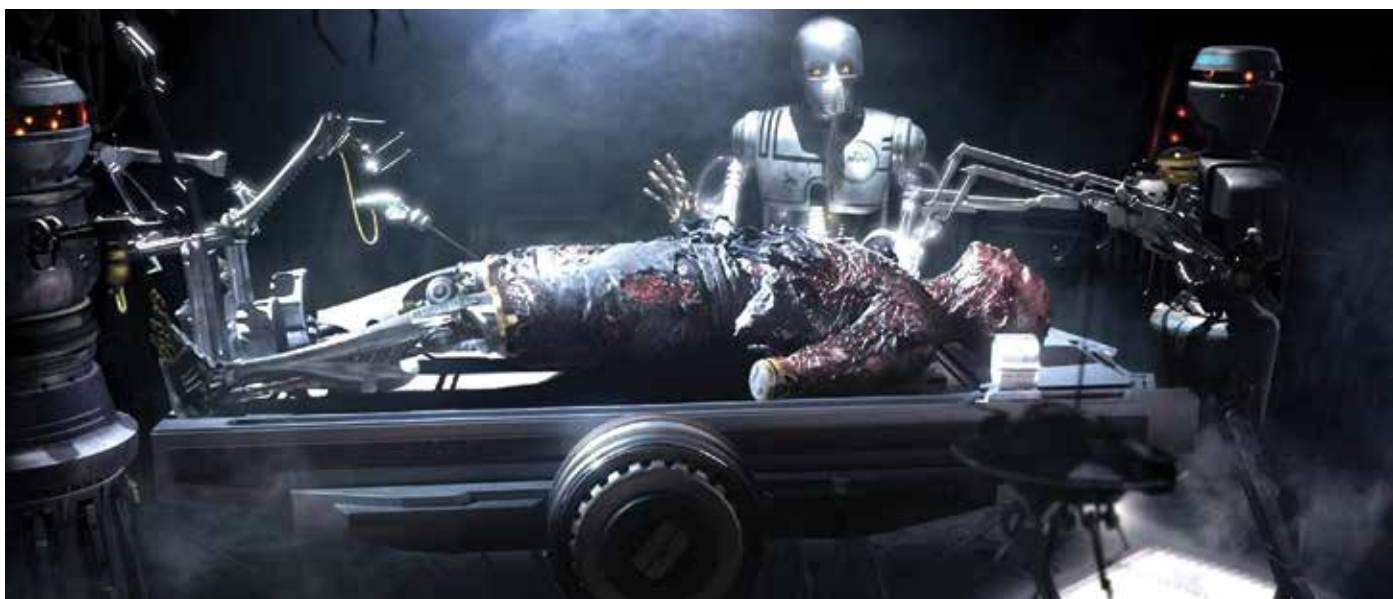




Netcare Waterfall
City Hospital



SCIENCE FICTION - SCIENCE FACT



Darth Vader undergoing robotic surgery. Image credit: *Star Wars. Episode III, Revenge of the Sith*, written and directed by George Lucas, produced by Rick McCallum. 20th Century Fox, Lucasfilm Ltd., 2013.

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I am fascinated by the idea that many of today's technological marvels were born in the imagination of science fiction authors and screen writers. Jules Verne, Aldous Huxley, Arthur C. Clarke, Isaac Asimov, Gene Roddenberry, George Lucas and others all imagined inventions in their books and films that would, years later, move from the realm of science fiction into science fact.

The 'tricorder' from Gene Roddenberry's 1966 television classic *Star Trek*, for example, uncannily predicts the functionality of modern smart phones.

When characters in science fiction stories are hurt and need medical care, one of a myriad of amazing, imagined medical devices is called into action. One such device, a commonly used sci-fi literary trope, is the robot surgeon. The characters of George Lucas' *Star Wars* stories, created for the first time in 1977, were cared for and operated on by robots. In *Star Trek Voyager*, released in 1995, the ship's doctor was a holographic doctor.

Today, nearly 40-years after the debut of *Star Wars* and 20 years after the first episode of *Star Trek Voyager*, robotic-assisted

"Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution."

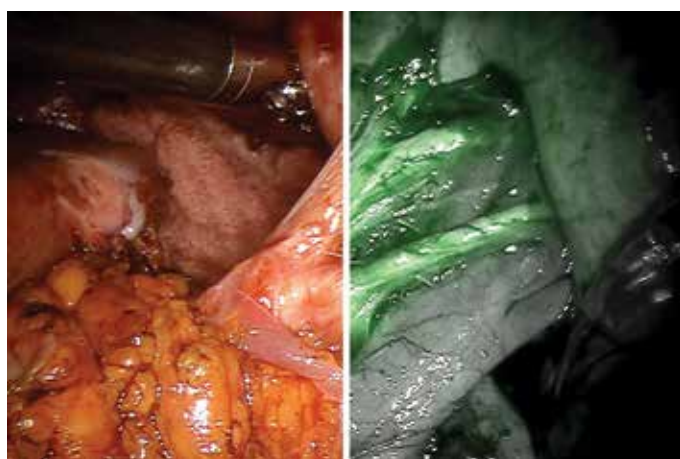
Albert Einstein.

surgery is as much part of science fact as science fiction. The da Vinci surgical system is arguably the best-known surgical robot. The first generation was launched in 2000 and there are currently more than 4 000 da Vinci robots in use worldwide. At Netcare Waterfall City Hospital, the da Vinci surgical system, one of three at Netcare hospitals, is used primarily for treating patients with prostate, kidney and bladder cancers.



Da Vinci robot prepped for surgery.

Perhaps the most significant difference between the robot surgeons of science fiction and the real-world surgical robots is the absence of autonomy. The surgical robots of Gene Roddenberry's and George Lucas' imagination autonomously operated on patients without human control. The da Vinci surgical system, on the other hand, is simply a tool in the hands of a human surgeon, much like a scalpel. It is much more advanced than a scalpel, however, providing surgeons with enhanced 3D vision with magnification, enhanced dexterity, greater precision and improved ergonomics. It allows for minimally invasive procedures requiring

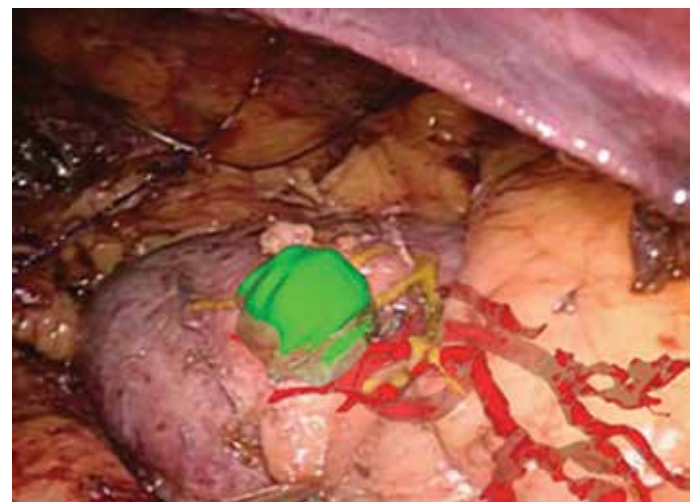


Firefly fluorescence imaging in action, demonstrating the arterial supply to the kidney. The left image shows normal vision, the right image shows fluorescence of the renal arteries. Image credit: Intuitive Surgical, <https://www.intuitive.com/en/products-and-services/da-vinci/vision>.

delicate dissection and reconstruction to be performed with fewer side effects and shorter hospital stays.

Novel technologies are being incorporated into surgical systems to enhance surgeons' senses and dexterity. One such technology is Firefly *fluorescence imaging*. Near-infrared technology, embedded into the camera of the surgical robot, allows for accurate visualisation of key surgical landmarks by the fluorescence of intra-venously injected indocyanine green dye.

Already in development is *augmented reality surgery*. Using cameras, tracking technology and other specialised equipment, pre-operative diagnostic imaging is superimposed over real-time surgical video. This provides the surgeon access to a virtual, rendered, composite image to identify the location of, for example, a tumour within an organ.



Three-dimensional model image of a kidney tumour (green) superimposed onto a surgical image. Image credit: Hekman et al.

Technology is advancing at an astronomical rate. In years to come, we may be diagnosed by a holographic doctor using computer-assisted diagnosis and operated on by an autonomous surgical robot; but then again, these may be nothing more than the crazy ideas of science fiction authors.

You can find more information on urologists offering robotic surgery at Netcare hospitals to treat prostate, kidney and bladder cancer at www.netcarehospitals.co.za/Specialised-services/Robotic-assisted

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