

Michael D. Schulz, Ph.D.

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Professional Positions

- 2017-present** **Virginia Tech, Blacksburg VA**
Assistant Professor
Department of Chemistry
- 2015-2017** **California Institute of Technology, Pasadena, CA**
Postdoctoral Scholar
Advisor: Robert Grubbs
- 2014-2015** **Max Planck Institute for Polymer Research, Mainz, Germany**
Fulbright Scholar
Advisor: Klaus Müllen

Education

- 2010-2014** **Ph.D., University of Florida, Gainesville, FL**
Organic and Polymer Chemistry
Advisor: Kenneth B. Wagener
- 2010-2014** **M.S., University of Florida (concurrent with PhD)**
Pharmaceutical Science-Medicinal Chemistry
Advisor: Kenneth B. Sloan
- 2007-2010** **B.S., University of Iowa, Iowa City, IA**
Chemistry

Selected Awards and Recognition

- SciFinder Future Leaders Program Participant (2017)
- Fulbright Research Grant (Germany)—US State Department (2014-2015)
- 65th Lindau Nobel Laureate Meeting Participant (2015)
 - *One of 650 young scientists worldwide selected to attend, along with 65 Nobel laureates*
 - *One of six young scientists selected by Nature to be featured in their documentary series on the meeting*
- Three Minute Thesis Competition 1st Place Winner—University of Florida (2014)
 - *Competition to present your doctoral thesis research in under three minutes*
- Conference of Southern Graduate Schools 3-Minute Thesis People's Choice (2015)
 - *Competition among the 1st place winners of 26 graduate schools*
- UF Science for Life Graduate Student Mentor Award (2014)
- Graduate Student Mentoring Award—University of Florida (UF) Grad School (2013)
- Butler Polymer Research Award (2013)
 - *Awarded to the top student in polymer chemistry*

- NSF-East Asia and Pacific Summer Institutes Fellow—Japan (2013)
 - *Funded travel to Japan, cost of living (3 months), and stipend*
- UF Alumni Fellowship (2010-2014)
 - *Awarded to top 5 incoming chemistry graduate students (tuition and stipend for 4 years)*
- Harvard University Research Experience for Undergraduates (2009)
- Donald J. Burton and Margaret A. Burton Memorial Scholarship in Chemistry (2009)
 - *Awarded to the top undergraduate student in chemistry research at the University of Iowa*
- Merck Index Award (2009)
- Iowa Center for Research by Undergraduates (ICRU) Fellowship (2008-2009)
- ICRU Summer Research Fellowship (2008)
- CRC Freshman Chemistry Award (2008)
 - *Awarded to top freshman chemistry student (of ~1000)*

Publications

1. Archer, W.R.; Thompson, T.N.; and **Schulz, M.D.*** “Effect of Copolymer Structure on Rare-Earth-Element Chelation Thermodynamics” *Macromol. Rapid Commun.* **2020**, ASAP. DOI: 10.1002/marc.202000614
2. Bardot, M.I.; and **Schulz, M.D.*** “Biodegradable Poly(Lactic Acid) Nanocomposites for Fused Deposition Modeling 3D Printing” *Nanomaterials* **2020**, 10, 2567–2587.
3. Hall, B.A.; Shelton, E.B.; Wu, Y.; and **Schulz, M.D.*** “Synthesis and Post-Polymerization Modification of Poly(arylene ether sulfone)s Containing Pendant Sulfonamide Groups” *Polymer* **2021**, 212, 123186.
4. Bianculli, R.H.; Mase, J.D.; and **Schulz, M.D.*** “Antiviral Polymers: Past Approaches and Future Possibilities” *Macromolecules* **2020**, 53, 9158–9186.
 - ACS Editors’ Choice Article
 - Featured on the front cover of *Macromolecules*
 - Most-read article in *Macromolecules* November–December 2020
5. Archer, W.R.; and **Schulz, M.D.*** “Isothermal titration calorimetry: practical approaches and current applications in soft matter” *Soft Matter* **2020**, 16, 8760–8774.
6. Liu, T.; Du, Z.*; Wu, X.; Rahman, M.M.; Nordlund, D.; Zhao, K.; **Schulz, M.D.**; Lin, F.; Wood, D.L.; Belharouak, I.* “Bulk and surface structural changes in high nickel cathodes subjected to fast charging conditions” *Chem. Commun.* **2020**, 56, 6973–6976.
7. Archer, W.R., Fiorito, A., Heinz-Kunert, S., MacNicol, P. L., Winn, S. A., **Schulz, M. D.*** “Synthesis and Rare-Earth-Element Chelation Properties of Linear Poly(ethyleneimine methylenephosphonate)” *Macromolecules* **2020**, 53, 2061-2068.
8. Thompson, T. N., Coley, A. S., **Schulz, M. D.*** “Synthesis of poly(bicyclohexyldimethylene terephthalate): effect of regioisomer ratios on physical properties” *Polym. Chem.* **2020**, 11, 2485-2491.

9. Archer, W. R., Hall, B. A., Thompson, T. N., Wadsworth, O. J., **Schulz, M. D.*** “Polymer sequestrants for biological and environmental applications” *Polym. Int.* **2019**, *68*, 1220-1237.
 - Featured on the front cover of *Polymer International*
10. Blumenfeld, C. M.[†], **Schulz, M. D.**[†], Hetts, S. W., Grubbs, R. H. “Drug capture materials based on genomic DNA-functionalized magnetic nanoparticles” *Nat. Commun.* **2018**, *9*, 2870. (†indicates equal contribution)
11. Yee, D.[†], **Schulz, M. D.**[†], Grubbs, R. H., Greer, J. “Functionalized 3D architected materials via thiol-Michael addition and two-photon lithography” *Adv. Mater.* **2017**, *29*, 1605293. (†indicates equal contribution)
12. Caire da Silva, L., Rojas, G., **Schulz, M. D.**, Wagener, K. B. “Acyclic diene metathesis polymerization: history, methods and applications” *Prog. Polym. Sci.* **2017**, *69*, 79-107.
13. Li, H., Caire da Silva, L., **Schulz, M. D.**, Rojas, G., Wagener, K. B. “A review of how to do an ADMET reaction” *Polym. Int.* **2017**, *66*, 7-12.
 - Featured on the front cover of *Polymer International*
14. Bachler, P. B., Forry, K. E., Sparks, C. A., **Schulz, M. D.**, Wagener, K. B., Sumerlin, B. S. “Modular segmented hyperbranched copolymers” *Polym. Chem.* **2016**, *7*, 4155-4159.
15. Çinar, S., **Schulz, M. D.**, Oyola-Reynoso, S., Bwambok, D. K., Gathiaka, S. M., Thuo, M. “Application of Ionic Liquids in Pot-in-Pot reactions” *Molecules* **2016**, *21*, 272.
16. Bachler, P., **Schulz, M. D.**, Sparks, C., Sumerlin, B., Wagener, K. B. “Aminobisphosphonate Polymers via RAFT and a Multicomponent Kabachnik-Fields Reaction” *Macromol. Rapid Commun.* **2015**, *36*, 828-833.
 - Featured on the back cover of *Macromolecular Rapid Communications*
17. **Schulz, M. D.**, Atkinson, M., Elsey, R., Thuo, M. M. “Copper(I) halides inhibit olefin isomerized byproducts from phosphine-based Grubbs' metathesis catalysts in polar protic solvents” *Transition Metal Chemistry* **2014**, *39*, 763-767.
18. Popwell, S., **Schulz, M. D.**, Wagener, K. B., Batich, C. D., Milner, R. J., Lagmay, J., Bolch, W. E. “Synthesis of Polymeric Phosphonates for Selective Delivery of Radionuclides to Osteosarcoma” *Cancer Biother. Radiopharm.* **2014**, *29*, 273-282.
19. **Schulz, M. D.**, Wagener, K. B. “Precision Polymers via ADMET Chemistry” *Macromolecular Chemistry and Physics* **2014**, *215*, 1936-1945.
 - Selected for publication in “Best of Macromolecular Journals 2015”
 - Featured on the front cover of “Best of Macromolecular Journals 2015”
20. Sauty, N., da Silva, L. C., **Schulz, M. D.**, Few, C. S., Wagener, K. B. “The ADMET Reaction” *Appl. Petrochem. Res.* **2014**, *4*, 225-233.
21. **Schulz, M. D.**, Sauty, N., Wagener, K. B. “Morphology control in precision polyolefins” *Appl. Petrochem. Res.* **2014**, *5*, 3-8.
22. **Schulz, M. D.**, Ford, R. R., Wagener, K. B. “Insertion Metathesis Depolymerization.” *Polym. Chem.* **2013**, *4*, 3656-3658.

23. Atallah, P., Wagener, K. B., **Schulz, M. D.** “ADMET: The Future Revealed” *Macromolecules* **2013**, *46*, 4735-4741.
 - Featured on the front cover of *Macromolecules*
24. Thuo, M. M., Reus, W., Kim, C., **Schulz, M. D.**, Whitesides, G. M. “Replacing -CH₂CH₂- with -CONH- does not significantly change rates of charge transport through Ag^{TS}-SAM//Ga₂O₃/EGaIn Junctions” *J. Am. Chem. Soc.* **2012**, *134*, 10876-10884.
25. **Schulz, M. D.**, Wagener, K. B. "Solvent Effects in Alternating ADMET Polymerization." *ACS Macro Letters* **2012**, *1*, 449-451.
26. Thuo, M. M., Reus, W. F., Nijhuis, C. A., Barber, J. R., Kim, C., **Schulz, M. D.**, Whitesides, G. M. “Odd-Even Effects in Charge Transport Across Self-Assembled Monolayers.” *J. Am. Chem. Soc.* **2011**, *133*, 2962-2975.
27. Mwangi, M. T., **Schulz, M. D.**, Bowden, N. B. “Sequential Reactions with Grubbs’ Catalyst and AD-MIX (α/β) using PDMS Thimbles.” *Org. Lett.* **2009**, *11*, 33–36.
28. Mwangi, M. T., Runge M. B., Hoak, K. M., **Schulz, M. D.**, Bowden, N. B. “A Materials Approach to Site-Isolation of Grubbs Catalysts from Incompatible Solvents and *m*-Chloroperoxybenzoic Acid.” *Chem. - Eur. J.* **2008**, *14*, 6780-6788.

Book Chapters:

29. **Schulz, M. D.**, Wagener, K. B. “ADMET Polymerization” in *Handbook of Metathesis: Metathesis Polymerization* (ed. R. H. Grubbs), Wiley-VCH Verlag GmbH, Weinheim, Germany, 2015, p. 313-355.
30. Caire da Silva, L.; Sauty, N. F.; Thompson, D.; Gaines, T. W.; **Schulz, M. D.**; Wagener, K. B. “Metathesis Polymerization-ADMET” in *Encyclopedia of Polymeric Nanomaterials*, S. Kobayashi and K. Müllen, Eds., Springer Berlin Heidelberg, 2015.

Patents:

31. **Schulz, M. D.**, Turner, S. R., Thompson, T. N. “Polyesters made with hydrogenated biphenyl 3,4'-dimethanol and hydrogenated biphenyl 4,4'-dimethanol.” Provisional Patent Serial No. 62/984,680. VTIP 20-068.
32. Blumenfeld, C. M., **Schulz, M. D.**, Yee, D., Greer, J., Hetts, S. W., Grubbs, R. H. “DNA-Functionalized Scaffolds for Drug Capture Applications.” US Patent application 15/696474 filed 6 September 2017.
33. Wagener, K. B., **Schulz, M. D.** “Metathesis depolymerization using acrylates.” International Patent Application No. PCT/US2013/055847; filed 20 August 2013; Published 27 February 2014 under publication number WO 2014/031677. Issued 09 August 2016; US Patent 9,409,850.
34. **Schulz, M. D.**, Wagener, K. B., Sumerlin, B. S., Batich, C. D., Sparks, C. S., Bolch, W. E., Milner, R., Smith, S., Kwan, M., Bachler, P., Popwell, S. “Polymeric metal chelators based on linear polyethyleneimine.” Provisional patent filed 18 November 2014. Application No. 62/081,049.

Non-Refereed Publications:

35. **Schulz, M. D.** "International Experience in Scientific Education: Distracting or Indispensable?" *ChemistryViews Magazine*, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. 7 January 2014. DOI: 10.1002/chemv.201300133
36. **Schulz, M. D.**, Ford, R. R., Wagener, K. B. "Insertion Metathesis Depolymerization." *Polymer Preprints (American Chemical Society, Division of Polymer Chemistry)* **2012**, *53*, 230-231.
37. **Schulz, M. D.**, Wagener, K. B. "Exploring Solvent Effects with Alternating Acyclic Diene Metathesis Polymerization." *Polymer Preprints (American Chemical Society, Division of Polymer Chemistry)* **2012**, *53*, 134-135.
38. Runge, M. B.; Mwangi, M. T.; Miller II, A. L.; Perring, M.; Hoak, K. M.; **Schulz, M. D.**; Bowden, N. B. "PDMS thimbles for the development of cascade reactions: A materials approach to organic chemistry" *PMSE Preprints* **2009**, *100*, 690-691.

Selected Presentations – Presenting author listed first

1. **Schulz, M. D.**; Archer, W.R.; Heinz-Kunert, S.; MacNicol, P.; Winn, S. "Phosphonate-containing materials for rare-earth element extraction." 260th American Chemical Society National Meeting, Virtual. 17 August–20 August 2020.
2. **Schulz, M. D.** "Polymeric Sequestrants for Environmental and Biological Applications." Department of Chemistry and Physics Seminar Series, Western Carolina University, Cullowhee, NC. 07 October 2019.
3. **Schulz, M. D.** "Polymer Sequestrants for Environmental and Biological Applications." Tosoh Polymer and Biomacromolecular Applications and Characterization Conference GPC2019, New Orleans, LA. 10 July 2019.
4. **Schulz, M. D.** "Polymeric Sequestrants for Environmental and Biological Applications." Virginia Tech – Waseda University Joint Workshop on Energy and Nanomaterials, Waseda University, Tokyo, Japan. 07 June 2019.
5. **Schulz, M. D.** "Polymer Sequestrants for Environmental and Biological Applications." Braskem, Pittsburgh, PA. 20 May 2019.
6. **Schulz, M. D.**; Wadsworth, O.; Oyola-Reynoso, S.; Hetts, S. "Materials for drug capture: An approach to mitigating the off-target toxicity of chemotherapy." 257th American Chemical Society National Meeting, Orlando, FL. 2 April 2019.
7. **Schulz, M. D.** "Challenge-inspired polymer synthesis: Materials for biomedical and environmental applications." Department of Chemistry Seminar, Appalachian State University, Boone, NC. 16 November 2018.
8. **Schulz, M. D.** "Materials for drug capture: An approach to mitigating the off-target toxicity of chemotherapy." ExxonMobil, Baytown, TX. 12 October 2018.

9. **Schulz, M. D.**; Wadsworth, O.; Oyola-Reynoso, S.; Hetts, S. “Developing materials for drug capture: An approach to removing chemotherapy agents from the bloodstream.” 256th American Chemical Society National Meeting, Boston, MA. 19 August 2018.
10. **Schulz, M. D.** “Developing materials for drug capture: An approach to reducing the off-target toxicity of chemotherapy.” 4th Functional Polymeric Materials Conference, Nassau, Bahamas, 7 June 2018.
11. **Schulz, M. D.** “Designing Polymers to Improve Disease Treatments.” Macromolecules Innovation Institute Technical Conference and Review, Blacksburg, VA. 18 April 2018.
12. **Schulz, M. D.**; Oyola-Reynoso, S.; Hetts, S. “Materials for drug capture: An approach to reducing the off-target toxicity of chemotherapy.” 255th American Chemical Society National Meeting, New Orleans. 18 March 2018.
13. **Schulz, M. D.**; Blumenfeld, C. M.; Yee, D.; Greer, J.; Grubbs, R. H. “Materials for drug capture: An approach for removing off-target chemotherapy from the bloodstream.” 254th American Chemical Society National Meeting, Washington, DC. 23 August 2017.
14. **Schulz, M. D.**; Blumenfeld, C. M.; Yee, D.; Greer, J.; Grubbs, R. H. “Materials for drug capture: Filtering off-target chemotherapy agents from the bloodstream.” 253rd American Chemical Society National Meeting, San Francisco, CA. 3 April 2017.
15. **Schulz, M. D.** “Synthesizing Materials for Medical Applications: Two Stories from the Interface between Chemistry and Medicine.” Seminar of Special Interest, Department of Chemistry, University of Illinois. Urbana-Champaign, IL. 3 February 2017.
16. **Schulz, M. D.** “Synthesizing Materials for Medical Applications: Two Stories from the Interface between Chemistry and Medicine.” Departmental Seminar, Department of Chemistry Seminar, Virginia Tech. Blacksburg, VA. 16 January 2017.
17. **Schulz, M. D.** “Synthesizing Materials for Medical Applications: Two Stories from the Interface between Chemistry and Medicine.” Departmental Seminar, Department of Chemistry Seminar, University of California, Merced. Merced, CA. 5 December 2016.
18. **Schulz, M. D.** “Fundamentals of Cancer Biology for Chemists.” University of Florida Polymer and Polymeric Materials Science and Engineering Student Chapter. Gainesville, FL. 10 April 2014.
19. **Schulz, M. D.**; Popwell, S.; Milner, R.; Bolch, W.; Batich, C.; Wagener, K. B. “Targeting Pediatric Bone Cancer with Polymer-Based Radiotherapy.” University of Florida Graduate Student Research Day, Gainesville, FL. 29 October 2013.
20. **Schulz, M. D.**; Wagener, K. B. “Applications of Insertion Metathesis: Exploring Solvent Effects, Depolymerization, and Olefin Isomerization.” Mashima Group Seminar. Osaka University. 23 August 2013.
21. **Schulz, M. D.**; Ford, Rachel R.; Wagener, K. B. “Insertion Metathesis Depolymerization.” International Symposium on Olefin Metathesis XX, Nara, Japan. 18 July 2013.
22. **Schulz, M. D.**; Wagener, K. B. “From Metathesis to Metastases and Everything in Between.” Chujo Group Seminar, University of Kyoto, Kyoto, Japan. 22 June 2013.

23. **Schulz, M. D.**; Wagener, K. B.; Chujo, Y. "Understanding the Connection between Binding and Supramolecular Architecture." Japan Society for the Promotion of Science Summer Program Presentation, Sokendai University, Hiyaama, Japan. 14 Jun 2013.
24. **Schulz, M. D.**; Ford, R. R.; Wagener, K. B. "Insertion Metathesis Depolymerization." 244th ACS National Meeting, Philadelphia, PA. 21 August 2012.
25. **Schulz, M. D.**; Wagener, K. B. "Solvent Effects in alternating ADMET polymerization." International Union of Pure and Applied Chemistry World Polymer Congress, Blacksburg, VA. 27 June 2012.
26. **Schulz, M. D.**; Cansiz, S.; Tan, W.; Wagener, K. B. "Polymer-aptamer conjugates for selective cytotoxicity." International Union of Pure and Applied Chemistry World Polymer Congress, Blacksburg, VA. 26 June 2012.
27. **Schulz, M. D.**; Wagener, K. B. "Exploring solvent effects in alternating acyclic diene metathesis (ADMET) polymerization." 243rd ACS National Meeting, San Diego, CA. 27 March 2012.
28. **Schulz, M. D.**; Mwangi, M. T.; Bowden, N. B. "Novel Cascade Reactions through Site-Isolation of Incompatible Organometallic Catalysts" 44th ACS Midwest Regional Meeting, Iowa City, IA. 23 October 2009.
29. **Schulz, M. D.**; Thuo, M. M.; Whitesides, G. M. "Chemical Methods of Minimizing Defects in Molecular Electronic Devices" Harvard University REU Symposium. Cambridge, MA. 7 August 2009.
30. **Schulz, M. D.**; Thuo, M. M.; Whitesides, G. M. "Minimizing Defects in Molecular Electronic Devices" Museum of Science. Cambridge, MA. 31 July 2009.
31. **Schulz, M. D.**; Mwangi, M. T.; Bowden, N. B. "Site-Isolation of Incompatible Organometallic Catalysts in Novel Cascade Reactions" 43rd ACS Midwest Regional Meeting, Kearney, NE. 11 October 2008.
32. **Schulz, M. D.**; Mwangi, M. T.; Bowden, N. B. "Fabrication of PDMS Thimbles for Site-isolation in Organic Synthesis" 236th ACS National Meeting, Philadelphia, PA. 18 August 2008.

Mentored Research Experience

California Institute of Technology

August 2015-July 2017

Advisor: Robert Grubbs

- Synthesized up-converting nanoparticle and developed applications
- Synthesized biocompatible hydrogels for microbe encapsulation
- Developed methods of drug capture for use in conjunction with chemotherapy administered by transarterial chemoembolization (TACE)

Max Planck Institute for Polymer Research

September 2014-July 2015

Advisor: Klaus Müllen

- *N*-carboxyanhydride (NCA) polymerization
- Polymerization in non-aqueous emulsion
- Synthesis of nanoparticles for drug delivery

University of Florida

June 2010-August 2014

Advisor: Kenneth B. Wagener

- Organic and polymer synthesis and characterization
- Studied olefin isomerization and solvent effects in acyclic diene metathesis (ADMET) polymerization
- Developed a new method of metathesis depolymerization
- Developed polymer-aptamer conjugates and studied their cytotoxicity
- Synthesized and developed polymers with pedant chelating ligands for the delivery of radionuclides in veterinary and pediatric osteosarcoma
- Designed polymers with UV absorbers for application as a sunscreen component

Kyoto University

June 2013-August 2013

Advisor: Yoshiki Chujo

- Synthesis of through-space conjugated polymers
- Characterization of electronic and photophysical properties

Harvard University

June 2009-August 2009

Advisor: George M. Whitesides

- Studied charge transport across *n*-alkanethiol self-assembled monolayers
- Developed possible applications of magnetic levitation

University of Iowa

Advisor: Ned B. Bowden

August 2007-May 2010

- Fabricated polydimethylsiloxane thimbles for site isolation of organometallic catalysts
- Green chemistry (cascade reactions)

Advisor: Amnon Kohen

August 2008-May 2009

- Studied enzyme kinetics and mechanisms

Teaching Experience

Virginia Tech Assistant Professor

Fall 2020: MACR 5015 (Fundamentals of Macromolecular Science and Engineering)

Fall 2020: CHEM 4014 (Survey of Chemical Literature)

Fall 2020: CHEM 5704 (Synthesis and Reactions of Macromolecules)

Summer 2020: CHEM 2536 (Organic Chemistry II for Non-Majors)

Spring 2020: CHEM 2536 (Organic Chemistry II for Non-Majors)

Fall 2019: CHEM 5704 (Synthesis and Reactions of Macromolecules)

Spring 2019: CHEM 2536 (Organic Chemistry II for Non-Majors)

Fall 2018: CHEM 4534 (Organic Chemistry of Polymers)

Fall 2017: CHEM 4534 (Organic Chemistry of Polymers)

University of Florida Assistant Lecturer

Fall 2013: CHM 2210 (Organic Chemistry I)

- Gave lectures to a class of 180 students; proctored and graded tests

University of Florida Teaching Assistant

Fall 2010: CHM 2046 (General Chemistry II)

- Taught discussion sections (53 students) and proctored exams
- Was responsible for discussion content and format, and also for administering and grading quizzes

Spring 2011: Organic Chemistry Lab

- Guided students through organic lab procedures and experiments
- Graded lab reports and quizzes
- Was responsible for the safety of the students throughout the course

Spring 2014: CHM 2045 (General Chemistry I)

- Taught discussion sections (approximately 75 students total) and proctored exams
- Was responsible for discussion content and format
- Held regular weekly office hours

University of Florida Undergraduate Research Mentor

2011-2014

- Mentored three undergraduate students within the Wagener group
- Taught and supervised chemistry lab procedures and ensured the safety of the students
- Designed experiments and projects to further chemistry understanding and education

Other Activities

- Referee for *Journal of the American Chemical Society*, *Advanced Materials*, *Polymer Chemistry*, *ACS Macro Letters*, *Journal of Polymer Science Part A: Polymer Chemistry*, *Polymer*, *Macromolecules*
- Teaching and Mentoring: Hosted NSF-sponsored REU students in the summer (2018). Developed a proposal writing workshop for new graduate students to encourage higher quality fellowship applications. Lead a research group of 9 graduate students and 12 undergraduate students, most of whom are members of groups underrepresented in science.

- Outreach: Performed chemistry demonstrations at a local elementary school; took part in Virginia Tech Science Festival and other local science outreach efforts.
- Service: Session chair at ACS National Meetings (2018). Presented a technical training seminar at the United States Patent and Trademark Office (2018).