Career Prospects and Research Opportunities in Cutting Edge Scientific and Biomedical Sciences Areas in the United States

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This lecture presents details on career opportunities in biomedical sciences for students pursuing higher education in the United States. Students can choose to complete higher education at the Masters or PhD levels in a variety of areas of biomedical sciences including in cutting edge areas of nanoscience, nanomedicine and green nanotechnology. Biomedical aspects of oncology, antibiotics, neurological sciences, brain research and psychological sciences also offer a wide range of career opportunities. Higher education in the US encompasses both formal education and experimental work. Normally, dissertation writing will be the requirement for completing both the Masters level and PhD level programs.

Nanomedicine is an example of a cutting research field where we have excelled with global reputation at the Institute of Green Nanotechnology within the Medical School, University of Missouri, Columbia, USA. Cancer continues to be a major public health problem worldwide and there were an estimated 18 million cancer cases around the world in 2018 of which 9.5 million patients died. By 2040, the global burden is expected to grow to 27.5 million new cancer cases and 16.3 million cancer deaths simply due to the growth and aging of the population. The future burden will probably be even larger due to increasing prevalence of factors that increase risk, such as smoking, unhealthy diet, physical inactivity, and fewer childbirths, especially in economically transitioning countries. A number of new therapeutic interventions to combat various forms of human cancer have been developed over the last several decades. However, cures and lifesaving arrestation of this disease have been rare because tumors bear innate characteristics to become resistant to various forms of treatment. It is becoming increasingly clear that various chemotherapeutic, immunotherapeutic and radiation-based treatment modalities activate NF-κB transcription factors, which are responsible for triggering various pro-tumorigenic cascade of processes within the tumor microenvironment. Tumor progression and the evasion of systemic immune surveillance are all dictated by significantly high levels of various immunosuppressive factors, such as IL-10, IL-6, and TGF-β. Tumor progression is further catalyzed by the immune cells, including regulatory T cells, dendritic cells, MDSCs and TAMs, which are known to express a low level of MHC class I molecules within the tumor microenvironment. Most cancer drugs, in current use which belong to specific targeted or cytotoxic agents, rely on "one gene, one target, one disease" approach despite the fact that cancer is a very complicated multi-target and multi-gene defective disease. However, several examples of phytochemical-based therapeutic approaches have shown the power of cocktail of phytochemicals in traditional Indian Ayurvedic (Chinese and African) medicines to be multi targeted by enhancing the $CD4^+/CD8^+$ T cell ratio in the tumor microenvironment. Herbal-based Ayurvedic medicine are also known to reeducate the macrophage by promoting the M1 differentiation of TAM, suggesting the poly-pharmacological and poly-targeted nature of phyto agents

This lecture will discuss career opportunities on the application of innovative Green Nanotechnology discoveries, made in Dr. Katti's laboratory, to develop novel nanomedicine agents derived from combination of tumor specific phytochemicals encapsulated onto

biocompatible gold nanoparticles. The longstanding objective of this approach focuses on providing credible scientific rationale to phytochemical-based herbal (Ayurvedic) nanomedicine—all aimed at developing new Precision Medicine modality referred to as 'Nano-Ayurvedic Medicine. Green Nanotechnology also allows the development of reproducible formulations of herbal and classical Ayurvedic Nanomedicines, thus providing a pathway for clinical trials for internal/external validity, to allow the safety and efficacy of specific herbal medicines in a more accurate and scientifically verifiable way. This lecture will discuss details on how green nanotechnology can be used to develop small-molecule phytochemical(s)-functionalized gold nanoparticles to simultaneously achieve: (i) Inhibition of NfkB activation; (ii) Targeting TAMs; and (iii) Inhibition of TNF-α induced p65 phosphorylation; and concomitant immunomodulatory therapeutic action. Details on the new invention of a medical modality, referred to as 'Nano-Ayurvedic Medicine', recently approved by the US Patents and Trade Marks Office will be presented. The lecture will also highlight the importance of clinical translation in medical research through recent results from human clinical trials on cancer patients of Nano-Ayurvedic Nanomedicine drugs derived through green nanotechnology. The overall importance of green nanotechnology in graduate education and toward developing nanomedicine agents for use in oncology and antibiotics with specific examples of recently commercialized pharmaceuticals would be presented. In addition to results on the frontiers of nanomedicine, ***this lecture will present outstanding opportunities for prospective French and International students for graduate education in the United States of America.***