

Chider Chen, Ph.D.

Office Address: 240 S. 40th Street Levy Building Room 544
 Department of Oral & Maxillofacial Surgery/Pharmacology
 School of Dental Medicine
 University of Pennsylvania
 Philadelphia, PA 19104-4283

Education: 1993-97 B.S. Soochow University, Taipei (Chemistry)
 1997-99 M.S. Soochow University, Taipei (Biochemistry)
 2009-14 Ph.D. University of Southern California, Los Angeles
 (Craniofacial Biology)

Postgraduate Training and Fellowship Appointments:

2009-14 Research Assistant, University of Southern California, Los Angeles
 2014-14 Postdoctoral Fellow, University of Southern California, Los Angeles
 2014-18 Postdoctoral Scientist, University of Pennsylvania, Philadelphia

Professional Experience:

1999-03 Research Associate, BioAgri Corp., Taipei
 2003-09 Research Associate, BioPromed Biotech Co., Ltd., Taipei

Faculty Appointment:

2018- Assistant Professor, University of Pennsylvania, Philadelphia

Awards, Honors and Membership in Honorary Societies:

2010 Pre-doctoral Candidate Research Award: 1st Place, Ostrow School of Dentistry of USC
 2011 Pre-doctoral Candidate Research Award: 2nd Place, Ostrow School of Dentistry of USC
 2012 Pre-doctoral Candidate Research Award: 2nd Place, Ostrow School of Dentistry of USC
 2012 Travel Award of the 8th Asia Pacific Symposium on Neural Regeneration in conjunction with the 5th Pan Pacific Symposium on Stem Cells and Cancer Research
 2013 Scholar of CIRM Research Training Program
 2013 Pre-doctoral Candidate Research Award: 1st Place, Ostrow School of Dentistry of USC
 2016 Ruth L. Kirschstein Rheumatology T32 Training Grant
 2016 NIDCR/NIH Pathways to Independence Award (K99/R00)
 2019 NIDCR Small Grant Award for New Investigators

Memberships in Professional and Scientific Societies:

National Societies:

International Association for Dental Research (2009-)

American Association for the Advancement of Science (2011-)

Editorial Positions:

Since 2010 Ad Hoc Reviewer, PLoS One
 Since 2011 Ad Hoc Reviewer, Oral Disease
 Since 2012 Ad Hoc Reviewer, Cell Death & Disease
 Since 2013 Ad Hoc Reviewer, Tissue Engineering Part A
 Since 2013 Ad Hoc Reviewer, Archives of Oral Biology
 Since 2014 Ad Hoc Reviewer, Stem cell research and therapy
 Since 2014 Ad Hoc Reviewer, Journal of Dental Research
 Since 2014 Ad Hoc Reviewer, Biomaterials
 Since 2015 Ad Hoc Reviewer, Carbohydrate Polymers
 Since 2016 Ad Hoc Reviewer, Allergologia et Immunopathologia
 Since 2016 Ad Hoc Reviewer, Cellular Immunology
 Since 2016 Ad Hoc Reviewer, Journal of Dentistry
 Since 2016 Ad Hoc Reviewer, Stem Cells International
 Since 2017 Ad Hoc Reviewer, Advanced Functional Materials
 Since 2017 Ad Hoc Reviewer, Scientific Reports
 Since 2017 Ad Hoc Reviewer, American Journal of Translational Research
 Since 2017 Ad Hoc Reviewer, Translational Research
 Since 2017 Ad Hoc Reviewer, The European Journal of Pharmacology
 Since 2018 Ad Hoc Reviewer, Materials Science & Engineering C
 Since 2018 Ad Hoc Reviewer, Stem Cell and Development
 Since 2018 Ad Hoc Reviewer, Food Research International
 Since 2018 Ad Hoc Reviewer, Macromolecular Research

Academic Committees at the University of Pennsylvania and Affiliated Hospitals: (New recruits: list activities at prior institution.)

2018- Member, DScD Thesis Committee

2019- Member, PDM Summer Retreat Organizing Committee

Major Teaching and Clinical Responsibilities at the University of Pennsylvania and Affiliated Hospitals: (New recruits: list activities at prior institution.)

1. One lecture in DENT 500 Foundational Science
2. Two lectures in DADE Dental Lecture for DScD students and residents
3. Basic Science Lab Contact: one day/week

Lectures by Invitation: (Basic Scientists: list only those in the past 5 years; Clinicians 10 years)

1. **Chen C.** (2017). Invited speaker. School of Dental Medicine Research Day, University of Pennsylvania, Philadelphia, PA.
2. **Chen C.** (2018). Invited speaker. Engineering Precision Dental Medicine Workshop, University of Pennsylvania, Philadelphia, PA.

Bibliography:

Research Publications, peer reviewed:

1. Chang K, Qian J, Jiang M, Liu YH, Wu MC, **Chen C**, Lai CK, Lo HL, Hsiao CT, Brown L, Bolen J Jr, Huang HI, Ho PY, Shih PY, Yao CW, Lin WJ, Chen CH, Wu FY, Lin YJ, Xu J, Wang K. Effective generation of transgenic pigs and mice by linker based sperm-mediated gene transfer. *BMC Biotechnology* 2002 2:5
2. Yamaza T, Kentaro A, **Chen C**, Liu Y, Shi Y, Gronthos S, Wang S, Shi S. Immunomodulatory properties of stem cells from human exfoliated deciduous teeth. *Stem Cell Res Ther.* 2010 1(1):5.
3. Kikuri T, Kim I, Yamaza T, Akiyama K, Zhang Q, Li Y, **Chen C**, Chen W, Wang S, Le AD, Shi S. Cell-based immunotherapy with mesenchymal stem cells cures bisphosphonate-related osteonecrosis of the jaw-like disease in mice. *J Bone Miner Res.* 2010 25(7):1668-79.
4. Yamaza T, Ren G, Akiyama K, **Chen C**, Shi Y, Shi S. Mouse Mandible Contains Distinctive Mesenchymal Stem Cells. *Journal of Dental Research.* 2010 90(3):317-24.
5. Liu Y, Wang L, Kikuri T, Akiyama K, **Chen C**, Xu X, Yang R, Chen W, Wang S, Shi S. Mesenchymal stem cell-based tissue regeneration is governed by recipient T lymphocytes via IFN- γ and TNF- α . *Nat Med.* 2011 17(12):1594-601.
6. Li B, Qu C, **Chen C**, Liu Y, Akiyama K, Yang R, Chen F, Zhao Y, Shi S. Basic Fibroblast Growth Factor Inhibits Osteogenic Differentiation of SHED through ERK Signaling. *Oral Diseases.* 2012 18(3):285-92.
7. Akiyama K[#], **Chen C[#]**, Wnag D[#], Xu X, Qu C, Yamaza T, Cai T, Chen W, Sun L, Shi S. Mesenchymal Stem Cell-Induced Immunoregulation Involves Fas Ligand/Fas-Mediated T Cell Apoptosis. *Cell Stem Cell.* 2012 10(5):544-55. (**#Co-first author**)
8. Moshaverinia A, **Chen C**, Akiyama K, Ansari S, Xu X, Chee WW, Schricker SR, Shi S. Alginate hydrogel as a promising scaffold for dental-derived stem cells: an in vitro study. *J. Mater. Sci Mater. Med.* 2012 23(12): 3041-51.
9. Zhao Y, Wang L, Liu Y, Akiyama K, **Chen C**, Atsuta I, Zhou T, Duan X, Jin Y, Shi S. Technetium-99 conjugated with methylene diphosphonate ameliorates ovariectomy-induced osteoporotic phenotype without causing osteonecrosis in the jaw. *Calcif Tissue Int.* 2012 91(6):400-8.
10. Akiyama K, You YO, Yamaza T, **Chen C**, Tang L, Jin Y, Chen XD, Gronthos S, Shi S. Characterization of bone marrow derived mesenchymal stem cell in suspension. *Stem Cell Res Ther.* 2012 19;3(5):40.

11. Yang R, Liu Y, Kelk P, Qu C, Akiyama K, **Chen C**, Atsuta I, Chen W, Zhou Y, Shi S. A subset of IL-17(+) mesenchymal stem cells possesses anti-Candida albicans effect. *Cell Research*. 2013 23(1):107-21.
12. Wang L, Zhao Y, Liu Y, Akiyama K, **Chen C**, Qu C, Jin Y, Shi S. IFN- γ and TNF- α synergistically induce mesenchymal stem cell impairment and tumorigenesis via NF κ B signaling. *Stem Cells*. 2013 31(7):1383-95.
13. Zhang Q, Atsuta I, Liu S, **Chen C**, Shi S, Shi S, Le AD. LI-17-mediated M1/M2 macrophage alteration contributes to pathogenesis of bisphosphonate-related Osteonecrosis of the Jaw. *Clin Cancer Res*. 2013 19(12) 3176-88.
14. Moshaverinia A, Ansari S, **Chen C**, Xu X, Akiyama K, Snead ML, Zadeh HH, Shi S. Co-encapsulation of anti-BMP2 monoclonal antibody and mesenchymal stem cells in alginate microspheres for bone tissue engineering. *Biomaterials*. 2013 34(28):6572-9.
15. Xu X, **Chen C**, Akiyama K, Chai Y, Le AD, Wang Z, Shi S. Gingivae contain neural-crest- and mesoderm- derived mesenchymal stem cells. *J. Dent. Res*. 2013 92(9):825-32.
16. Moshaverinia A, Xu X, **Chen C**, Akiyama K, Snead ML, Shi S. Dental mesenchymal stem cells encapsulated in alginate hydrogel co-delivery microencapsulation system for cartilage regeneration. *Acta Biomater*. 2013 9(12):9343-50.
17. Moshaverinia A, **Chen C**, Akiyama K, Xu X, Chee WW, Schricker SR, Shi S. Encapsulated dental-derived mesenchymal stem cells in an injectable and biodegradable scaffold for applications in bone tissue engineering. *J Biomed Mater Res A*. 2013 101(11):3285-94.
18. Atsuta I, Liu S, Miura Y, Akiyama K, **Chen C**, An Y, Shi S, Chen FM. Mesenchymal stem cells inhibit multiple myeloma cells via the Fas-L/Fas pathway. *Stem cell Res Ther*. 2013 4(5):111.
19. Moshaverinia A, **Chen C**, Xu X, Akiyama K, Ansari S, Zadeh HH, Shi S. Bone regeneration potential of stem cells derived from periodontal ligament or gingival tissue sources encapsulated in RGD-modified alginate scaffold. *Tissue Eng Part A*. 2013 20(3-4):611-21.
20. Qin H, Qu C, Yamaza T, Yang R, Lin X, Duan XY, Akiyama K, Liu Y, Zhang Q, **Chen C**, Chen Y, Qi HH, Feng XH, Le A, Shi S. Ossifying fibroma tumor stem cells are maintained by epigenetic regulation of a TSP1/TGF-b/SMAD3 autocrine loop. *Cell Stem Cell*. 2013 13(5):577-89.
21. Moshaverinia A, Xu X, **Chen C**, Ansari S, Zadeh HH, Snead ML, Shi S. Application of stem cells derived from the periodontal ligament or gingival tissue sources for tendon tissue regeneration. *Biomaterials*. 2014 35(9):2642-50.

22. **Chen C**, Akiyama K, Yamaza T, You YO, Xu X, Li B, Zhao Y, Shi S. Telomerase governs immunomodulatory properties of mesenchymal stem cells by regulating FAS ligand expression. *EMBO Mol. Med.* 2014 6(3):322-34.
23. Liu Y, Wang L, Liu S, Liu D, **Chen C**, Xu X, Chen X, Shi S. Transplantation of SHED prevents bone loss in the early phase of ovariectomy-induced osteoporosis. *J. Dent. Res.* 2014 93(11):1124-32.
24. Liu Y, **Chen C**, Liu S, Liu D, Xu X, Chen X, Shi S. Acetylsalicylic Acid treatment improves differentiation and immunomodulation of SHED. *J. Dent. Res.* 2015 94(1):209-18.
25. **Chen C**, Akiyama K, Wang D, Xu X, Li B, Moshaverinia A, Brombacher F, Sun L, Shi S. mTOR inhibition rescues osteopenia in mice with systemic sclerosis. *J. Exp. Med.* 2015 212(1):73-91.
26. Wang L, Liu S, Zhao Y, Liu D, Liu Y, **Chen C**, Karray S, Shi S, Jin Y. Osteoblast-induced osteoclast apoptosis by fas ligand/FAS pathway is regulated for maintenance of bone mass. *Cell Death Differ.* 2015 22(10):1654-64.
27. Moshaverinia A[#], **Chen C**[#], Xu X, Ansari S, Zadeh HH, Schricker SR, Paine ML, Modarian-Oldak J, Khademhosseini A, Snead ML, Shi S. Regulation of the stem cell-host immune system interplay using hydrogel coencapsulation system with an anti-inflammatory drug. *Adv Funct Mater.* 2015 25(15):2296-2307. (**#Co-first author**)
28. Diniz IM, **Chen C**, Xu X, Ansari S, Zadeh HH, Marques MM, Shi S, Moshaverinia A. Pluronic F-127 hydrogel as a promising scaffold for encapsulation of dental-derived mesenchymal stem cells. *J. Mater. Sci Mater. Med.* 2015 26(3):153.
29. Diniz IM, **Chen C**, Ansari S, Zadeh HH, Moshaverinia M, Chee D, Marques MM, Shi S, Moshaverinia A. Gingival mesenchymal stem cell (GMSC) delivery system based on RGD-coupled alginate hydrogel with antimicrobial properties: a novel treatment modality for peri-implantitis. *J. Prosthodont.* 2015 25(2):105-15.
30. Yang R, Qu C, Zhou Y, Konkel JE, Shi S, Liu Y, **Chen C**, Liu S, Liu D, Chen Y, Zandi E, Chen W, Zhou Y, Shi S. Hydrogen sulfide promotes Tet1- and Tet2-mediated Foxp3 demethylation to drive regulatory T cell differentiation and maintain immune homeostasis. *Immunity.* 2015 43(2):251-263.
31. Liu S, Liu D, **Chen C**, Hamamura K, Moshaverinia A, Yang R, Liu Y, Jin Y, Shi S. MSC transplantation improves osteopenia via epigenetic regulation of Notch signaling in lupus. *Cell Metab.* 2015 22(4):606-618.
32. Ansari S[#], **Chen C**[#], Xu X, Annabi N, Zadeh HH, Wu BM, Khademhosseini A, Shi S, Moshaverinia A. Muscle tissue engineering using gingival mesenchymal

- stem cells encapsulated in alginate hydrogels containing multiple growth factors. *Ann Biomed Eng.* 2016 44(6):1908-1920. (**#Co-first author**)
33. Liu Y, Kou X, **Chen C**, Yu W, Su Y, Kim Y, Shi S, Liu Y. Chronic high dose alcohol induces osteopenia via activation of mTOR signaling in bone marrow mesenchymal stem cells. *Stem Cells.* 2016 34(8):2157-2168.
 34. Doyran B, Tong W, Li Q, Jia Q, Zhang X, **Chen C**, Enomoto-Iwamoto M, Lu XL, Qin L, Han L. Nano-indentation modulus of murine cartilage: a sensitive indicator of the initiation and progression of post-traumatic osteoarthritis. *Osteoarthritis Cartilage.* 2017 25(1):108-117.
 35. **Chen C**, Wang D, Moshaverinia A, Liu D, Kou X, Yu W, Yang R, Sun L, Shi S. Mesenchymal stem cell transplantation in tight-skin mice identifies miR151-5p as a therapeutic target for systemic sclerosis. *Cell Research.* 2017 27(4):559-577.
 36. Ansari S[#], **Chen C**[#], Hasani-Sarabadi MM, Yu B, Zadeh HH, Wu BM, Moshaverinia A. Hydrogel elasticity and microarchitecture regulate dental-derived mesenchymal stem cell-host immune system cross-talk. *Acta Biomater* 2017 60:181-189. (**#Co-first author**)
 37. Ansari S, Diniz IM, **Chen C**, Aghaloo T, Wu BM, Shi S, Moshaverinia A. Alginate/hyaluronic acid hydrogel delivery system characteristics regulate the differentiation of periodontal ligament stem cells toward chondrogenic lineage. *J Mater Sci Mater Med* 2017 28(10):162.
 38. Xiao E, He L, Wu Q, Li J, He Y, Zhao L, Chen S, An J, Liu Y, **Chen C**[#], Zhang Y[#]. Microbiota regulates bone marrow mesenchymal stem cell lineage differentiation and immunomodulation. *Stem Cell Res Ther* 2017 8(1):213. (**#Corresponding author**)
 39. Ansari S, Diniz IM, **Chen C**, Sarrion P, Tamayol A, Wu BM, Moshaverinia A. Human Periodontal Ligament- and Gingiva-derived Mesenchymal Stem Cells Promote Nerve Regeneration When Encapsulated in Alginate/Hyaluronic Acid 3D Scaffold. *Adv Healthc Mater* 2017 6(24).
 40. Su Y, **Chen C**, Guo L, Du J, Li X, Liu Y. Ecological Balance of Oral Microbiota is required to maintain Oral Mesenchymal Stem Cell Homeostasis. *Stem Cells* 2018 36(4):551-561.
 41. Liu Y, Jing H, Kou X, **Chen C**, Liu D, Jin Y, Lu L, Shi S. PD-1 is required to maintain stem cell properties in human dental pulp stem cells. *Cell Death Differ* 2018 25(7):1350-1360.
 42. Kou X, Xu X, **Chen C**, Sanmillan ML, Cai T, Zhou Y, Giraud C, Le A, Shi S. The Fas/Fap-1/Cav-1 complex regulates IL-1RA secretion in mesenchymal stem cells to accelerate wound healing. *Sci Transl Med* 2018 10(432).

43. Yang R, Yu T, Kou X, Gao X, **Chen C**, Liu D, Zhou Y, Shi S. Tet1 and Tet2 maintain mesenchymal stem cell homeostasis via demethylation of the P2rx7 promoter. *Nat Commun* 2018 9(1):2143.
44. Liu D, Kou X, **Chen C**, Liu S, Liu Y, Yu W, Yu T, Yang R, Wang R, Zhou Y, Shi S. Circulating apoptotic bodies maintain mesenchymal stem cell homeostasis and ameliorate osteopenia via transferring multiple cellular factors. *Cell Research* 2018 28(9):918-933.
45. Tong W, Tower RJ, **Chen C**, Wang L, Zhong L, Wei Y, Sun H, Cao G, Jia H, Pacifici M, Koyama E, Enomoto-Iwamoto M, Qin L. Periarticular mesenchymal progenitors initiate and contribute to secondary ossification center formation during mouse long bone development. *Stem Cells* 2019 37(5):677-689.
46. Ko KI, Syverson AL, Kralik RM, Choi J, DerGarabedian BP, **Chen C**, Graves DT. Diabetes-induced NF- κ B dysregulation in skeletal stem cells prevents resolution of inflammation. *Diabetes* 2019 68(11):2095-2106.
47. Sevari SP, Shahnazi S, **Chen C**, Mitchell JC, Ansari S, Moshaverinia A. Bioactive glass-containing hydrogel delivery system for osteogenic differentiation of human dental pulp stem cells. *J Biomed Mater Res* 2019 Nov 9.

Reviews and Chapters:

1. Akiyama K, **Chen C**, Gronthos S, and Shi S. Methods in Odontogenesis; Lineage differentiation of mesenchymal stem cells from dental pulp, apical papilla and periodontal ligament. *Methods Mol Biol* 2012 887:111-21.
2. Xiao E, **Chen C**, Zhang Y. The mechanosensor of mesenchymal stem cells: mechanosensitive channel or cytoskeleton? *Stem Cell Res Ther.* 2016 7(1):140.
3. Mao X, Liu Y, **Chen C**, Shi S. Mesenchymal stem cells and their role in dental medicine. *Dent Clin North Am.* 2017 61(1):161-172.
4. Ansari S, Seagroves JT, **Chen C**, Shah K, Aghaloo T, Wu BM, Bencharit S, Moshaverinia A. Dental and orofacial mesenchymal stem cells in craniofacial regeneration: The prosthodontist's point of view. *J Prosthet Dent.* 2017 3913(17):30056-2.
5. Sui B, **Chen C**, Kou X, Li B, Xuan K, Shi S. Pulp Stem Cell-Mediated Functional Pulp Regeneration. *J Dent Res.* 2019 98(1):27-35.
6. Zhang Q, **Chen C**, Chang M, Shanti RM, Cannady SB, O'Malley BW, Shi S, Le A. A Multidisciplinary, Patient-Centered Approach to Reconstruction and Oral Rehabilitation of Patients Sustaining Orofacial Injuries: The University of Pennsylvania Initiative. *J Dent Res.* 2019.

Patents:

1. US 13/810,878, Publication#: US 20130330300 A1. High Telomerase Activity Bone Marrow Mesenchymal Stem Cells, Methods of Producing the Same and Pharmaceuticals and Treatment Methods Based Thereon. Shi S., Akiyama K., **Chen C.**
2. US 14/389,322, Publication#: US 20150104428 A1. Compositions and Treatment Methods for Mesenchymal Stem Cell-Induced Immunoregulation. Shi S., Akiyama K., **Chen C.**
3. US 14/896,891, Publication#: US 20160129043 A1. Composition of mesenchymal stem cells. Shi S., Xu X., **Chen C.**, Le A.

Abstracts:

1. **Chen C**, Akiyama K, Xu X, Li B, Yamaza T, Shi S. (2012). Ostrow School of Dentistry Research Day, University of Southern California, Los Angeles, CA. **2nd Place Award, Graduate Pre-doctoral Candidate.**
2. **Chen C**, Akiyama K, Xu X, Li B, Yamaza T, Shi S. (2012). The 8th Asia Pacific Symposium on Neural Regeneration in conjunction with the 5th Pan Pacific Symposium on Stem Cells and Cancer Research & the 1st Cross-Strait Biotechnology Forum, Taipei, Taiwan. **Travel Award.**
3. **Chen C**, Akiyama K, Yamaza T, Xu X, Shi S. (2013). Ostrow School of Dentistry Research Day, University of Southern California, Los Angeles, CA. **1st Place Award, Graduate Pre-doctoral Candidate.**
4. **Chen C**, Akiyama K, Yamaza T, Xu X, Shi S. (2013). CIRM Grantee Meeting, San Francisco, CA.
5. **Chen C**, Akiyama K, Yamaza T, Xu X, Li B, Zhao Y, Shi S. (2014). School of Dental Medicine Research Day, University of Pennsylvania, Philadelphia, PA.
6. Moshaverinia A[#], **Chen C**[#], Ansari S, Zadeh HH, Shi S. (2014). IADR General Session and Exhibition, Boston, CA.
7. **Chen C**, Akiyama K, Wang D, Moshaverinia A, Sun L, Shi S. (2015). School of Dental Medicine Research Day, University of Pennsylvania, Philadelphia, PA.
8. Moshaverinia A[#], **Chen C**[#], Ansari S, Shi S. (2016). AADR Annual Meeting, Los Angeles, CA.
9. **Chen C**, Wang D, Moshaverinia A, Kou X, Yu W, Sun L, Shi S. (2016). School of Dental Medicine Research Day, University of Pennsylvania, Philadelphia, PA.

Grant Support

Past

CIRM Stem Cell Biology Training Grant (TG2-01161)
California Institute for Regenerative Medicine (CIRM)
PI: Robert Maxson, Role: Pre-doctoral training fellow

8/1/2012-7/31/2014, \$96,700 (Total)

Training Program/Rheumatic Diseases (T32 AR007442-29)

National Institutes of Health (NIAMS)

PI: Peter A. Merkel, Role: Post-doctoral training fellow

7/1/2016-8/31/2016, \$47,268 (Annual)

Pathways to Independence Award (K99 DE025915)

FAS Controls Exosome-Mediated miRNA Transfer in MSC-Based Therapy

National Institutes of Health (NIDCR)

PI: Chider Chen

9/7/2016- 8/31/2018, \$141,558 (Total)

Current

Pathways to Independence Award (R00 DE025915)

FAS Controls Exosome-Mediated miRNA Transfer in MSC-Based Therapy

National Institutes of Health (NIDCR)

PI: Chider Chen

4/3/2019- 3/31/2022, \$732,171 (Total)

NIDCR Small Grant Program for New Investigators (R03 DE028026)

Epigenetic Regulation of Mesenchymal Stem Cell in Aging

National Institutes of Health (NIDCR)

PI: Chider Chen

4/4/2019- 3/31/2021, \$322,000 (Total)