effect of Y220C Mutant on the Conformational Transition of p53C Probed by Molecular Dynamics Simulation. *Acta Physico-Chimica Sinica*. **2016**, 32 (10), 2620-2627.

## CONFERENCE PRESENTATIONS

[1] **Shen H.**, Wang H., Zhou Z., Zhang M., Shen Y., Shuai D. Photoreactive Electrospun Filters for Controlling Airborne Transmission of SARS-CoV-2, 95th ACS Colloid and Surface Science Symposium, USA, 06/2021. ORAL

[2] **Shen H.**, Wang H., Zhou Z., Zhang M., Shen Y., Shuai D. Electrospun Nanofibrous Air Filters for Controlling Airborne Transmission of COVID-19, ACS Spring Meeting, USA, 04/2021. ORAL

[3] **Shen H.**, Durkin D. P., Aiello A., Diba T., Lafleur J., Zara J. M., Shen Y., Shuai D. Visible-Light-Responsive Graphitic Carbon Nitride/Chitosan Composite Films for Antimicrobial Packaging, ACS Spring Meeting, USA, 04/2021. ORAL

[4] **Shen H.**, Diba T., Lafleur J., Zara J. M., Shen Y., Shuai D. Graphitic Carbon Nitride and Its PVC Composites for Biofilm Control under Visible Light Irradiation, AEESP Conference, Tempe, AZ, USA, 05/2019. ORAL

[5] **Shen H.**, López-Guerra E. A., Diba T., Solares S. D., Zara J. M., Shen Y., Shuai D. Visible-Light-Responsive Photocatalyst of Graphitic Carbon Nitride for Biofilm Control, ACS Spring Meeting, Orlando, FL, USA, 04/2019. ORAL

[6] **Shen H.**, Shuai D., Shen, Y. Visible-Light-Responsive Photocatalyst of Graphitic Carbon Nitride Nanomaterials for Pathogenic Biofilm Control, 2018 SNO Conference, Washington, DC, USA, 11/2018. ORAL

[7] **Shen H.**, López-Guerra E. A., Diba T., Solares S. D., Zara J. M., Shen Y., Shuai D. Visible-Light-Responsive Photocatalyst of Graphitic Carbon Nitride for Pathogenic Biofilm Control, 8$^{th}$ ASM Conference on Biofilms, Washington, DC, USA, 10/2018. POSTER

[8] **Shen H.**, López-Guerra E. A., Diba T., Solares S. D., Zara J. M., Shuai D. Visible-Light-Responsive Graphitic Carbon Nitride Nanomaterials for Biofilm Control, Gordon Research Conference: Nanoscale Science and Engineering for Agriculture and Food Systems, South Hadley, MA, USA, 06/2018. POSTER

[9] **Shen H.**, López-Guerra E. A., Diba T., Solares S. D., Zara J. M., Shuai D. Visible-Light-Responsive Graphitic Carbon Nitride Nanomaterials for Biofilm Control, Gordon Research

Seminar: Nanoscale Science and Engineering for Agriculture and Food Systems, South Hadley, MA, USA, 06/2018. ORAL

[10] **Shen H.**, Shuai D. Visible-Light-Responsive Photocatalytic Graphitic Carbon Nitride for Antimicrobial Applications, AEESP Conference, Ann Arbor, MI, USA, 06/2017. ORAL

[11] **Shen H.**, Shuai D. Antimicrobial Applications of Visible-Light-Responsive Photocatalysts, ACS Spring Meeting, San Francisco, CA, USA, 04/2017. ORAL

## PROPOSAL PREPARATION EXPERIENCE

Assisted with proposal writing for Photocatalytic Graphitic Carbon Nitride for Inhibiting Biofilm Development and Encrustations on Indwelling Urinary Catheters, PIs: John Lafleur, Santiago D. Solares, and Danmeng Shuai. *07/2020*. **Funded by The George Washington University**.

Assisted with proposal writing for Electrospun Nanofibrous Air Filters for Coronavirus Control, PIs: Yun Shen and Danmeng Shuai. *05/2020*. **Funded by National Science Foundation**.

Assisted with proposal writing for Interactions between Photoreactive 2D Nanomaterials and Biofilms, PIs: Yun Shen, Danmeng Shuai, and Na Wei. *08/2019*. **Funded by National Science Foundation**.

## RESEARCH EXPERIENCE

Graduate Research Assistant

Department of Civil and Environmental Engineering, The George Washington University

*2016-present*

**Transcriptomics study on biofilms under stresses caused by photoreactive materials, *06/2020-present.***

- Collaborated with Prof. Na Wei at the University of Illinois at Urbana-Champaign on analyzing transcriptomic data.
- Objective: To understand the interplay between emerging photoreactive 2D nanomaterials and biofilms.

• Synthesized and characterized photoreactive 2D nanomaterials, i.e., graphitic carbon nitride (g-$C_3N_4$) nanosheets; Investigated bacterial response to photoreactive 2D nanomaterials within biofilm through transcriptomics.

• This research project provides fundamental understanding of bacteria-nanomaterial interactions, which guide the design of future antimicrobial materials.

**Development of electrospun nanofibrous membranes for controlling coronavirus aerosols,** ***03/2020-present.***

• Collaborated with Prof. Yun Shen at the University of California, Riverside on the design, fabrication, and implementation of electrospun nanofibrous membranes for controlling coronavirus aerosols. Particularly, I synthesized and characterized the nanofibrous membranes, conducted bioaerosol generation and filtration tests, and evaluated the impact of photosensitization on virus infectivity, genome integrity, and lifecycle in host cells.

• Objective: To fabricate nanofibrous air filters using electrospinning for efficient filtration and inactivation of coronavirus aerosols.

• Nanofibrous electrospun membranes showed excellent aerosol filtration efficiency (>99% for removing the most penetrating aerosols with a size of 100-500 nm); NaCl aerosols are a conservative surrogate for coronavirus aerosols in my filtration tests to understand the filtration efficiency; photosensitized electrospun membranes effectively removed coronavirus aerosols, and they rapidly inactivated coronaviruses in droplets and damaged virus genome and virus binding to the host cells through the singlet oxygen generated under visible light irradiation.

• Highlighted the promise of electrospun membranes for broad air filtration applications, e.g., PPE and HVAC filters, for preventing the airborne transmission of SARS-CoV-2 and beyond.

**Development of visible-light-responsive g-$C_3N_4$ and its polymer composites for pathogenic biofilm control,** ***09/2016-03/2020.***

• Collaborated with Profs. Santiago Solares and Jason Zara at GW on biofilm characterizations; Collaborated with Prof. David Durkin at US Naval Academy on nanomaterial characterizations.

• Objective: To control pathogenic biofilms using visible-light-driven photocatalysis.

• Via a series of techniques, i.e., confocal laser scanning microscopy (CLSM), optical coherence tomography (OCT), scanning electron microscopy (SEM), and atomic force microscopy (AFM), it is demonstrated that under the visible light irradiation, g-$C_3N_4$ and g-$C_3N_4$/chitosan composites not only inhibited biofilm development but also eradicated mature biofilms through reactive oxygen species.

• Highlighted the promise of using g-$C_3N_4$ and its polymer composites for a broad range of antimicrobial applications, especially for controlling persistent biofilms under visible-light irradiation.

Graduate Research Assistant

Department of Biological Engineering, Tianjin University

*2013-2016*

**Inhibition effects of small organic molecules on the conformational transition and aggregation of amyloid-β (Aβ) protein on the membrane, *2013-2016*.**

• Objective: To design novel inhibitors *in vivo* to provide new strategies for treating the Alzheimer's Disease.

• Applied molecular simulation and single molecule experiments to study the interactions between Aβ and cell membrane.

• Revealed the molecular mechanism of candidate molecules inhibiting Aβ aggregation on the surface of cell membrane.

## PROFESSIONAL SERVICE

**Journal reviewer**

• Environment International

• Journal of Hazardous Materials

## HONORS AND AWARDS

[1] ACS CSW Student Travel Award, 04/2019.

[2] Accelerate GW I-Corps Site Program, 10/2018.

[3] MoBE 2017 Symposium Travel Award, 10/2017.

[4] AEESP Stantec Student Travel Award, 06/2017.

[5] Runner-up Prize, GW SEAS Student Research and Development Showcase, 02/2017.

## REFERENCES

*Advisor, Ph.D.*

**Danmeng Shuai**, Associate Professor

Department of Civil and Environmental Engineering

The George Washington University

2029940506, danmengshuai@gwu.edu

*Co-Advisor, Ph.D.*

**Yun Shen**, Assistant Professor

Department of Chemical and Environmental Engineering

University of California, Riverside

yun.shen@ucr.edu

*Committee Member, Ph.D.*

**Santiago Solares**, Professor

Department of Mechanical and Aerospace Engineering

The George Washington University

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