Final Technical Report of Grant ONR N00014-15-1-2412
Entitled:
Recruitment and Nurturing of a New Faculty

Submitted by

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September 2018

ABSTRACT

This report is our final technical report for the Jackson State University Navy STEM grant. a) The grant will recruit a materials science faculty in the areas of polymer or nanomaterials science relevant to the research mission of the department of the Navy. b) The acquired start-up funds will be provided to the new faculty member to start new research programs that are import for the Navy. c) The new faculty is expected to supervise both undergraduate and graduate students form the traditionally underrepresented minority population and contribute to the development of a diverse of workforce for the Navy.

We achieved all three objectives. As to the first objectives, a new faculty, Dr. Yongfeng Zhao, has been recruited immediately after the grant started. The faculty has created a strong research program in nanomaterials science.

We also achieved the second objective. In the support of the start-up, the new faculty developed rigorous research program in polymer and nanomaterials at Jackson State University. He has obtained three external grants from different funding agents including one from national science foundation (NSF). He also actively discuss with program officers from Office of Navy Research for research opportunity.

Finally, we achieved the third objective. The faculty has supervised six undergraduate students and three graduate students in his lab. All of them are underrepresented minority students and most of them are female. Under the faculty's supervision, his students won prizes for oral and poster presentation five times in several conferences. After graduation, his master student continue her study in a Medical School. One of undergraduates went to pharmaceutical school.

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1) Summary of Accomplishments

This is a final technical report for the ONR grant N00014-15-1-2412 during the period of May 2015 through the end of June 2018. We are grateful to the Office of Navy Research (ONR) for this support.

In this grant, we proposed to recruit a materials science faculty in the areas of polymer or nanomaterials science relevant to the research mission of the department of the Navy. The acquired start-up funds will be provided to the new faculty member to start new research programs that are import for the Navy. The new faculty is expected to supervise both undergraduate and graduate students form the traditionally underrepresented minority population and contribute to the development of a diverse of workforce for the Navy.

We accomplished all three major objectives. The following part of the report will summarize the activities and achievement under the grant. The executive of this grant start with recruitment of new faculty in polymer and nanomaterials. Then we will report the outcome and impact of the grant on research, teaching, and service in JSU. We will include the new faculty's effort on developing research project directly related to Office of Navy Research.

2) Recruitment of new faculty in polymer and nanomaterials

A new faculty is recruited immediate after the grant started. After on-site interview, the search committee member hired Dr. Yongfeng Zhao as tenure track assistant professor in Department of Chemistry and Biochemistry at Jackson State University. The detailed contact information and research focus are list in our department website:

http://www.jsums.edu/chemistry/yongfeng-zhao/

The ONR grant was used as start-up fund for new faculty. Dr. Zhao received 50% teaching release time based on his normal teaching load of 4 classes. During summer, he got two month summer salary so he can initiate his research program in JSU. Under support of the grant, one technician was hired. Minority graduate student and undergraduate were supported to conduct research in lab.

Several instruments are purchased to support Dr. Zhao's research. These instruments include Isotemp 17.7 CF Value Refrigerator, Eppendorf 5418 Centrifuge, Buchi rotavapor and Buchi Vacuum Pump, H3505-HS40 Hotplate Stirrer, Laser Source with 808 nm (Power Technology Inc), ICI 7320 Infrared Camera, Eppendorf Model F1.5 ThermoMixer.

3) Development of research program in JSU

Dr. Zhao planned to develop research projects in three areas. These projects are aligned with challenges faced by Navy research.

Project 1: Design, synthesis and characterization of multifunctional small molecules and polymers for surface functionalization.

Project 2: Development of organic, inorganic and organic-inorganic hybrid nanomaterials with controlled sizes and functions by green chemistry

Project 3: Application of bioconjugation / nanomaterials as chemical tools for sensing, imaging, diagnostics and therapy of human diseases.

Dr. Zhao actively seek the external fund. He submitted proposal to funding agents such as National Science Foundation (NSF), National Institute of Health (NIH). Among the proposals he submitted, three grants have been awarded. These grant will continue to support students to do research in his lab. He has published peer-reviewed papers. Dr. Zhao has been invited to give talks in seminar or conference. To disseminate his research, Dr. Zhao frequently attend conference in his research area. This give him opportunity to introduce his research and track the current research progress by other labs.

Grant reviewer:

Panelist, National Science Foundation (NSF) 2017

Funds obtained:

a. Title: Synthesis of biomimetic melanin-like multifunctional nanoparticles for pH sensitive magnetic resonance imaging and photothermal therapy
Agency: National Science Foundation (NSF)
Role: Principle Investigator
Period: 7/1/2017-6/30/2020
Award Amount: $ 298,005

b. Title: Bioinspired materials and their application
Agency: Mississippi IDeA Network of Biomedical Research Excellence (INBRE)
Role: Principle Investigator
Period: 7/1/2018-6/30/2019
Award Amount: $ 30,800

c. Title: Development of dual functional therapeutic nanoparticles for treatment of advanced breast cancer
Agency: IU-MSI seed grant
Role: co-Principle Investigator
Period: 9/1/2018-8/31/2019
Award Amount: $ 15,000

Publications:

a. Zhao, Y. F.; Pang, B.; Detering, L.; Luehmann, H.; Yang, M.; Black, K.; Sultan, D.; Xia,Y.; Liu, Y.; "Melanocortin 1 receptor targeted imaging of melanoma with gold nanocages and positron emission tomography", *Molecular Imaging*, **2018**, in press

b. Liu, Y.; Gunsten, S.; Sultan, D.; Luehmann H.; Zhao, Y. F.; Blackwell, T.; Bollermann-Nowlis, Z.; Pan, J.-H.; Byers, D.; Atkinson, J.; Kreisel, D. Holtzman, M.; Gropler, R.; Combadiere, C.; Brody, S. "PET-based Imaging of Chemokine Receptor 2 in Experimental and Disease-related Lung Inflammation", *Radiology*, **2017**, 283, P. 162409

c. Liu, Y.; Li, W,; Luehmann H.; Zhao, Y. F.; Detering, L.; Sultan, D. E.; Hsiao, H. M.; Krupnick, A. S.; Gelman, A. E.; Combadiere, C.; Gropler, R. J.; Brody. S. L.; Kreisel, D. "Noninvasive Imaging of $CCR2^{+}$ Cells in Ischemia Reperfusion Injury after Lung Transplantation" *American Journal of Transplantation*, **2016**, 16, 3016-3023

d. Zhao, Y. F. ; Detering, L.; Sultan, D.; Cooper M. L.; You, M.; Cho, S.; Meier, S. L.; Luehmann, H.; Sun, G.; Rettig, M.; Dehdashti, F.; Wooley, K. L.; Dipersio, J. F.; Liu, Y. "Gold Nanoclusters Doped with ^{64}Cu for CXCR4 Positron Emission Tomography Imaging of Breast Cancer and Metastasis", *ACS Nano*, **2016**, 10, 5959–5970

e. Pang, B[§].; Zhao, Y. F. [§]; Luehmann, H.; Yang, X.; Detering, L.; You, M.; Zhang, C.; Zhang, L.; Li, Z.; Ren Q.; Liu, Y.; Xia, Y. "^{64}Cu-Doped PdCu@Au Tripods: A Multifunctional Nanomaterial for Positron Emission Tomography and Image-Guided Photothermal Cancer Treatment", *ACS Nano*, **2016**, 10, 3121-3131 ([§] Co-first authors)

Invited presentation:

a. Zhao, Y. F., Development of Nanomaterials and Their Biomedical Applications, Millsaps College, October 25th, 2017
b. Zhao, Y. F., Development of Nanoparticles for Biomedical Application: Cancer Imaging and Therapy, Louisiana State University, March 3rd, 2017
c. Zhao, Y. F., Chemokine Receptor CCR5 Targeted PdCu@Au Tripods for Imaging- Guided Photothermal Therapy, 81th Mississippi Academy of Science Annual Meeting, February 23rd, 2017

Attended Conferences:

a. Yongfeng Zhao, Chemokine Receptor CCR5 Targeted PdCu@Au Tripods for Imaging-Guided Photothermal Therapy, 81th Mississippi Academy of Science Annual Meeting, February 23-34, 2017, Hattiesburg, Mississippi

b. Yongfeng Zhao, CXCR4 Targeted Nanoclusters Imaging Breast Cancer and Lung Metastasis, 16th SSCC&MS symposium, July 28-29, 2016, Jackson, Mississippi

c. Yongfeng Zhao, Renal Clearable Dold Nanoclusters as a New Platform for Tumor Targering, 14th International Nanomedicine &Drug Delivery Symposium, September 16-18, 2016, Baltimore, Maryland

d. Yongfeng Zhao, Targeting to Tumor Based on Specific Biomarkers by a Renal Clearable Gold Nanoclusters, Gordon Research Conference, June 18-23, 2017 Mount Snow, West Dover, VT

e. Yongfeng Zhao, 82th Mississippi Academy of Science Annual Meeting, February 22-23, 2018, Hattiesburg, Mississippi

4) Teaching and supervision of new faculty in JSU

Dr. Zhao spend a lot of time to teach in JSU. He normally teach organic chemistry and general chemistry as needed by Chemistry Department. He is developing polymer chemistry class for undergraduate students. By collaboration with Dr, Han, he developed a class titled “Acetinide Chemistry” which is supported by Department of Defence.

Under the faculty’s supervision, his students won prizes for oral and poster presentation five times in several conferences. After graduation, Mariah Williams went to pharmaceutical school; Devin Guillory continue her Ph.D program in University of Arkansas Medicinal School. We also provided the list of students and researchers Dr. Zhao supervised.

Instructor:

Organic Chemistry (CHEM 241)
Organic Chemistry Lab (CHML 241)
General Chemistry (CHEM 142)
General Chemistry Lab (CHML 142)

Excellence in supervision:

a. Terriona Cowan, The First Place for poster presentation in Southern School on Chemistry and Engineering Conference, Oxford, MS, 2018.
b. Terriona Cowan, The Second Place for poster presentation in REU symposium, 2018.
c. Reed Effland, The First Place for oral presentation in REU symposium, 2018.
d. Devin Guillory, The First Place for oral presentation in ERN conference, Washington, D.C, 2017.
e. Mariah Williams, The First Place for oral presentation in REU symposium, 2017.
f**.** Terriona Cowan, won travel award, Graduate oral presentation in Chemistry & Chemical Engineering, 2018 Emerging Researchers National (ERN) Conference in STEM on February 22-24, 2018, Washington, DC

Students supervised:

Technician
Xianchun Zhu Ph.D. in Chemistry, Mississippi State Univ, Starkville, MS 04/16-08/16
PohLee Cheeh Ph.D. in Chemistry, University of Mississippi, Oxford, MS 02/17-

Graduate students
Devin Guillory M.S. in Chemistry, Jackson State University, Jackson, MS 08/15-08/17
Terriona Cowan M.S. in Chemistry, Jackson State University, Jackson, MS 08/15-
Zelena Johnson M.S. in Chemistry, Jackson State University, Jackson, MS 08/16-

Undergraduate students
Reed Effland Chemistry (B.S.), Beheaven University, Jackson, MS 06/18-08/18
Paul Brown Biology (B. S.), Jackson State University, Jackson, MS 10/17-
Zhivon Johnson Chemistry (B.S.), Jackson State University, Jackson, MS 06/16-05/17

Regina Johnson Chemistry (B.S.), Jackson State University, Jackson, MS 09/15-12/15
Ledarius Whitley Chemistry (B.S.), Jackson State University, Jackson, MS 01/16-12/16
Mariah Williams Chemistry (B.S.), Jackson State University, Jackson, MS 06/17-08/17

5) Effort to work with Office of Navy Research

Dr. Zhao is always looking for opportunity to work on the research projects directly related to Navy's mission. He summited concept grant to ONR program officer. He attend seminar and workshop organized by Department of Defense or ONR

After he started to work in JSU, he applied for Office of Navy Research (ONR) Summer Faculty Research Program in 2015.

Dr. Zhao Contact with program officer, Dr. Chrisey and Dr. McElvaney from ONR to submit a concept proposal in 2016. The proposal is titled as "Ultrasmall Copper Nanoclusters-Polymer Hybrids for Marine Anti-Biofouling Applications"

In 2018, Dr. Zhao attend the seminar organized by Crane Research Priority Panel for grant opportunity in University of Indiana Bloomington.

Workshop:

Dr. Zhao attend workshop titled "Advanced Materials for Transformative Changes to the Defense, Aerospace, and Civil Environments", University of Mississippi, Nov 15-17, 2016

6) Service in JSU and society

Dr. Zhao served JSU and material research society. It is worthy to note that he served as panelist for NSF grant. That is a great honor for a junior faculty. The following is service he did during this grant. He attend workshop for education in minority institute.

Serve as committee member:

a. Safety committee for department of chemistry
b. Facility committee for department of chemistry

Serve in conferences:

a. Chair of Section 3: Nano Science. 80th Mississippi Academy of Science Annual Meeting, February 18th, 2016
b. Mediator: 16th SSCC&MS symposium, July 28-29, 2016, Jackson, Mississippi
c. Judge for student posters, 81th Mississippi Academy of Science Annual Meeting, February 23-34, 2017, Hattiesburg, Mississippi
d. Judge for student presentations, 80th Mississippi Academy of Science Annual Meeting, February 18th, 2016

e. Judge for student posters, 80th Mississippi Academy of Science Annual Meeting, February 18th, 2016

Workshop:

Yongfeng Zhao, QEM training in Baltimore, June 24-25, 2016