Karen Elizabeth Martin, PhD

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HIGHLIGHTS

I am a biomedical engineer with extensive training in **biomaterials**, **immunoengineering**, **NK cell biology**, and **genetic engineering**. My research goal is to establish NK cells as a frontline cellular immunotherapy for solid tumors by utilizing engineering tools such as cell surface engineering, micro- and nanoparticle fabrication, receptor engineering, and synthetic biology to overcome current therapeutic-limiting manufacturing and biological challenges.

- **Scholarly Activity:** published 4 first author publications, including in *Biomaterials* (x2) and *Nature Reviews Immunology*; 11 additional co-authored publications, including in *Science Advances* (x2), *Nature Communications*, *Nature Materials*, and *Cell Stem Cell*
- **Funding:** received an NSF Graduate Research Fellowship and an internal collaborative seed grant (PRIMA Synergy Grant)
- **Teaching and Mentoring:** served as a teaching assistant for 4 courses at two different universities; mentored 3 undergraduate students (2 now in PhD programs and 1 in an MS program); current mentor to 1 PhD student
- **Leadership and Professional Service:** co-chair of the inaugural Immunoengineering Gordon Research Seminar; co-organizer of the Georgia Tech Immunoengineering Seminar Series; co-organizer of the Oslo University Hospital Department of Cancer Immunology Seminar Series

EDUCATION

Georgia Institute of Technology, Atlanta, GA, USA 2016 – 2022
Ph.D. Bioengineering
*Thesis: "*Hydrogel-delivered mesenchymal stem cells modulate the local immune environment and direct tissue repair"
Advisor: Andrés J. García, PhD

Cornell University, Ithaca, NY, USA 2011 – 2016
B.S. Mechanical Engineering
Minor in Biomedical Engineering

EMPLOYMENT/RESEARCH EXPERIENCE

Postdoctoral Fellow November 2022 – present
Oslo University Hospital, Oslo, Norway
Department of Cancer Immunology
Advisor: Karl-Johan Malmberg, MD, PhD

Graduate Research Assistant, NSF Graduate Research Fellow August 2016 – October 2022
Georgia Institute of Technology, Atlanta, GA, USA
Bioengineering Program, Woodruff School of Mechanical Engineering
Advisor: Andrés García, PhD

Undergraduate Research Assistant 2013 – 2015
Cornell University, Ithaca, NY, USA
Meinig School of Biomedical Engineering
Advisor: Cynthia Reinhart-King, PhD

Summer Undergraduate Research Fellow 2015
University of Rochester School of Medicine, Rochester, NY, USA
Department of Microbiology and Immunology
Advisor: James Miller, PhD

PUBLICATIONS

1. Q. Hammer**, K. Perica**, R. Mbofung, H. van Ooijen, **K.E. Martin**, P. Momayyezi, E. Varady, Y. Pan, M. Jelcic, B. Groff, R. Abujarour, S. Krokeide, T. Lee, A. Williams, J.P. Goodridge, B. Valamehr, B. Önfelt, M. Sadelain, and K.-J. Malmberg. Genetic ablation of adhesion ligands mitigates rejection of allogeneic cellular immunotherapies. *Cell Stem Cell*, 31(9):1376-1386.e8 (2024). **These authors contributed equally.
2. **K.E. Martin****, Q. Hammer**, K. Perica**, M. Sadelain, and K.-J. Malmberg. Engineering immune-evasive allogeneic cellular immunotherapies. *Nature Reviews Immunology,* 24(9): 680-693 (2024). (*Review article*) **These authors contributed equally.
3. M.M. Coronel, S.W. Linderman, **K.E. Martin**, M.D. Hunckler, J.D. Medina, G. Barber, K. Riley, E.S. Yolcu, H. Shirwan, A.J. García. Delayed graft rejection in autoimmune islet transplantation via biomaterial immunotherapy. *American Journal of Transplantation*, 23(11): 1709-1722 (2023).
4. **K.E. Martin**, M.D. Hunckler, E. Chee, J.D. Caplin, G.F. Barber, P.P. Kalelkar, R.S. Schneider, and A.J. García. Hydrolytic hydrogels tune mesenchymal stem cell persistence and immunomodulation for enhanced diabetic cutaneous wound healing. *Biomaterials*, 301: 122256 (2023).
5. S.B. Shah, C.R. Carlson, K. Lai, Z. Zhong, G. Marsico, K.M. Lee, N.E. Félix Vélez, E.B. Abeles, M. Allam, T. Hu, L.D. Walter, **K.E. Martin**, K. Gandhi, S.D. Butler, R. Puri, A.L. McCleary-Wheeler, W. Tam, O. Elemento, K. Takata, C. Steidl, D.W. Scott, L. Fontan, H. Ueno, B.D. Cosgrove, G. Inghirami, A.J. García, A.F. Coskun, J.L. Koff, A. Melnick, and A. Singh. Combinatorial treatment rescues tumor-microenvironment-mediated attenuation of MALT1 inhibitors in B-cell lymphomas. *Nature Materials*, 22(4):511-523 (2023).
6. **K.E. Martin**, P.P. Kalelkar, M.M. Coronel, H.S. Theriault, R.S. Schneider, and A.J. García. Host type 2 immune response to xenogeneic serum components impairs biomaterial-directed osteo-regenerative therapies. *Biomaterials*, 286: 121601 (2022).
7. M.M. Coronel, **K.E. Martin**, M.D. Hunckler, P.P. Kalelkar, R.M. Shah, and A.J. García. Hydrolytically degradable microgels with tunable mechanical properties modulate the host immune response. *Small*, 18(36): 2106896 (2022).
8. R.S. Schneider, A.C. Vela, E.K. Williams, **K.E. Martin**, W.A. Lam, and A.J. García. High-throughput on-chip human mesenchymal stromal cell potency prediction. *Advanced Healthcare Materials*, 11(2): 2101995 (2022).
9. **K.E. Martin** and A.J. García. Macrophage phenotypes in tissue repair and the foreign body response: implications for biomaterial-based regenerative medicine strategies. *Acta Biomaterialia*, 133, 4-16 (2021). (*Review article*)
10. M.M. Coronel, **K.E. Martin**, M.D. Hunckler, G. Barber, E.B. O'Neill, J.D. Medina, E. Opri, C.A. McClain, L. Batra, J.D. Weaver, H.S. Lim, E.A. Botchwey, E.S. Yolcu, H. Shirwan, and A.J. García. Immunotherapy via PD-L1-presenting biomaterials leads to long-term islet graft survival. *Science Advances*, 6(35): eaba5573 (2020).
11. A.Y. Clark, **K.E. Martin**, J.R. García, C.T. Johnson, H.S. Theriault, W.M. Han, D.W. Zhou, E.A. Botchwey, and A.J. García. Integrin-specific hydrogels modulate human mesenchymal stem cell survival, engraftment, and reparative activities. *Nature Communications*, 11(1): 114 (2020).
12. C.T. Johnson, M.C.P. Sok, **K.E. Martin**, P.P. Kalelkar, J.D. Caplin, E.A. Botchwey, and A.J. García. Lysostaphin and BMP-2 co-delivery reduces S. aureus infection and regenerates critical-sized segmental bone defects. *Science Advances*, 5(5): eaaw1228 (2019).

13. C.T. Johnson, J.A. Wroe, R. Agarwal, **K.E. Martin**, R.E. Guldberg, R.M. Donlan, L.F. Westblade, and A.J. García. Hydrogel delivery of lysostaphin eliminates orthopedic implant infection by Staphylococcus aureus and supports fracture healing. *PNAS*, 115(22): E4960-E4969 (2018).
14. S.P. Carey, **K.E. Martin**, and C.A. Reinhart-King. Three-dimensional collagen matrix induces a mechanosensitive invasive epithelial phenotype. *Scientific Reports* **7**: 42088 (2017).
15. S.P. Carey, Z.E. Goldblatt, **K.E. Martin**, B. Romero, R.M. Williams, and C.A. Reinhart-King. Local extracellular matrix alignment directs cellular protrusion dynamics and migration through Rac1 and FAK. *Integrative Biology*, 8(8): 821-835 (2016).

GRANTSMANSHIP

Synergy Grant, Precision Immunotherapy Alliance (PI: Martin) 2024 – 2025
"Development of *in vitro* and *in vivo* models of T cell-mediated allorejection"
Awarded, 200 000 NOK ($18,600) over 1 year

Graduate Research Fellowship, National Science Foundation (PI: Martin) 2018 – 2022
"Biomaterial-directed mesenchymal stem cell immunomodulation and bone regeneration in immunocompetent mouse models"
Awarded, $96,000 over 3 years

AWARDS AND HONORS

Postdoctoral Fellowship Seal of Excellence, Marie Sklodowska-Curie Actions	2024
Student Travel Achievement Recognition (STAR Award), Society for Biomaterials	2022
NextProf Nexus, University of Michigan	2021
Summer Scholars Program, University of Rochester School of Medicine and Dentistry	2015
Engineering Learning Initiatives Undergraduate Research Grant, Cornell University	2014

PATENTS AND PATENT APPLICATIONS

1. "Hydrogels Having Controlled Hydrolytic Degradation," Application No. PCT/US2023/070488, filed July 19, 2023. Inventors: A.J. García, M. Hunckler, K. Martin
2. "Cell Potency Assays, Platforms, and Methods of Use," Provisional Patent No. 63/182,075, filed April 30, 2021. Inventors: R.S. Schneider, A.J. García, W.A. Lam, E.K. Williams, K.E. Martin

SELECTED PRESENTATIONS

Conference Oral Presentations:

1. **K.E. Martin**, P.P. Kalelkar, H.S. Theriault, M.M. Coronel, R.S. Schneider, and A.J. García. Host type-2 immune response to xenogeneic serum proteins impairs biomaterial-directed mesenchymal stem cell therapy. Society for Biomaterials Annual Meeting, Baltimore, MD, USA, April 2022
2. **K.E. Martin**, P.P. Kalelkar, H.S. Theriault, M.M. Coronel, R.S. Schneider, and A.J. García. Host type-2 immune response to xenogeneic serum proteins impairs biomaterial-directed mesenchymal stem cell therapy. Georgia Tech Immunoengineering Trainee Seminar, Atlanta, GA, USA, December 2021
3. **K.E. Martin**, R.S. Schneider, A.J García. Mesenchymal stem cell modulation of the synthetic biomaterial immune microenvironment. Tissue Engineering and Regenerative Medicine International Society World Congress, virtual, November 2021
4. **K.E. Martin**, R.S. Schneider, A.J García. Mesenchymal stem cell modulation of the synthetic biomaterial immune microenvironment. Society for Biomaterials Annual Meeting, virtual, April 2021

5. **K.E. Martin**, A.Y. Clark, J.R. García, C.T. Johnson, H.S. Theriault, W.M. Han, D.W. Zhou, E.A. Botchwey, and A.J. García. Integrin-specific hydrogels direct mesenchymal stem cell immunomodulation and bone regeneration. Materials Research Society Fall Meeting, Boston, MA, USA, December 2019
6. **K.E. Martin**, A.Y. Clark, J.R. García, C.T. Johnson, H.S. Theriault, W.M. Han, D.W. Zhou, E.A. Botchwey, and A.J. García. Integrin-specific hydrogels direct mesenchymal stem cell immunomodulation and bone regeneration. Georgia Tech Immunoengineering Trainee Seminar, Atlanta, GA, USA, November 2019

Invited Talks:

1. "Engineering allorejection-resistant cell therapy products." Oslo University Hospital, Comprehensive Cancer Center Seminar, Oslo, Norway, October 2024

Poster Presentations:

1. **K.E. Martin**, L. Torralba-Raga, K. Melchers, S. Zandstra Krokeide, M. Thune Wiiger, E. Sohlberg, and K.-J. Malmberg. Generation of immune-evasive allogeneic adaptive NK cell therapies. Society for Immunotherapy of Cancer, Houston, TX, USA, November 2024
2. **K.E. Martin**, L. Torralba-Raga, K. Melchers, S. Zandstra Krokeide, M. Thune Wiiger, E. Sohlberg, and K.-J. Malmberg. Generation of immune-evasive allogeneic adaptive NK cell therapies. Norwegian Cancer Symposium, Oslo, Norway, September 2024
3. Q. Hammer, K. Perica, **K.E. Martin***, R. Mbofung, P. Momayyezi, S. Krokeide, L. Kveberg, J.P. Goodridge, B. Valamehr, M. Sadelain, and K.-J. Malmberg. Engineered immune stealth to mitigate rejection of allogeneic NK cell therapies. Immunoengineering Gordon Research Conference, Barga, Italy, February 2024 (*presenting author)
4. **K.E. Martin**, P.P. Kalelkar, M.M. Coronel, H.S. Theriault, R.S. Schneider, and A.J. García. Host type-2 immune response to xenogeneic serum proteins impairs biomaterial-directed regenerative therapies. Immunoengineering Gordon Research Conference, Ventura, CA, USA, July 2022
5. **K.E. Martin**, A.Y. Clark, J.R. García, C.T. Johnson, H.S. Theriault, W.M. Han, D.W. Zhou, E.A. Botchwey, and A.J. García. Integrin-specific hydrogels direct mesenchymal stem cell immunomodulation and bone regeneration. Biomaterials and Tissue Engineering Gordon Research Conference, Castelldefels, Spain, July 2019
6. **K.E. Martin**, A.Y. Clark, J.R. García, C.T. Johnson, H.S. Theriault, W.M. Han, D.W. Zhou, E.A. Botchwey, and A.J. García. Integrin-specific hydrogels direct mesenchymal stem cell immunomodulation and bone regeneration. Regenerative Medicine Workshop, Charleston, SC, USA, March 2019
7. **K.E. Martin,** S. Leddon, and J. Miller, Exploring the structure-function relationship of CD28 homodimer interactions. University of Rochester Medical School Summer Scholars Symposium, Rochester, NY, USA, July 2015
8. **K.E. Martin,** S.P. Carey, and C.A. Reinhart-King, ECM stiffening drives EMT-like changes in 3D epithelial cell morphogenesis. Biomedical Engineering Society Annual Meeting, San Antonio, TX, USA, October 2014
9. **K.E. Martin,** S.P. Carey, and C.A. Reinhart-King Characterizing the role of Rac1 in 3D cancer cell spreading and migration. Cornell Undergraduate Research Board Spring Forum, Ithaca, NY, USA, April 2014

TEACHING EXPERIENCE

Statics (COE 2001), Graduate Teaching Practicum — Fall 2019
Georgia Institute of Technology, Woodruff School of Mechanical Engineering

System Dynamics (MAE 3260), Undergraduate Teaching Assistant — Spring 2016
Cornell University, Sibley School of Mechanical and Aerospace Engineering

Mechatronics (MAE 3780), Undergraduate Teaching Assistant — Spring 2015
Cornell University, Sibley School of Mechanical and Aerospace Engineering

Intro to Computer Programming in MATLAB (BEE1510), Undergraduate Teaching Assistant — Fall 2012
Cornell University, Department of Biological and Environmental Engineering

MENTORING EXPERIENCE

Hannah Cuthbertson Husbyn, PhD student in Immunology, University of Oslo — 2024 – present

Samuel Robertson, BS student in Mechanical Engineering, Purdue University — 2021
Summer Undergraduate Research in Engineering program
Current position: MS student at Georgia Institute of Technology

Hannah Theriault, BS student in Biomedical Engineering, Georgia Institute of Technology — 2018 – 2021
Senior thesis: "Examination of the interactions between hMSC-laden integrin-specific hydrogel therapies and the fracture microenvironment"
Current position: PhD student at the University of Illinois Urbana-Champaign

Ian Smith, BS student in Biomedical Engineering, Georgia Institute of Technology — 2018 – 2020
Current position: PhD student at the University of Maryland, College Park

PROFESSIONAL SERVICE

Precision Immunotherapy Alliance Annual Workshop, Social Program Committee Member — 2024

Oslo University Hospital Department of Cancer Immunology Seminar Series, Co-organizer — 2024 – present

Oslo University Hospital Postdoc Forum, Science Day Committee Member — 2023 – 2024

Gordon Research Seminar on Immunoengineering, Co-chair — 2022 – 2024

Georgia Tech Immunoengineering Trainee Seminar Series, Co-organizer — 2021 – 2022

Georgia Tech Bioengineering Graduate Association, Recruitment Chair — 2016 – 2018

REVIEWING ACTIVITIES

Peer-reviewed Journals:
Journal of Biomaterials Research: Part A
Scandinavian Journal of Immunology
Science Advances

Conference Abstracts:
Gordon Research Seminar: Immunoengineering

Fellowships/Awards:
President's Undergraduate Research Awards, Georgia Institute of Technology

PROFESSIONAL DEVELOPMENT

Research Supervision, The Postdoctoral Programme, University of Oslo, Oslo, Norway — 2024

Writing Grant Applications, The Postdoctoral Programme, University of Oslo, Oslo, Norway — 2024

NextProf Nexus, University of Michigan, Ann Arbor, MI, USA — 2021

PROFESSIONAL MEMBERSHIPS

Society for Immunotherapy of Cancer (SITC)	2023-present
Norwegian Society for Immunology (NSI)	2022-present
Society for Biomaterials (SFB)	2020-2022