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Executive Summary *The medical response to the The m botic medical technology. Nanorobotics now in development have the potential to signifcantly impact human health by delivering new imaging and surgical techniques, as well as drug therapies, that are likely to improve morbidity and mortality outcomes in years to come.*

The Promise of Nanorobotics

Nanorobotics, also known as microrobotics, describes devices the size of a nanometer (nm) or one billionth of a meter (10^{-9} meters). Nanorobots are 200 times smaller than a red blood cell. Nanomedicine uses nanotechnology to prevent and treat human diseases. The miniaturization of robotic devices ofers signifcant potential for advancing medical treatment.[1]

Specifcally, nanorobots are being designed to perform biological tasks such as targeted drug delivery and microsurgery. Nanorobots have demonstrated initial proofs of concept for diagnosis, imaging, biopsy therapies such as radioactive drugs based on specifc diagnostic test results. Additionally, robotics on the nanoscale could be used to deliver biological components such as proteins, viral vaccines or antibodies. In fact, self-propelling nanorobots have been reported to deliver an attenuated vaccine in mice. Nanorobots also have potential use in collecting bacteria inside the body, leading to greater understanding of the human biome.[2,3,4]

Nanorobots, which are made up of artifcial as well as biological components, must frst be delivered into the body without causing unnecessary harm. The most common methods to deliver nanorobots are injection (60%), oral administration (30%), catheter (5%) and topical administration (5%). Self-propelling magnetic nanorobots are capable of navigation in biological fuids and can operate in small, difcult- to convert magnetic, light, acoustic or other forms of energy into kinetic energy or propulsion forces. The other method is self-propulsion, whereby a magnetic feld is applied to the robot, allowing it to make a motion like cilia in microorganisms. The nanorobot can then be accurately guided to a target location in the

body for drug release. Ultrasound is another external energy power source.

Retrieval of nanorobots after completion of a procedure presents another challenge. Methods include using a magnetic catheter (since nanorobots can be discharged from the kidney and collected in urine) or using biodegradable nanorobots.[4]