A. Basic Information

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B. Education

- B.S., Chemistry; Peking University, Beijing, China; 1999
- M.Phil., Polymer Science; Hong Kong University of Science & Technology, Hong Kong; 2002
- M.S., Molecular and Medical Pharmacology; UCLA; 2006
- Ph.D., Chemical and Biomolecular Engineering; UCLA; 2010; Advisor: Tatiana Segura
- Postdoc, Regenerative Medicine; UC Berkeley; 2010-2014; Advisor: David Schaffer

C. Employment History

- Shanghai Genius Advanced Materials Co., China; R&D Engineer; 09/2002 – 08/2003
- Hong Kong University of Science and Technology; Research Assistant; 12/2003 – 06/2004
- University of Nebraska-Lincoln (UNL), Department of Chemical & Biomolecular Engineering; Assistant Professor; 09/2014 – present
- University of Nebraska-Medical Center (UNMC), Regenerative Medicine Program; member; 09/2015 – present
- University of Nebraska-Medical Center, Buffet Cancer Center; member; 09/2016 – present
- CellGro Technologies, LLC; Co-Founder; 2017-present

D. Awards

- NUTech Ventures Emerging Innovator of the Year award, UNL, 2017
- Layman Award, UNL, 2017
- College of Engineering Junior Faculty Leadership Development Award, UNL, 2014-2017

E. Research Experience

Research Interests:

- Large-scale cell manufacturing
- Cell therapies for cancers, chronic wounds, type 2 diabetes and aging-related diseases
- Biomaterials
- Cell culture meat

Active Research Projects:

1) Large-scale cell biomanufacturing; 2014–present; UNL; my role: PI

   The goals are to i) systematically understand how the cell culture microenvironment factors, individually and combined, influence the cell culture outcome (e.g. cell viability, growth rate, and yield) and product properties (e.g. genetics, epigenetics, metabolomics, transcriptome,

secretome, and in vivo homing, survival, integration, safety and potency); and ii) apply the gained knowledge to develop transformative cell culture technologies that enable robust manufacturing of high quality and high quantity therapeutic cells at various scales and affordable cost. To date, very few research groups are working on this important area. We have done breakthrough work on this project. Please see my research statement for details.

2) Molecular tools for cell & tissue manufacturing; 2016 – present; UNL; my role: PI

   The goal is to develop a class of biocompatible molecules for precisely controlling cellular aggregation and assembling during cell manufacturing and tissue assembling.

3) Super mesenchymal stem cells (MSCs) as anti-aging therapeutics; 2018 – present; UNL; Role: PI

   We have developed technology to culture MSCs with significantly higher potency than MSCs made with current ways. We are developing these super-MSCs as anti-aging, anti-inflammation, and immuno-suppressing therapeutics.

4) Super-T cells for cancer immunotherapies; 2018 – present; UNL; Role: PI

   The goal is to develop technology to culture T cells, CAR-T cells, tumor-infiltrating lymphocytes (TILs), NK, CAR-NK cells so they have long persistence and potency for treating cancers to reduce the recurrence.

5) Brown adipose tissue (BAT) for treating type 2 diabetes; 2016 – present; UNL; Role: PI

   The goal is to develop transplantable induced pluripotent stem cells (iPSCs) derived BATs for treating type 2 diabetes.

6) Combinational biotherapeutics for chronic wounds; 2017 – present; UNL; Role: Co-PI

   The goal is to develop a high-potency biotherapeutics for chronic wounds. Fibrin is the provisional matrix and drug-releasing vehicle.

7) Cell culture meat; 2019 – present; UNL; Role: PI

   With industrial collaborators, we are addressing a few bottlenecks of the emerging cultivated meat industry including fabricating large-volume tissue, scaling up cell culture and developing cell banks.

F. Patents

1) Dissolvable and degradable artificial circulation systems for large volume tissues, **Lei Y**, Qiang L, and Wang O, U.S. Provisional 62/871,825
2) Cell Expansion System, **Lei Y** and Viljoen H., PCT/US2019/022594
3) Personalized cellular biomanufacturing with a closed, miniature cell culture system, **Lei Y**, PCT/US2017/063036
4) Large scale cell manufacture system, **Lei Y**, 2016, PCT/US2016/063486
5) Thermoreversible polymers and methods of use thereof, Fuentes CM, Ekerdt BL, Schaffer D, Segalman R, **Lei Y**, 2016, PCT/US2016/055362

G. Publications

*: corresponding author

See google scholar for recent publications:

https://scholar.google.com/citations?hl=en&user=nSXlx44AAAAJ&view_op=list_works&sortby=pubdate

1) Li Q, Wang O, **Lei Y***. Molecular surfactants allowed large-scale production of human pluripotent stem cell spheroids with uniform size. Under review.
2) Li Q, Wang O, **Lei Y***. Scalable production of human pluripotent stem cells derived cardiomyocytes in dissolvable tubular micro-bioreactors. Under review.
3) Li Q, Wang O, **Lei Y***. An artificial circulation system for large-volume tissue fabrication. Under review.
4) Wang O, **Lei Y***. Fibrin-fibronectin nano-matrix enhances wound healing and skin regeneration. Under review.
5) Wang O, **Lei Y***. An in vitro model for cell injection to brain tissue. Under review.
6) Li Q, Wang O, **Lei Y***. Personalized drug screening using patient-specific primary cancer stem cells. Under review.
7) Wang O, **Lei Y***. Creating a cell-friendly microenvironment to enhance cell culture efficiency. **Cell & Gene Therapy Insights**. 2019; 5(3), 341–350 (invited commentary).
8) Lin H, Qiu X, Du Q, Li Q, Wang O, Akert L, Wang Z, Anderson D, Liu K, Gu L, Zhang C, **Lei Y***. Engineered Microenvironment for Manufacturing Human Pluripotent Stem Cell-Derived Vascular Smooth Muscle Cells. **Stem Cell Reports**. 2019 Jan 8;12(1):84-97.
9) Lin H, Li Q, Du Q, Wang O, Wang Z, Akert L, Carlson MA, Zhang C, Subramanian A, Zhang C, Lunning M, Li M, **Lei Y***. Integrated generation of induced pluripotent stem cells in a low-cost device. **Biomaterials**. 2019 Jan;189:23-36.
10) Lin H, Du Q, Li Q, Wang O, Wang Z, Liu K, Akert L, Zhang C, Chung S, Duan B, **Lei Y***. Differentiating human pluripotent stem cells into vascular smooth muscle cells in three-dimensional thermoreversible hydrogels. **Biomater Sci.** 2018 Dec 18;7(1):347-361.
11) Lin H, Du Q, Li Q, Wang O, Wang Z, Elowsky C, Liu K, Zhang C, Chung S, Duan B, **Lei Y***. Manufacturing human pluripotent stem cell derived endothelial cells in scalable and cell-friendly microenvironments. **Biomater Sci.** 2018 Dec 18;7(1):373-388.
12) Wang O, Ismail A, Fabian FM, Lin H, Li Q, Elowsky C, Carlson MA, Burgess W, Velander WH, Kidambi S, **Lei Y***. A totally recombinant fibrin matrix for mesenchymal stem cell culture and delivery. **J Biomed Mater Res A**. 2018 Dec;106(12):3135-3142.
13) Ismail AEA., Fabian FM., Wang O., **Lei Y**., Carlson MA., Burgess WH., Velander WH. The isolation of a plasma-derived γγ' fibrinogen: Fibronectin mixture that forms a novel polymeric matrix. **Process Biochemistry.** 2018 Dec; 75:257-265,
14) Lin H, Du Q, Li Q, Wang O, Wang Z, Liu K, Elowsky C, Zhang C, **Lei Y***. Hydrogel-Based Bioprocess for Scalable Manufacturing of Human Pluripotent Stem Cell-Derived Neural Stem Cells. **ACS Appl Mater Interfaces.** 2018 Sep 5;10(35):29238-29250.
15) Lin H, Du Q, Li Q, Wang O, Wang Z, Sahu N, Elowsky C, Liu K, Zhang C, Chung S, Duan

B, **Lei Y***. A Scalable and Efficient Bioprocess for Manufacturing Human Pluripotent Stem Cell-Derived Endothelial Cells. **Stem Cell Reports**. 2018 Aug 14;11(2):454-469.

16) Lin H, Li Q, Wang O, Rauch J, Harm B, Viljoen HJ, Zhang C, Van Wyk E, Zhang C, **Lei Y***. Automated Expansion of Primary Human T Cells in Scalable and Cell-Friendly Hydrogel Microtubes for Adoptive Immunotherapy. **Adv Healthc Mater.** 2018 Aug;7(15):e1701297.

17) Qi D, Wu S, Lin H_4, Kuss MA, **Lei Y**, Krasnoslobodtsev A, Ahmed S, Zhang C, Kim HJ, Jiang P, Duan B. Establishment of a Human iPSC- and Nanofiber-Based Microphysiological Blood-Brain Barrier System. **ACS Appl Mater Interfaces.** 2018 Jul 5;10(26):21825-21835.

18) Ekerdt BL, Fuentes CM, **Lei Y**, Adil MM, Ramasubramanian A, Segalman RA, Schaffer DV. Thermoreversible Hyaluronic Acid-PNIPAAm Hydrogel Systems for 3D Stem Cell Culture. **Adv Healthc Mater.** 2018 Jun;7(12):e1800225.

19) Kuss M, Kim J, Qi D, Wu S, **Lei Y**, Chung S, Duan B. Effects of tunable, 3D-bioprinted hydrogels on human brown adipocyte behavior and metabolic function. **Acta Biomater.** 2018 Apr 15;71:486-495.

20) Li Q, Lin H, Rauch J, Deleyrolle LP, Reynolds BA, Viljoen HJ, Zhang C, Zhang C, Gu L, Van Wyk E, **Lei Y***. Scalable Culturing of Primary Human Glioblastoma Tumor-Initiating Cells with a Cell-Friendly Culture System. **Sci Rep.** 2018 Feb 23;8(1):3531.

21) Li Q, Lin H, Du Q, Liu K, Wang O, Evans C, Christian H, Zhang C, **Lei Y***. Scalable and physiologically relevant microenvironments for human pluripotent stem cell expansion and differentiation. **Biofabrication.** 2018 Feb 1;10(2):025006.

22) Li Q, Wang Q, Wang O, Shao K, Lin H, **Lei Y***. A simple and scalable hydrogel-based system for culturing protein-producing cells. **PLoS One.** 2018 Jan 2;13(1):e0190364.

23) Lin H, Li Q, **Lei Y***. Three-dimensional tissues using human pluripotent stem cell spheroids as biofabrication building blocks. **Biofabrication.** 2017 Apr 24;9(2):025007.

24) Lin H, Li Q, **Lei Y***. An Integrated Miniature Bioprocessing for Personalized Human Induced Pluripotent Stem Cell Expansion and Differentiation into Neural Stem Cells. **Sci Rep.** 2017 Jan 6;7:40191.

25) Li Q, Lin H, Wang O, Qiu X, Kidambi S, Deleyrolle LP, Reynolds BA, **Lei Y***. Scalable Production of Glioblastoma Tumor-initiating Cells in 3 Dimension Thermoreversible Hydrogels. **Sci Rep.** 2016 Aug 23;6:31915.

26) **Lei Y**, Jeong D, Xiao J and Schaffer D. Developing Defined and Scalable 3D Culture Systems for Culturing Human Pluripotent Stem Cells at High Densities. **Cellular & Molecular Bioengineering**. 2014; 7:172.

27) **Lei Y** and Schaffer D. A fully defined and scalable 3D culture system for the production of human pluripotent stem cells and their progeny. **Proceedings of the National Academy of Sciences.** 2013; 110:E5039-48.

28) Tokatlian T, Cam C, Siegman SN, **Lei Y**, Segura T. Design and characterization of microporous hyaluronic acid hydrogels for in vitro gene transfer to mMSCs. **Acta Biomaterialia**. 2012; 8:3921-31.

29) Zhang J, **Lei Y**, Dhaliwal A, Ng QK, Du J, Yan M, Lu Y, Segura T. Protein-polymer

nanoparticles for nonviral gene delivery. **Biomacromolecules**. 2011; 12:1006-14.

30) **Lei Y**, Rahim M, and Segura T. Hyaluronic acid and fibrin hydrogels with concentrated DNA/PEI polyplexes for local gene delivery. **J Control Release**. 2011; 153:255-61.

31) **Lei Y**, Gojggini S, Lam J and Segura T. The spreading, migration and proliferation of mouse mesenchymal stem cells cultured inside hyaluronic acid hydrogels. **Biomaterials**. 2011; 32:39-47.

32) **Lei Y**, Huang S, Kashani PS, and Segura T. Incorporation of active DNA/cationic polymer polyplexes into hydrogel scaffolds. **Biomaterials**. 2010; 31:9106-16.

33) **Lei Y**, Ng Q and Segura T. Two and Three-dimensional gene transfer from enzymatically degradable hydrogel scaffolds. **Microscopy Res Technique**. 2010; 73:910-7.

34) **Lei Y** and Segura T. DNA delivery from matrix metalloproteinase degradable poly(ethylene glycol) hydrogels to mouse cloned mesenchymal stem cells. **Biomaterials** 2009; 30:254-65.

35) Weng LT, Ng KM, Cheung ZL, **Lei Y** and Chan CM. Quantitative analysis of styrene-pentafluorostyrene random copolymers by ToF-SIMS and XPS. **Surface and Interface Analysis**. 2006 38: 32-43.

36) Ou YC, **Lei Y**, Fang XP, Yang GS. Maleic anhydride grafted thermoplastic elastomer (TPEg) as interfacial modifier for Polypropylene/Polyamide6 blends. **Journal of Applied Polymer Science.** 2004; 91:1806.

37) **Lei Y**, Chan CM, and Li L. Growth process of homogeneously and heterogeneously nucleated spherulites as observed by Atomic Force Microscopy. **Polyme**r. 2003; 44:4673.

38) **Lei Y**, Chan CM, Weng LT, Ng KM and Li L. Surface chemical and morphological properties of a blend containing semi-crystalline and amorphous polymers studied with ToF-SIMS, XPS and AFM. **Polymer.** 2003; 44:3883.

39) **Lei Y**, Chan CM, Weng LT and Ng KM. XPS C1s binding energies for fluorocarbon-hydrocarbon microblock polymers. **Surface and Interface Analysis.** 2003; 35:852.

40) **Lei Y**, Chan CM, Li JX, Ng KM, Jiang Y and Li L. The birth of an embryo and development of the founding lamella of spherulites as observed by Atomic Force Microscopy. **Macromolecules.** 2002; 35:6751.

41) Jiang Y, Gu Q, Li L, **Lei Y** and Chan CM. Structural changes during isothermal crystallization of a Poly(bisphenol A-co-Decane Ether) polymer. **Polymer.** 2002 43: 5615-5621.

42) Chan CM, Li L, Ng KM, Li JX and **Lei Y**. Direct observation of growth of lamellae and spherulites of a semi-crystalline polymer by AFM. **Polymeric Materials Science and Engineering.** 2002; 86:389.

43) Luo YH, Jiang Y, **Lei Y**, Chan CM and Li L. Progress of polymer crystal growth studied with AFM. **Chinese Science Bulletin.** 2002; 47:1121-1125.

44) Li L, Chan CM, Yeung KL, Ng KM and **Lei Y**. Direct observation of growth of lamellae and spherulites of a semicrystalline polymer by AFM. **Macromolecules.** 2001; 34: 316-325.

45) Li L, Chan CM, **Lei Y** and Weng LT. A time-of-flight secondary ion mass spectrometry study of sequential polymers with a well-defined segmental length. **Polymer.** 2001; 42: 6841-6849.