

## Medicine and Engineering -- New and Innovative Treatments of Diseases

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Medicine and Engineering have had a long history in collaborative endeavors. Throughout medical history, engineers have been partners in the development of new technologies. Early in the collaboration there was the development of prostheses, diagnostic devices such as stethoscopes, and then mechanical/electrical machines that have aided in the observation of human physiology (EKG machines) and diagnosis and treatment of illness (i.e., dialysis machines). The use of robotics in the treatment of diseases has allowed providers to perform surgery continents away from the patient. Portable, noninvasive, nonhazardous medical diagnostic devices are now available that can detect cardiac and respiratory conditions and thoracic and brain trauma in the field.

Telemedicine now provides us with the opportunities to deliver medical care to patients who in the past have not had access to medical care. Medical networking uses the skills of subspecialists to provide direction and education to health care providers miles from main medical facilities.

As we move further into the twenty-first century, medicine and engineering are exploring frontiers of diagnostic and therapeutic interventions not yet before imagined.

Nanotechnology is the science and engineering involved in the design, synthesis, characterization and application of materials and devices whose smallest functional organization in at least one dimension is on the nanoscale or one billionth of a meter. The agents of change will be microscopically small, future products of a new discipline known as nanotechnology.

Nanomedicine is the application of nanotechnology to medicine. It is the preservation and improvement of human health, using molecular tools and molecular knowledge of the human body. Nanomedicine will use engineered molecular systems and molecular knowledge of the human body to maintain and improve human health. Applications to medicine utilize materials and devices designed to interact with the body at a subcellular (i.e., molecular) scale with a high degree of specificity.

Nanomedicine is being used for applications in molecular diagnostics, nanodiagnostics, and improvements in the discovery, design and delivery of drugs, including nanopharmaceuticals. Nanobiotechnology forms the basis of many new devices being developed for medicine and surgery such as nanorobots. It has applications in practically every branch of medicine and examples are presented of those concerning cancer, neurological disorders, renal disorders, and infectious diseases.

Nanotechnology, the manufacturing technology of the 21st century, should let us build a broad range of complex molecular machines (including molecular computers) that will let us develop tools that will let medicine, for the first time, intervene in a sophisticated and controlled way at the cellular and molecular level. Nanomedicine will facilitate the integration of diagnostics with therapeutics and facilitate the development of personalized medicine, i.e. prescription of specific therapeutics best suited for an individual. Many of the developments have already started and within a decade a definite impact will be felt in the practice of medicine.