

# Stanford

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## Edwin Chang

Director, Small Animal Imaging Facility at Porter Drive, Rad/Molecular Imaging Program at Stanford

### SUPERVISORS

- Sanjiv Gambhir

### Bio

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#### BIO

Dr. Edwin Chang obtained his PhD (1992) at McGill University from the Department of Medicine, Division of Experimental Medicine. From 1993 onwards, he began work at Geron Corporation (Menlo Park, California) in which he studied the mechanism of cellular immortalization as well as cellular aging and applied his findings in the search for therapies against both cardiovascular diseases and cancer. In 2002, he joined Stanford University where he initially utilized his experience from Geron Corporation to research cardiovascular and endothelial progenitor cell function. In 2009, he became part of the Molecular Imaging Program at Stanford (MIPS) where he explored the applicability of various modalities (PET, BLI, CT, MRI, US) for many projects related to cancer and to vascular function. In 2012, he became a member of the Canary Center at Stanford University where he has leveraged his experience in cell and preclinical studies to develop imaging modalities to track therapeutic responses against cancer as well as detecting early stage cancers. Currently, he is exploring not only diagnostics against cancers but therapeutics as well. As a result, Dr. Chang has explored the relevance of medicinal compounds from the Ayurvedic medical tradition, in particular Withaferin A from the winter cherry plant, in stopping cancers such as glioblastomas. He has also examined the cooperativity of Withaferin A with other interventions that are known to inhibit gliomas such as combination therapies of Withaferin A with temozolomide, with other ginsenosides and with alternating electric fields (known as tumor treating fields or TTFields).

#### CURRENT ROLE AT STANFORD

Lab Manager and Lab Scientist at Canary Center at Stanford

#### HONORS AND AWARDS

- Canadian Heart and Stroke Foundation Post-doctoral research fellowship, McMaster University/ Geron Corporation (1992-1995)
- First prize at Ninth Annual Student Research Seminar, McGill University (1989)
- Canadian Medical Research Council Graduate Scholarship, University of British Columbia (1984-1986)
- Gordon Roy Findley Chemistry Award, Brock University (1983-1984)
- NSERC Summer Undergraduate Scholarship, Brock University (1982-1984)
- Scholler In-House Scholarship for scholastic excellence, Brock University (1984)
- Scholler In-House Scholarship for scholastic excellence, Brock University (1983)
- Scholler In-House Scholarship for scholastic excellence, Brock University (1982)
- Gail Thompson Award for English Essay Composition, Sir Winston Churchill Secondary School (1979)

## EDUCATION AND CERTIFICATIONS

- PhD, McGill University, School of Medicine, Montreal, PQ, Canada , Experimental Medicine (1991)
- MSc, University of British Columbia, Vancouver, B.C., Canada , Biochemistry (1984)
- BSc, Brock University, St. Catharines, ON, Canada , Biology/Chemistry (1986)

## PATENTS

- Edwin Chang. "United States Patent 18-275 Novel cell membrane permeability mechanism of tumor treating fields on cancer cells", Leland Stanford Junior University, Jun 18, 2018
- Edwin Chang. "United States Patent 17-238 Prevention and Treatment of Teratoma Formation During Stem Cell Therapy using Alternating Electric Fields", Leland Stanford Junior University, Jun 13, 2017
- Edwin Chang. "United States Patent 13-017 Blood Biomarkers for Monitoring Response to anti-EGFR Therapy", Leland Stanford Junior University, Jan 16, 2013
- Edwin Chang. "United States Patent 10-184 Use of 18F-FPPRGD2 tracer to monitor drug therapy and evolving hypoxic status in ischemic wound healing", Leland Stanford Junior University, Jun 7, 2010

## Professional

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### PROFESSIONAL INTERESTS

Dr. Chang has explored the relevance of medicinal compounds from the Ayurvedic medical tradition, in particular Withaferin A from the winter cherry plant, in stopping cancers such as glioblastomas. He has also examined the cooperativity of Withaferin A with other interventions that are known to inhibit gliomas such as combination therapies of Withaferin A with temozolomide, with other ginsenosides and with alternating electric fields (known as tumor treating fields or TTFs). He also has professional interests in stem cell research, the biology of aging, cancer as well as telomere and telomerase biology.

### WORK EXPERIENCE

- Lab Manager and Lab Scientist with Dept. of Radiology at Stanford - Stanford University (9/1/2011 - present)

## Publications

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### PUBLICATIONS

- **Tumor Treating Fields Increases Membrane Permeability in Glioblastoma Cells** *Cell Death Discovery*  
Chang, E., Patel, C. B., Pohling, C., Young, C., Song, J., Flores, T., Zeng, Y., Joubert, L. M., Arami, H., Natarajan, A., Sinclair, R., Gambhir, S. S.  
2018; 4
- **A blood biomarker for monitoring response to anti-EGFR therapy.** *Cancer biomarkers : section A of Disease markers*  
Hughes, N. P., Xu, L., Nielsen, C. H., Chang, E., Hori, S. S., Natarajan, A., Lee, S., Kjar, A., Kani, K., Wang, S. X., Mallick, P., Gambhir, S. S.  
2018
- **The Exosome Total Isolation Chip.** *ACS nano*  
Liu, F. n., Vermesh, O. n., Mani, V. n., Ge, T. J., Madsen, S. J., Sabour, A. n., Hsu, E. C., Gowrishankar, G. n., Kanada, M. n., Jokerst, J. V., Sierra, R. G., Chang, E. n., Lau, et al  
2017
- **Synergistic inhibition of glioma cell proliferation by Withaferin A and tumor treating fields.** *Journal of neuro-oncology*  
Chang, E. n., Pohling, C. n., Beygui, N. n., Patel, C. B., Rosenberg, J. n., Ha, D. H., Gambhir, S. S.  
2017
- **A novel theranostic strategy for MMP-14 expressing glioblastomas impacts survival.** *Molecular cancer therapeutics*  
Mohanty, S. n., Chen, Z. n., Li, K. n., Morais, G. R., Klockow, J. n., Yerneni, K. n., Pisani, L. n., Chin, F. T., Mitra, S. n., Cheshier, S. n., Chang, E. n., Gambhir, S. S., Rao, et al  
2017
- **Withaferin A and its potential role in glioblastoma (GBM)** *JOURNAL OF NEURO-ONCOLOGY*  
Dhami, J., Chang, E., Gambhir, S. S.

2017; 131 (2): 201-211

- **AshwaMAX and Withaferin A inhibits gliomas in cellular and murine orthotopic models** *JOURNAL OF NEURO-ONCOLOGY*  
Chang, E., Pohling, C., Natarajan, A., Witney, T. H., Kaur, J., Xu, L., Gowrishankar, G., D'Souza, A. L., Murty, S., Schick, S., Chen, L., Wu, N., Khaw, et al  
2016; 126 (2): 253-264
- **ROS and Brain Diseases: The Good, the Bad, and the Ugly** *OXIDATIVE MEDICINE AND CELLULAR LONGEVITY*  
Popa-Wagner, A., Mitran, S., Sivanesan, S., Chang, E., Buga, A.  
2013
- **Cerenkov Luminescence Imaging (CLI) for Cancer Therapy Monitoring** *JOVE-JOURNAL OF VISUALIZED EXPERIMENTS*  
Xu, Y., Liu, H., Chang, E., Jiang, H., Cheng, Z.  
2012
- **Diffusible amyloid oligomers trigger systemic amyloidosis in mice** *BIOCHEMICAL JOURNAL*  
Senthilkumar, S., Chang, E., Jayakumar, R.  
2008; 415: 207-215
- **Human EPC mobilization and differentiation is influenced by exercise and by aging**  
Chang, E., Paterno, J., Chang, E., Rejadas, J., Edwards, K., Cooke, J. P., Gurtner, R. C.  
WILEY-BLACKWELL PUBLISHING, INC.2008: A24–A24
- **Aging and diabetes compromises endothelial progenitor cell function and differentiation**  
Chang, E., Paterno, J., Chang, E., Rejadas, J., Edwards, K., Cooke, J. P., Gurtner, G. C.  
WILEY-BLACKWELL PUBLISHING, INC.2008: A24
- **Ischemia-induced mobilization of bone marrow resident mesenchymal stem cells is impaired in diabetes** *93rd Annual Clinical Congress of the American-College-of-Surgeons*  
Thangarajah, H., Chang, E., Gurtner, G. C.  
ELSEVIER SCIENCE INC.2007: S64–S64
- **Adipose-derived mesenchymal stem cells mobilize to sites of ischemia and participate in postnatal neovascularization** *5th Annual Scientific Meeting of the International-Federation-of-Adipose-Therapeutics-and-Science*  
Thangarajah, H., Vial, I. N., Chang, E., Paterno, J. M., Gurtner, G. C.  
WILEY-BLACKWELL.2007: 3283–84
- **Endothelial progenitor cells participate in nicotine-mediated angiogenesis** *JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY*  
Heeschen, C., Chang, E., Aicher, A., Cooke, J. P.  
2006; 48 (12): 2553-2560
- **A central role for nicotinic cholinergic receptor-dependent pathways in regulation of endothelial cell migration - Novel insights into angiogenesis**  
Chang, E., Ng, M. K., Ishii, A., Wang, B., Cooke, J. P.  
LIPPINCOTT WILLIAMS & WILKINS.2004: 219
- **Nicotine administration significantly alters peripheral, bone marrow and splenic stem cell populations in C57/BI6 mice** *53rd Annual Scientific Session of the American-College-of-Cardiology*  
Chang, E., Wang, B. Y., Forsberg, C., Allsopp, R., Weissman, I. L., Cooke, J.  
ELSEVIER SCIENCE INC.2004: 490A–490A
- **Genetic determinants of nicotine-induced angiogenesis** *52nd Annual Scientific Session of the American-College-of-Cardiology*  
Chang, E., Wang, Y., Bui, H. M., Jacobi, J., Heeschen, C., Jang, J. J., Cooke, J. P.  
ELSEVIER SCIENCE INC.2003: 256A–257A
- **Aging and survival of cutaneous microvasculature** *JOURNAL OF INVESTIGATIVE DERMATOLOGY*  
Chang, E., Yang, J. W., Nagavarapu, U., Herron, G. S.  
2002; 118 (5): 752-758
- **eNOS activity is reduced in senescent human endothelial cells - Preservation by hTERT immortalization** *CIRCULATION RESEARCH*  
Matsushita, H., Chang, E., Glassford, A. J., Cooke, J. P., Chiu, C. P., Tsao, P. S.  
2001; 89 (9): 793-798

- **Microarray analysis of replicative senescence** *CURRENT BIOLOGY*  
Shelton, D. N., Chang, E., Whittier, P. S., Choi, D., Funk, W. D.  
1999; 9 (17): 939–45
- **Telomerase expression in human somatic cells does not induce changes associated with a transformed phenotype** *NATURE GENETICS*  
Jiang, X. R., Jimenez, G., Chang, E., Frolkis, M., Kusler, B., Sage, M., Beeche, M., Bodnar, A. G., Wahl, G. M., Tlsty, T. D., Chiu, C. P.  
1999; 21 (1): 111–14
- **Expression of telomerase increases the lifespan of primary cells without induction of transformation.**  
Lebkowski, J., Jiang, X. R., Chang, E., Frolkis, M., Morin, G., Lichtsteiner, S., Jimenez, G., Beeche, M., Wahl, G., Sage, M., Tlsty, T., Bodnar, A., Chiu, et al  
W B SAUNDERS CO.1998: 198A
- **Identification and cloning of a sequence homologue of dopamine beta-hydroxylase** *GENE*  
Chambers, K. J., Tonkin, L. A., Chang, E., Shelton, D. N., Linskens, M. H., Funk, W. D.  
1998; 218 (1-2): 111–20
- **TELOMERE LENGTH AND REPLICATIVE AGING IN HUMAN VASCULAR TISSUES** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
CHANG, E., HARLEY, C. B.  
1995; 92 (24): 11190–94
- **TELOMERE SHORTENING IS ASSOCIATED WITH CELL-DIVISION IN-VITRO AND IN-VIVO** *EXPERIMENTAL CELL RESEARCH*  
ALLSOPP, R. C., CHANG, E., KASHEFIAAZAM, M., ROGAEV, E. I., PIATYSZEK, M. A., SHAY, J. W., HARLEY, C. B.  
1995; 220 (1): 194–200
- **THE RNA COMPONENT OF HUMAN TELOMERASE** *SCIENCE*  
FENG, J. L., FUNK, W. D., WANG, S. S., WEINRICH, S. L., AVILION, A. A., CHIU, C. P., ADAMS, R. R., CHANG, E., ALLSOPP, R. C., YU, J. H., LE, S. Y., WEST, M. D., HARLEY, et al  
1995; 269 (5228): 1236–41