Toward Smart and Autonomous Robots for Surgery

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**ABSTRACT:** Research in medical robots has made remarkable progress in the last twenty years – with medical robots transitioning from experimental prototypes to commercial surgical systems that are now market leaders for many surgical procedures. As exciting as these advances have been, the future of medical robotics promises to yield even greater engineering and scientific accomplishments, which will lead to enhanced patient care such as fewer complications and faster procedure and recovery times. By developing new methodologies that increase the autonomy and improve image guidance we can enable them to perform tasks that were previously unimaginable.

In current robotic assisted surgery, proficiency with teleoperated master-slave systems depends solely on a surgeon’s technique and experience. Novel strategies and technological developments are required to take full advantage of the precision, speed, repeatability, maneuverability, and accuracy that robotics can provide. Computer-assisted and robotic interventions have the ability to allow for better pre-operative planning, merge pre- and intra-operative imaging, and to enable realistic simulation and training. My goal is to unlock the potential of robotic assisted surgery to enable new treatments, increase efficiency, and reduce complications for better patient outcomes. Specifically I investigate methodologies that (i) increase the smartness and autonomy and (ii) improve image guidance of medical robots to perform previously impossible tasks, improve efficiency, and improve patient outcomes.

**BIO:** Axel Krieger is the program lead for Smart Tools at the Sheikh Zayed Institute for Pediatric Surgical Innovation at Children’s National, leading a group of scientists and engineers in the research and development of robotic tools and laparoscopic devices. His expertise includes medical imaging, medical robotics, and integrated tool design. He holds several licensed patents for biomedical devices. He joined the Sheikh Zayed Institute after several years of experience in private industry at Sentinelle Medical Inc and Hologic Inc. His role within these organizations was Product Leader developing devices and software systems from concept to FDA approval and market introduction. He completed his undergraduate and master’s degrees at the University of Karlsruhe in Germany and his doctoral studies at Johns Hopkins, where he pioneered a MR guided prostate biopsy robot.