

Dr. Aleeza Farrukh

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Research Interests

Exploring organic and polymer chemistry tools for the fabrication of functional materials. Soft and dynamic biomaterials, Structural surface and interfaces, Bioelectronics, Nanotechnology and Neurobiology.

Work Experience

- 02/2019-Present **Postdoctoral Researcher**
University of California, Irvine (UCI), United States of America.
Mentor: Alon A. Gorodetsky.
- 12/2017-12/2018 **Postdoctoral Researcher**
Leibniz-Institute for New Materials (INM), Saarbrücken, Germany.
Mentor: Aránzazu del Campo.
- 10/2011-10/2013 **Lab Instructor**
Lahore University of Management Sciences (LUMS), Lahore, Pakistan.
Mentor: Basit Yameen.
- 03/2010-03/2011 **Lecturer**
Government Kulliat-ul-Banat Degree College, Lahore, Pakistan.
Subject: Chemistry.

Education

- 10/2013-11/2017 **Ph.D. Polymer and Material Chemistry** (*Doctor rer. nat.*)
Max Planck Graduate Center (MPGC-JGU), Mainz, Germany
Research Institute: Max Planck Institute for Polymer Research, Mainz, Germany.
Advisor: Aránzazu del Campo
Thesis Title: "Photo-Triggerable Laminin Mimetic Peptides for Directional Neural Regeneration" (*summa cum laude*)
- 10/2009-07/2011 **M.Phil in Organic Chemistry**
University of the Punjab, Lahore, Pakistan
Advisor: Ejaz Ahmed
Thesis Title: "Isolation and Structure Elucidation of Antimicrobial Phytochemicals of *Aerva javanica*" (CGPA = 3.86/4.00)
- 10/2007-08/2009 **M.Sc. in Chemistry (Organic Chemistry Major)**
University of the Punjab, Lahore, Pakistan
Advisor: Ejaz Ahmed
Thesis Title: "Synthesis of Aromatic Triacids and Triols from Myristeloic and Oleic Acids and Synthesis of Hydroxyl Coumarin and its Derivatives" (CGPA=3.81/4.00)

Awards

Funding Awards

- 2018 Leibniz Research Association Award to Attend Nobel Laureate Meeting, Lindau, Germany (€ 5000).
- 2014-2017 Max Planck Graduate Center (MPGC-JOGU) Fellowship, Mainz, Germany (€ 16000/year).
- 2007-2009 Merit Scholarship in M.Phil. and M.Sc. from Institute of Chemistry, University of the Punjab, Lahore, Pakistan (PKR 24000/year covering full tuition fee and travel expenses).

Academic Awards

- 2018 Leibniz Research Association Outstanding Thesis Prize in the category of Natural Sciences and Engineering, Berlin, Germany (€ 3000).
- 2017 2nd Prize Evonik Call for Research Proposals, Evonik Industries, Germany (€ 5000).
- 2015 Poster Prize in Biomaterials & Tissue Engineering, Gordon Research Conference, Girona, Spain.
- 2005 Fatima Jinnah Gold Medal, Government Kulliat-ul-Banat Degree College, Pakistan.

2005 1st Prize in Inter-Colleges Science Quiz, Lahore, Pakistan.

Teaching Experience

- 04-08/2015 Laboratory Demonstrator for Organic Chemistry Practical Course, JGU, Germany. I was responsible for giving instructions for the experiments and supervising 3rd year undergraduate students (16 hours/week).
- 10/2011-11/2013 Teaching Assistant for Advance Organic Chemistry Practical Course, LUMS, Pakistan. I was responsible for designing of experiments, preparation of laboratory manual, conducting and grading experiments for 4th year undergraduate students (12 hours/week)
- 03/2010-03/2011 Lecture, Government Kulliat-ul-Banat Degree College, Lahore, Pakistan. I prepared and gave (10 hours/week) lectures for inorganic, organic and physical chemistry courses as well as conducted chemistry practical course (8 hours/week) for higher secondary school students.

Mentoring Experience

- 6/2016–9/2018 INM/University of Saarland Ph.D. student, Germany. Project: Spatiotemporally controlled mechanotransduction properties of cells using cadherin mimics on bifunctional micropatterned biomaterial platforms.
- 10/2016–4/2018 INM/University of Saarland Ph.D. student, Germany. Project: Synthesis of two-photon photoremovable groups and fabrication of photodegradable hydrogels for cell encapsulation.
- 1/2016–3/2017 INM/University of Saarland Ph.D. student, Germany. Project: Micropatterned soft hydrogels to study the interaction of ligands in T cell activation.
- 3/2018–10/2018 INM/University of Saarland MSc. student, Germany. Project: The influence of hydrogel stiffness on mono- and co-cultures of primary cells.
- 4/2016–9/2016 INM/University of Saarland MSc. student, Germany. Project: Fabrication of micro-patterned ligands on polyacrylamide-co-hydroxy-acrylamide hydrogel for cell culture.
- 1/2013–10/2013 LUMS/Visiting PhD student from LCWU, Pakistan. Project: Branched polyamine functionalized mesoporous silica for water remediation.
- 10/2012–10/2013 LUMS/Visiting MSc. student from UET, Pakistan. Project: Synthesis and functionalization of graphene oxide and its nano-composites for fuel cell applications.
- 10/2012–10/2013 LUMS/Visiting MSc. student from UET, Pakistan. Project: Polyelectrolyte polymer brushes functionalized silica gel for water remediation applications.
- 10/2012–8/2013 LUMS/Visiting MSc. student from UET, Pakistan. Project: Development of protogenic groups containing polymer brush modified additives to improve the proton conductivity of polyelectrolyte membranes for fuel cell applications.
- 8/2012–7/2013 LUMS/Visiting MSc. student from UET, Pakistan. Project: Design and application of silica gel functionalized adsorbents for efficient remediation of cationic dyes.
- 5/2012–3/2013 LUMS/Visiting MSc. student from LCWU, Pakistan. Project: Enzyme-immobilized magnetic nanoparticles for nematocidal activity.
- 10/2011–6/2012 LUMS/Visiting MSc. student from Kinnard, Pakistan. Project: Polymer brush functionalized magnetic nanoparticles for efficient remediation of heavy metals from water samples.
- 10/2012–10/2013 LUMS/Undergraduate student, Pakistan.

	Project: Controlling surface properties of poly ether-ether ketone (PEEK) using UV assisted self-grafting polymerization.
10/2011–6/2012	LUMS/Undergraduate Student, Pakistan. Project: Polymer grafted magnetic nanoparticles for removal of microbes.
10/2011–6/2012	LUMS/Undergraduate Student, Pakistan. Project: Development of enzyme functionalized nanoparticles and their application as catalyst for synthetic organic chemistry reactions.

Professional Training

02/2018	3D Cell Culture Techniques at Leibniz Institute for Interactive Materials, Aachen Germany.
09/2017, 01/2018	Traction force microscopy at Institute for Bioengineering of Catalonia Barcelona, Spain (Part of Research Exchange for Mechano-Control, EU Horizon 2020 Project).
03/2017	Biomaterials-Based Approaches to Personalized Medicine at Leibniz Health Tech Symposium, Berlin, Germany.
09/2015	Public Speaking for Women Scientists at Sci Mento-Hessenweit, Goethe-Universität Frankfurt, Germany.
04-05/2015	Modern Techniques in Neuroscience at Max Plank Institute for Polymer Research, Frankfurt, Germany.
07/2014	Basic Cell Culture Course at Promocell Academy, Heidelberg, Germany.

Professional Memberships

- Materials Research Society (MRS)
- American Chemical Society (ACS)

Research Proposal Writing and Reporting Experience

- Contributed in writing funding application within the Biomolecular Electronics group, UCI, (PI: Prof. Alon A. Gorodetsky) for National Institutes of Health (NIH), (Submitted in August 2020, waiting for the decision).
- Contributed in writing funding applications within the Biomolecular Electronics group, UCI, (PI: Prof. Alon A. Gorodetsky) for Air Force Office of Scientific Research (AFOSR), (\$800,000), (2021-2024).
- Contributed in research work leading to grant extension as well as preparation of monthly and quarterly reports within Biomolecular Electronics group, UCI, (PI: Prof. Alon A. Gorodetsky) for Defense Advanced Research Projects Agency (DARPA), (\$ 950,000), (2017-2020).
- Contributed in writing funding application, annual reporting, research work and publication within the Dynamic Biomaterials group, INM, (PI: Prof. Aránzazu del Campo) for EU Horizon, 2020 Project (€ 7 134 928,75), (2017-2021).
- Contributed in research work, preparation of annual reports and publication within Advanced Interdisciplinary Macromolecular group, LUMS, (PI: Prof. Basit Yameen) for Higher Education Commission (HEC), (PKR 600,0000), (2011-2013).
- Contributed in research work, preparation of annual reports and publication within Advanced Interdisciplinary Macromolecular, LUMS, (PI: Prof. Basit Yameen) for Higher Education Commission (HEC), (PKR 599,5190), (2011-2013).

Skills

- Experienced in organic synthesis, polymer synthesis and solid phase peptide synthesis.
- Extensive experience in purification (HPLC) and characterization of organic compounds (1D and 2D ¹H and ¹³C-NMR, UV-Vis, FTIR, ESI-MS) and polymers (GPC, DLS, rheology).
- Highly skilled in chemical modification of surfaces and nanoparticles by SI-ATRP, FRP, SAMs.
- Extensive knowledge in surface characterization techniques: WCA, ATR-IR, XPS, QCM-D.
- Expertise in designing, functionalization and characterization of hydrogels (SEM, DMA, FCS) and their application as 2D and 3D biomaterial platforms.
- Worked with primary and cell line cultures in 2D and 3D and experienced in fixation, mounting, staining and quantification software (Fiji, Image J, Zen and Origin).

- Experienced in epifluorescence, confocal, 2P- microscopy and live cell imaging.
- Experienced in fabrication and electrical characterization of bioelectronic devices (EIS).

List of Publications

- Nair, R. V., **Farrukh, A.**; del Campo, A.; Light-regulated angiogenesis via a phototriggerable VEGF peptidomimetic (under revision).
- Zhang, J.; Zhao, R.; Li, B.; **Farrukh, A.**; Hoth, M.; Qu, B.; del Campo, A.; Micropatterned soft hydrogels to study the interplay of ligands and forces in T cell activation, *Acta Biomaterialia*, DOI: 10.1016/j.actbio.2020.10.028, (2020).
- Paez, J. I.; A.; **Farrukh, A.**; Mendoza, R. V.; Biegun, M.K.W.; del Campo, A.; Thiol methylsulfone based hydrogels for 3D cell encapsulation, *ACS Applied Materials Interface*, 12, 8062–8072 (2020).
- Farrukh, A.**; Paez, J. I.; del Campo, A.; 4D biomaterials for light-guided angiogenesis, *Advanced Functional Materials*, 29, 180773 (2019).
- Farrukh, A.**; Zhao, S.; Paez, J. I.; Kavyanifar, A.; Salierno, M.; Cavalie, A.; del Campo, A.; In-situ, light-guided axon growth on biomaterials via photoactivatable laminin peptidomimetic IK (HANBP) VAV, *ACS Applied Materials Interface*, 10, 41129–41137 (2018).
- Farrukh, A.**; Zhao, S.; del Campo, A.; Microenvironments designed to support growth and function of neuronal cells, *Frontiers in Biomaterials*, 5, 62, (2018).
- Zheng, Y.; **Farrukh, A.**; del Campo, A.; Optoregulated biointerfaces to trigger cellular responses, *Langmuir*, 34, 14459-14471 (2018).
- Farrukh, A.**; Fan, W.; Zhao, S.; Salierno, M.; Paez, J. I.; del Campo, A.; Photoactivatable adhesive ligands for light-guided neuronal growth, *ChembioChem*, 19, 1271 – 1279 (2018). (Optogenetics special edition cover page).
- Nair, R. V., **Farrukh, A.**; del Campo, A.; A photoactivatable $\alpha 5\beta 1$ -specific integrin ligand, *ChembioChem*, 19, 1280 – 1287, (2018).
- Paez, J. I.; **Farrukh, A.**; Ustahüseyin, O.; del Campo, A.; Biofunctionalization of poly(acrylamide) gels. Chapter 8. Biomaterials for Tissue Engineering: Methods and Protocols. Methods in Molecular Biology, Kanika Chawla (ed.), *Springer Nature*, 1758, 101-114 (2018).
- Farrukh, A.**; Paez, J. I.; Salierno, M.; Fan, W.; Berninger, B.; del Campo, A.; Bifunctional poly(acrylamide) hydrogels through orthogonal coupling chemistries, *Biomacromolecules*, 18, 906–913 (2017).
- Farrukh, A.**; Felipe Ortega, Fan, W.; Marichal, N.; Paez, J. I.; Berninger, B.; del Campo, A.; Salierno, M.; Bifunctional hydrogels containing the laminin-motif IKVAV promote neurogenesis, *Stem Cell Reports*, 9, 1432-1440 (2017).
- Farrukh, A.**; Paez, J. I.; Salierno, M.; del Campo, A.; Bioconjugating Thiols to Poly (acrylamide) Gels for Cell Culture Using Methylsulfonyl Co-monomers, *Angewandte Chemie International Edition*, 55, 2092 –2096 (2016).
- Farrukh, A.**; Ashraf, F.; Kaltbeitzel, A.; Ling, X.; Wagner, M.; Duran, H.; Ghaffar, A.; Rehman, H. ur.; Parekh, S. H.; Domke, K. F.; Yameen, B.; Polymer brush functionalized SiO₂ nanoparticle based Nafion nanocomposites: a novel avenue to low-humidity proton conducting membranes, *Polymer Chemistry*, 6, 5782-5789 (2015).
- Butt, A.; **Farrukh, A.**; Ghaffar, A.; Duran, H.; Oluz, Z.; Rehman, H. ur.; Hussain, T.; Ahmad, R.; Tahir, A.; Yameen, B.; Design of enzyme-immobilized polymer brush-grafted magnetic nanoparticles for efficient nematocidal activity, *RSC Advance*, 5, 77682-77688 (2015).
- Nayab, S.; **Farrukh, A.**; Oluz, Z.; Tuncel, E.; Tariq, S. R.; Rehman, H. ur.; Kirchoff, K.; Duran, H.; Yameen, B.; Design and Fabrication of Branched Polyamine Functionalized Mesoporous Silica: An Efficient Absorbent for Water Remediation, *ACS applied materials & interfaces*, 6, 4408–4417 (2014).
- Yousaf, A.; **Farrukh, A.**; Oluz, Z.; Tuncel, E.; Duran, H.; Dogan, S. Y.; Rehman, H. ur.; Yameen, B.; UV-light assisted single step route to functional PEEK surfaces, *Reactive & Functional Polymers*, 83, 70–75 (2014).
- Farrukh, A.**; Akram, A.; Ghaffar, A.; Eylül Tuncel, Zehra Oluz, Duran, H.; Rehman, H. ur.; T.; Yameen, B.; Surface-functionalized silica gel adsorbents for efficient remediation of cationic dyes, *Pure and Applied Chemistry*, 86, 1177–1188, (2014).
- Farrukh, A.**; Akram, A.; Hanif, S.; Hamid, A.; Ghaffar, A.; Duran, H.; Yameen, B.; Design of Polymer Brush Grafted Magnetic Nanoparticles for Highly Efficient Water Remediation, *ACS applied materials & interfaces*, 5, 3784-93 (2013).

19. Yameen, B.; **Farrukh, A.**; Polymer Brushes: Promises and Challenges, *Chemistry: An Asian Journal* 8, 1736-53 (2013).
20. Ahmed, E.; Sharif, A.; Chohan, S.; Khan, M.-ul-A.; Munawar, M. A.; **Farrukh, A.**; Begum, R.; Afza, N.; Ashraf, M., Arshad, S.; A Convenient Synthesis of Bioactive 5-Arylidenebarbiturates *Journal of the Chemical Society of Pakistan*, 34, 1305-11 (2012).
21. Sharif, A.; Ahmed, E.; Malik, A.; Hassan, M.-ul-.; Munawar, M. A.; **Farrukh, A.**; Nagra, S.A.; Anwar, J.; Ashraf, M.; Mahmood, Z.; Antimicrobial constituents from *Aerva javanica*, *Journal of the Chemical Society of Pakistan*, 33, 439 (2011).
22. Sharif, A.; Ahmed, E.; Munawar, M. A.; Jabeen, S.; Khan, M.-ul-A.; Begum, R.; **Farrukh, A.**; Ashraf, M.; Arshad, S.; Afza, N.; Facile Syntheses of Bioactive 5-Arylidene thiobarbituric Acids, *Journal of The Chemical Society of Pakistan*, 33(4), 578 (2011).

Manuscripts in Preparation

1. **Farrukh, A.**; Chatterjee, A.; Bogdanov, G.; Gorodetsky, A. A.; Bioelectronic Control Over Cellular Differentiation.
2. **Farrukh, A.**; Joseph, D.; Nair, R. V., del Campo, A.; A Biomaterials Platform to Decouple Cell-Matrix and Cell-Cell Interaction and Mechanics.

Patents

1. Paez, J.I; **Farrukh, A.**; del Campo, A. Neuartige Hydrogele, Application number DE102019117997.1, priority date 03.07.2019.
2. Backes, I.; Hegetschweiler, A.; González, L.G.; Kraus, T.; del Campo, A.; **Farrukh, A.**; Thai, T.; Druckbare elektrisch leitfähige Zinten mit biologischer Interaktion, Application number DE 102019135645.8, priority date 20.12.2019.

Selected Conferences

- Materials Research Society Conference, December **2020**, Boston, USA (Virtual). (**Oral Presentation**)
- WE-Heraeus-Seminar (622) on Neural Mechanics, August **2016**, Bad Honnef, Germany. (**Oral Presentation**)
- WE-Heraeus-Seminar (623) on Cellular Dynamics, September **2016**, Bad Honnef, Germany (**Poster**)
- Biomaterials & Tissue Engineering, Gordon Research Conference, July **2015**, Girona, Spain (**Oral and Poster Presentation**)
- European Polymer Congress, June **2015**, Dresden, Germany (**Oral Presentation**)
- 5th International Symposium: Interface Biology of Implants, May **2015**, Warnemünde, Germany (**Poster**)
- Symposium "Vorbild Natur" Gesellschaft Deutscher Naturforscher und Ärzte (GDNÄ), September **2014**, Mainz, Germany (**Poster**)