UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

Poster Session 2

Commons West, Easel 7

1:00 PM to 2:30 PM

Assessment of Quantum Dots on Proliferating and Differentiating Male and Female Human Neural Progenitor Cells in Vitro

Thanh (Tanya) Truong, Senior, Environmental Health
Youjun Suh, Senior, Biochemistry
Mentor: Elaine Faustman, Environmental & Occupational Health Sciences, Institute for Risk Analysis and Risk Communication
Mentor: Sungwoo Hong, Environmental & Occupational Health Sciences

The application of quantum dots (QDs) is increasing in optical manufacture (solar cells), biological and chemical devices (cancer research). Exposure to QDs can potentially lead to a variety of adverse health effects especially for children and pregnant women. The goal of this study is to determine the toxicity of CdSe/ZnS QDs on brain development of both sexes using in vitro techniques. To determine sex-specific response, we used human neural progenitor cells (hNPC) lines derived from male (NSC-H14) and female (hNP1). An in-vitro model was established using an adverse outcome pathway (AOP) framework. We plated cells in proliferation or differentiation media for treatment to assess the morphology and biochemistry response in cells. Two QDs, differing in their surface chemical properties: carboxyl functional group – ITK and polyethylene glycol (PEG) without reactive functional group (Qtracker) were assessed. Cadmium chloride (Cd) was also tested to determine whether the toxicity of QDs is associated with ion release. The NSC-H14 and hNP1 cells were exposed to QDs of concentration from 0, 2.5, 5, 10, 20 and 40 nM on days in vitro (DIV) 0. After 24 hours, we evaluated the number of cells remaining (cell viability) with an LDH assay at each dose treatment. The results showed that exposures to ITK QDs demonstrated significant dose-dependent decreases in viability of both cell lines during the proliferative stage. Male (NSC-H14) cells were more responsive than female (hNP1) cells to the cytotoxicity of ITK. We did not observe significant dose response for Qtracker and Cd at the same dose range as ITK, either in proliferation nor differentiation stages of both male and female cell lines. Our results indicate that the coating on quantum dots may play a significant role in the exposure and toxicity of the cells, suggesting potential strategies to reduce the adverse health effects of quantum dots.

Session 2E

Animal Responses to their Environment

Session Moderator: Jay Parrish, Biology

MGH 238

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Characterizing *In Vitro* Testes Co-Culture for Safety Assessment: Characterization of Testes Longitudinal Cellular Dynamics *In Vitro*

Youjun Suh, Senior, Biochemistry
Mentor: Elaine Faustman, Environmental & Occupational Health Sciences, Institute for Risk Analysis and Risk Communication
Mentor: Sungwoo Hong

Building upon our rat testicular o-culture system developed to improve evaluation of chemicals and identify their potential adverse health effects on humans, we have designed *in vitro* mouse system to expedite such assessments. Models of *in vitro* cell cultures are, however, limited in their approach typically using a monoculture of single cell types. Using a 3 dimensional organotypic approach can provide a framework for evaluating systematic interactions between cells with a goal to reduce the need for *in vivo* assessments. We utilized a novel organotypic, *in vitro* model of testicular development that mirrors the development shown by *in vivo* studies. We used isolated testicular tissue harvested from C57BL/6 male mice on post-natal day 9 and digested into a single cell suspension. Testicular co-cultures were maintained for up to 16 days in 24 well plates. Data collections occurred at days *in vitro* (DIV) 3, 7, and 16. These timepoints represent "windows of potential susceptibility" for testicular development. Plates were stained with antibodies providing markers corresponding to morphological features of specific cell type; six different primary antibodies were used as markers to visualize the change in cell populations; markers for Sertoli cells corresponded to Vimentin, Leydig cells with 3b-HSD, Germ cells to DAZL, SCP3 and c-kit, and proliferation with PCNA. We used an immunofluorescence dual staining technique with

Scanning Laser Image Cytometery (iCys) to quantify the proportion of cell types and to determine changes in phenotypic distribution of the cell population. Our observations *in vitro* demonstrated concordance of changes in Sertoli cells, Leydig cells and Germ cells throughout testicular development with similar trends *in vivo*. Our observation of similarities in testicular development in our 3 D *in vitro* experiment and *in vivo* studies is important and supports the current trends in minimizing the need for *in vivo* studies for chemical toxicological.