BIOGRAPHICAL SKETCH

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NAME: Park, JinSeok

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Assistant Professor of Pediatrics

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
Seoul National University, Seoul	BS	02/2008	Chemical and Biological Engineering
Johns Hopkins University, Baltimore, Maryland	PHD	05/2014	Biomedical Engineering
Yale University, New Haven, Connecticut	Postdoctoral Fellow	03/2020	Biomedical Engineering

A. Personal Statement

Cancer cells actively interact with extracellular matrix (ECM) in tumor microenvironment (TME) for tumor progression. A significant challenge to investigating the cancer cell-ECM interactions is the lack of simple yet precise in vitro platforms reproducing the pathophysiological cell behaviors closely associated with cancer clinical outcomes. I have introduced the promises of in vitro nanofabricated substrates as an engineering-oriented approach for understanding the regulation of cancer cell phenotypes, e.g., invasive cell migration by the mechano-chemically complicated ECM in TME. The substrates not only approximate the effect of structurally complicated ECM but also retain the simple usability of traditional in vitro platforms such as tissue culture plates. With this engineering-based technique, I have studied how TME with distinctively reorganized ECM determines cancer cell migration regulating the invasive phenotype and in turn, metastasis, through the prism of mechanobiology.

Specifically, I have designed nanofabricated substrates mimicking ECM in TME with the similar dimension of remodeled ECM fibers. With this *in vitro* substrate, I introduced a new directional cell migration, “topotaxis,” directed migration by topographical gradients of ECM guiding cancer cells to invade easily and thus, metastasize (Park *et al.*, ***Nat Mater***, 2016) and developed a mathematical model to describe this topotactic behavior predicting cancer cell invasion (Park *et al.*, ***PNAS***, 2017). Furthermore, I have investigated how aligned ECM in TME by cancer cell invasion contributes to metastasis (Park and Kim *et al*., ***Nat. Commun,*** 2018) even without chemical and genetic perturbation. Furthermore, I have developed phenotypic filtering based on cell migration reflecting metastasis potential. As applying the filtering to melanoma and glioblastoma, I have unveiled a correlation between their migration and their clinical outcomes. Also, I have identified genetic signatures regulating cancer cell migration and investigate how they regulate metastasis.

My lab aims to understand how cancer cells interpret TME and their interpretation modulates cell phenotypes associated with poor clinical outcomes. As leveraging innovative *in vitro* models replicating pathophysiological features of TME through the combination of engineering approaches such as nanofabrication, we will pursue the identification of critical signatures regulating the interaction of cancer cells with TME. We hypothesize that the identified signatures determine cancer-promoting phenotypes such as metastasis and pro-tumoral immune reactions. We will investigate how the signatures control cancer-related signaling at the molecular and cellular levels and explore their potentials in precision medicine as pharmaceutical targets or prognosis factors through implementing the novel engineering-oriented approaches. I believe my lab will develop unique insights, contribute extensively to cancer research and create synergistic collaborations with your current and future members of USC Norris Comprehensive Cancer Center.

1. Park J, Kim DH, Shah SR, Kim HN, Kshitiz, Kim P, Quiñones-Hinojosa A, Levchenko A. Switch-like enhancement of epithelial-mesenchymal transition by YAP through feedback regulation of WT1 and Rho-family GTPases. Nat Commun. 2019 Jun 26;10(1):2797. PubMed PMID: 31243273; PubMed Central PMCID: PMC6594963.
2. Park J, Holmes WR, Lee SH, Kim HN, Kim DH, Kwak MK, Wang CJ, Edelstein-Keshet L, Levchenko A. Mechanochemical feedback underlies coexistence of qualitatively distinct cell polarity patterns within diverse cell populations. Proc Natl Acad Sci U S A. 2017 Jul 11;114(28):E5750-E5759. PubMed PMID: 28655842; PubMed Central PMCID: PMC5514712.
3. Park J, Kim DH, Kim HN, Wang CJ, Kwak MK, Hur E, Suh KY, An SS, Levchenko A. Directed migration of cancer cells guided by the graded texture of the underlying matrix. Nat Mater. 2016 Jul;15(7):792-801. PubMed PMID: 26974411; PubMed Central PMCID: PMC5517090.
4. Park J, Kim HN, Kim DH, Levchenko A, Suh KY. Quantitative analysis of the combined effect of substrate rigidity and topographic guidance on cell morphology. IEEE Trans Nanobioscience. 2012 Mar;11(1):28-36. PubMed PMID: 21908261.

B. Positions and Honors

Positions and Employment

2008 - 2014	Research Assistant, Johns Hopkins University, Department of Biomedical Engineering, Baltimore, MD
2014 - 2020	Postdoctoral Fellow, Yale University, Department of Biomedical Engineering, New Haven, CT
2016 - 2017	Visiting Researcher, Yale University, Department of Neurosurgery, New Haven, CT
2020 -	Assistant Professor of Pediatrics, Children Hospital Los Angeles, Division of Hematology, Oncology and Blood & Marrow Transplantation, Los Angeles, CA

Other Experience and Professional Memberships

2015 - 2016	Member, American Academy of Neurology
2016 -	Member, American Association for Cancer Research
2016 -	Member, Biomedical Engineering Society

Honors

2001 - 2007	Merit-based full tuition support, Seoul National University
2006	Merit-based full tuition support, Kwanjeong Scholarship Foundation
2008 - 2013	Scholarship, Samsung Scholarship Foundation
2008	Summa Cum Laude (Top 2), School of Chemical and Biological Eng., SNU
2012	SBE 6th ICBN Poster Award, 2nd Place, Society for Biological Engineering
2018	Best Poster Award, Yale Systems Biology Research Symposium

C. Contribution to Science

1. Investigation of melanoma with nanofabricated substrata mimicking extracellular matrix of tumor microenvironment

    a. Kim DH, Ewald AJ, Park J, Kshitiz, Kwak M, Gray RS, Su CY, Seo J, An SS, Levchenko A. Biomechanical interplay between anisotropic re-organization of cells and the surrounding matrix underlies transition to invasive cancer spread. Sci Rep. 2018 Sep 21;8(1):14210. PubMed PMID: 30242256; PubMed Central PMCID: PMC6155084.

    b. Park J, Holmes WR, Lee SH, Kim HN, Kim DH, Kwak MK, Wang CJ, Edelstein-Keshet L, Levchenko A. Mechanochemical feedback underlies coexistence of qualitatively distinct cell polarity patterns within diverse cell populations. Proc Natl Acad Sci U S A. 2017 Jul 11;114(28):E5750-E5759. PubMed PMID: 28655842; PubMed Central PMCID: PMC5514712.

c. Park J, Kim DH, Kim HN, Wang CJ, Kwak MK, Hur E, Suh KY, An SS, Levchenko A. Directed migration of cancer cells guided by the graded texture of the underlying matrix. Nat Mater. 2016 Jul;15(7):792-801. PubMed PMID: 26974411; PubMed Central PMCID: PMC5517090.

d. Howard JD, Moriarty WF, Park J, Riedy K, Panova IP, Chung CH, Suh KY, Levchenko A, Alani RM. Notch signaling mediates melanoma-endothelial cell communication and melanoma cell migration. Pigment Cell Melanoma Res. 2013 Sep;26(5):697-707. PubMed PMID: 23773728.

2. Identification of signaling molecules promoting cancer invasion with in vitro ECM model

a. Park J, Kim DH, Shah SR, Kim HN, Kshitiz, Kim P, Quiñones-Hinojosa A, Levchenko A. Switch-like enhancement of epithelial-mesenchymal transition by YAP through feedback regulation of WT1 and Rho-family GTPases. Nat Commun. 2019 Jun 26;10(1):2797. PubMed PMID: 31243273; PubMed Central PMCID: PMC6594963.

b. Park J, Kim DH, Levchenko A. Topotaxis: A New Mechanism of Directed Cell Migration in Topographic ECM Gradients. Biophys J. 2018 Mar 27;114(6):1257-1263. PubMed PMID: 29590582; PubMed Central PMCID: PMC5883610.

c. Smith CL, Kilic O, Schiapparelli P, Guerrero-Cazares H, Kim DH, Sedora-Roman NI, Gupta S, O'Donnell T, Chaichana KL, Rodriguez FJ, Abbadi S, Park J, Quiñones-Hinojosa A, Levchenko A. Migration Phenotype of Brain-Cancer Cells Predicts Patient Outcomes. Cell Rep. 2016 Jun 21;15(12):2616-24. PubMed PMID: 27292647; PubMed Central PMCID: PMC5517094.

3. Development and application of in vitro disease models with nano-fabrication technique

a. Nishimura S, Mishra-Gorur K, Park J, Surovtseva YV, Sebti SM, Levchenko A, Louvi A, Gunel M. Combined HMG-COA reductase and prenylation inhibition in treatment of CCM. Proc Natl Acad Sci U S A. 2017 May 23;114(21):5503-5508. PubMed PMID: 28500274; PubMed Central PMCID: PMC5448170.

b. Molitoris JM, Paliwal S, Sekar RB, Blake R, Park J, Trayanova NA, Tung L, Levchenko A. Precisely parameterized experimental and computational models of tissue organization. Integr Biol (Camb). 2016 Feb;8(2):230-242. PubMed PMID: 26822672; PubMed Central PMCID: PMC4831076.

c. Kshitiz, Park J, Kim P, Helen W, Engler AJ, Levchenko A, Kim DH. Control of stem cell fate and function by engineering physical microenvironments. Integr Biol (Camb). 2012 Sep;4(9):1008-18. PubMed PMID: 23077731; PubMed Central PMCID: PMC3476065.

d. Park J, Kim HN, Kim DH, Levchenko A, Suh KY. Quantitative analysis of the combined effect of substrate rigidity and topographic guidance on cell morphology. IEEE Trans Nanobioscience. 2012 Mar;11(1):28-36. PubMed PMID: 21908261.

D. Additional Information: Research Support and/or Scholastic Performance

Completed Research Support

U54CA209992, NCI
Levchenko (PI)
08/01/16-03/31/20
Systems analysis of phenotypic switch in control of cancer invasion
Role: Post-Doctoral Scholar

U01CA155758-05, NCI
Levchenko (PI)
09/01/11-08/31/17
Analysis of the signaling and mechanical cues promoting invasion in melanoma
Role: Post-Doctoral Scholar