

# The MRI-Safe Robot.

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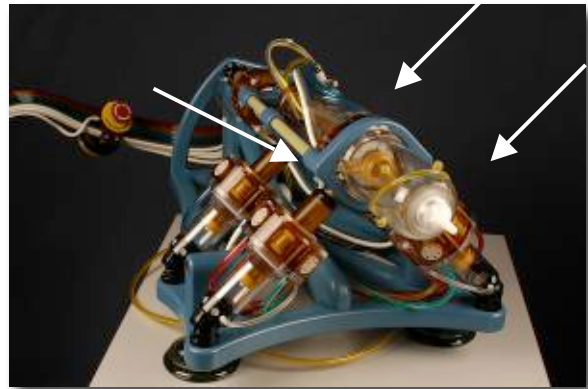
For the diagnosing of prostate cancer, a biopsy must be made of the tissue to ensure that the patient indeed is infected. Potential tumors are easily spotted through MRIs, but are not seen with many other commonly used imaging methods. Because of this, biopsies of the prostate are done almost blind, where multiple samples are often taken to guarantee an accurate sample reading. Because of the nature of an MRI, it is not very possible to retrieve the sample by way of conventional robotics due to electro-magnetic interferences that would occur between the two entities.

However, recently at Johns Hopkins University Urology Lab, a robot was developed which does not use any metallic parts or flowing current. The entire device is constructed of ceramic, plastics and rubber, and is powered by air and light. This new type of motor, called the PneuStep, allows the robot to move in a very precisely controlled, stepwise fashion. By doing this, the robot is able to enter the confines of any traditional MRI machine and extract a sample of the cancerous material.

The robot works using air to cyclically move gears against each other, allowing the pistons to move and control the position of the robot. The feedback information from the position of the robot and the position of the target are fed to and from the controlling unit via fiber-optic cables. Through preclinical trials, the device has exhibited very precise and steady movement down to 50  $\mu\text{m}$  (which is the size of the 'step' involved in the robot's movement) and only deviated from a target by a maximum distance of 1 mm. Moving in a stepwise

fashion allows the robot to have an inherent failsafe mechanism to stop the machine within 50  $\mu\text{m}$  of a problem.

This new product has many implications in the field of image-guided interventions, where a robot can now be used in conjunction with an MRI scan to be performing an otherwise difficult task in real time, ultimately saving time.



**Figure 1:** *MRI-Safe Robot with PneuStep motors (arrows).*

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