UC San Diego
JACOBS SCHOOL OF ENGINEERING
NanoEngineering

UC SAN DIEGO NANOENGINEERING SEMINAR

Wednesday, October 31st, 2018
Seminar Presentation: 11:00am – 12:00pm
SME 248

"Nano-enabled Chemotherapy and Chemo-immunotherapy for Pancreas and Solid Cancers"

Dr. Andre Nel
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Abstract: Pancreatic ductal adenocarcinoma (PDAC) is a deadly disease that is currently treated by two major drug regimens, namely gemcitabine, and a 4-drug combination known as FOLFIRINOX (oxaliplatin, 5-fluorouracil, Irinotecan, and leucovorin). In addition to the impediments of late diagnosis and early metastatic spread, a major treatment obstacle is the abundant dysplastic stroma, which provides a barrier to vascular access of chemotherapeutic agents at the tumor site as well as participating in drug resistance and a compromised immune response. While FOLFIRINOX leads to better survival outcome, the high toxicity levels of irinotecan and oxaliplatin prevent their use as a first-line treatment options. He have developed a mesoporous silica nanoparticle (MSNP) carrier, coated by a lipid bilayer, which can effectively deliver a synergistic combination of paclitaxel and gemcitabine, or irinotecan as a single drug. These "silicasome" carriers outperform commercial nanocarriers (Abraxane and Onivyde) in terms of efficacy as well as toxicity reduction in a rigorous orthotopic PDAC model. For example, the irinotecan carrier significantly reduces bone marrow and gastrointestinal toxicity compared to Onyvide. In addition to survival improvement by chemotherapy delivery, he has also developed a nano-enabled immunotherapy platform for PDAC and other solid cancers that is premised on the induction of immunogenic cell death (ICD) plus local delivery of a metabolic checkpoint inhibitor. A series of nanocarriers have now been developed for successful tumor killing at primary and metastatic cancer sites. We can also achieve ICD outcomes with catalytically active nanomaterials that induce the biological response pathways that culminate in the specialized form of cell death, concomitant with the ability to activate innate immune responses to provide effective immunotherapy outcomes.

Biosketch: Dr. Nel is a Distinguished Professor of Medicine at UCLA, where he has successfully established one of the largest federally-funded nanotechnology research programs in the US. Professor Nel is a recipient of the Harry Truman Award and received the 2013 California Governor's Environmental Economic Leadership Award. He served as a chair of an NIH study section and was a NSF panel member for producing a comprehensive US Government blueprint to further develop the Nanotechnology Initiative (NNI) from 2010-2020. He was a member of the US Bilateral Presidential Commission for technology cooperation with Russia, and served as a panel member on Pres. Obama's PCAST panel for strategizing the NNI technological innovation and commercialization. Dr Nel has represented the US State Department and the NIH in cooperative research agreements with Japan and the Chinese Academy of Sciences. He also co-directed a leading EPA Particle Center studying the impact of air pollution on asthma. Dr. Nel has been peer selected as one of the Best Doctors in America and received the John Salvaggio Award for outstanding service to the American Academy of Asthma Allergy and Immunology. He has been included as a Highly Cited Scientist (top 1% in the world of chemistry) by Clarivate analytics and frequently delivers plenary talks at international forums.

Dr. Nel's current research focuses on nano-cancer and nanosafety. His interest in nano-cancer is focused around pancreatic cancer, with a view to develop an engineered approach by targeting the cancer stroma, accessing stromal vascular mechanisms and generating a systemic immune response to the primary and metastatic tumor. The nano-enabled immunotherapy platform is premised on the induction of immunogenic cell death plus interference in an immunomodulatory pathway through the use of synergistic, dual-delivery carriers. He is the co-inventor of the silicasome platform, comprised of lipid bilayer coated mesoporous silica nanoparticles, which can be adapted for high drug loading of a large number of chemotherapeutics, including synergistic drug delivery, and the successful integration of chemo- with immunotherapy for the cancer treatment. His research on nanosafety is focused on developing high throughput screening approaches to assess nanomaterial behavior at the nano/bio interface for the purposes of developing product safety and safe implementation in the marketplace.