Dr. Kattesh V. Katti's research is focused on the development of molecular imaging and therapy agents including gamma- and positron-emitting isotopes for imaging and beta-emitting isotopes for therapy. The fundamental work in main group, transition metal, radiometal and bioconjugate chemistry has resulted in major discoveries on the utility of functionalized chemical precursors toward the development of tumor specific macro and nano-materials for molecular imaging and therapy of cancer, osteoarthritis and cardiovascular diseases. Dr. Katti's pioneering work in green nanotechnology has paved the foundation for the utility of gold nanoparticles in molecular imaging and therapy. This research has led to the development of innovative theranostic tumor-specific gold nanoparticles and the corresponding radioactive gold nanomaterials from Au-198 and Au-199 isotopes. Dr. Katti's research goals are to discern quantitative, organ-specific whole-body measurements and to perform dynamic serial measurements, using SPECT/PET, MRI and CT imaging modalities to determine the fate of diagnostic and therapeutic probes in vivo.

The overarching aim of Dr. Katti's work continues to be the measurement of detailed toxicity profiles with the ultimate goal of translating his discoveries for clinical care in treating of human cancer patients. An important offshoot of Dr. Katti's work on radioactive nanoparticles is the discovery of innate tumor specificity of phytochemical-conjugated non-radioactive gold nanoparticles. This important transition from the radioactive gold to the non-radioactive gold nanoparticles has resulted in the design and development of gold nanoparticle-based immunotherapeutic agents. Through extensive in vitro and in vivo experiments, Dr. Katti has validated the creation of phytochemical-encapsulated biocompatible gold nanoparticles to develop fundamentally new approaches to cancer therapy. This new paradigm in the design of gold nanoparticles will allow investigations of pharmaceutical action, in real time, by probing specific types of cancers at cellular levels, invoking cross-talk among the primary tumor, the tumor microenvironment and macrophages.

The overall goal of developing tumor-cell-specific gold nanoparticles is driven by Dr. Katti's long-term objective to develop novel therapeutics that will directly target tumor-associated macrophages (M2-TAMs) to destroy tumors and slow down tumor growth and progression. Extensive data has been gathered to validate the central hypothesis of his studies that targeting of primary tumors and M2-TAMs using gold nanoparticles is an effective therapeutic approach for lethal breast and prostate cancer and potentially for other cancers. Dr. Katti's ongoing studies are focused on elucidating mechanisms of innate and selective affinity of phytochemical-functionalized gold nanoparticles to target mammary and prostate cancer cell surface receptors (e.g. Laminin) while targeting M2-TAM biology in tandem - all aimed at providing a better prognosis for treating patients who have been diagnosed with lethal triple negative breast and prostate cancers. The synergistic benefits of having gold nanoparticles conjugated with receptor specific phytochemical-derived vectors are expected to result in the development of tumor cell and tumor microenvironment specific therapeutics.