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Optimizing the microenvironment of human pluripotent stem cells to maximize our understanding in their biology and their potential in regenerative medicine

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Human pluripotent stem cells (PSC) - embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs) - have significant implications in regenerative medicine. However for their effective use in clinical applications, like cell therapy, these cells must be derived and cultured in clinical-relevant conditions. Current practices to culture hPSCs *in vitro* that depends on feeder cells or extracellular matrices are non-cost effective, undefined, inconsistent. They also haveincreased risk of contamination by xenogeneic components,viral and non viral pathogens which hinder their use to treat debilitating human diseases. Our research hascontributed to overcomingthese roadblocks by the development of synthetic polymer coatings and xeno-free culture conditionsthat support the culture and derivation of clinical-relevant hPSCs. Using these conditions we have generated transgene integration-free hiPSCs with proven self-renewal, pluripotency and genomic stability in long-term *in vitro* culture. Furthermore, these culture conditions also allow us to test mechanistic studies aimed at resolving how hPSCs interact with their extracellular environment to remain in a unique undifferentiated state and to make fate-changing lineage decisions. In future directions, we envision that in combination with high-throughput screenings, the use of small molecules, gene-transfection libraries and directed chemical manipulations, synthetic substrates will facilitate the development of defined culture conditions for multiple cell-lineage commitment of hPSCs. Thus, the establishment of defined culture conditions allows us to test the molecular basis of pluripotent stem cell self-renewal and cell-lineage differentiation, the derivation of transgene-free hiPSCs, facilitate their large-scale expansion and pave the way for their clinical application.

Biography

Luis G. Villa-Diaz got his DVM degree from Universidad Veracruzana in Mexico, a Master in Applied Sciences from Lincoln University, New Zealand, and his Ph.D. from Kobe University, Japan. His post-doctoral experiences include work at University of Michigan Medical School, at the Ob&Gyn Department, and at University of Michigan School of Dentistry in the lab of Paul Krebsbach. He is currently a faculty member in the School of Dentistry working with Dr. Krebsbach. He has published close to 15 papers in reputed journals such Nature Biotechnology, Nature Protocols, Stem Cells, ACS Nano, etc.

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