

Medical Robots That Are Changing the World

Advancements in medical technology are creating a world where robots may play a bigger part in healing the sick than doctors. Robotics experts have set their sights on the medical field. But what this does mean is that the medical field is on the brink of sweeping changes that could mean better diagnostics, safer and less invasive surgery, shorter waiting times, reduced infection rates, and increased long-term survival rates for everyone.

daVinci robot



Robotic surgical systems are telemanipulators in which a surgeon controls microinstruments remotely from a console. The daVinci robotic system is an integrated computer-based system consisting of two interactive robotic arms, a camera arm, and a remote control with three-dimensional vision capability. The daVinci robot uses instruments with six degrees of freedom that provide the same flexibility as the human wrist. The system conveys high-definition three-dimensional imaging to the surgeon at the console, and sensors register the surgeon's finger and wrist movements, which are translated (tremor free) into the motion of the microinstruments in the field.

Interchangeable instruments include a hook, round-tip scissors, forceps and large-needle drivers. The working robotic arms are attached to reusable 8-mm trocars, and the camera is placed through a standard 12-mm laparoscopic port. For optimal robot function and to minimize the risk of collisions, the angle created by the camera port and each working robotic port should be obtuse and the distance between the camera port and each working port should be at least one handbreadth. With telerobotic surgery, the motions of the surgeon at the remote control unit are replicated by the robotic arms placed inside the patient. Tactile feedback is not available with daVinci; therefore, an increased reliance on visual inputs is required. Using the daVinci system, operations can be done with just a few tiny incisions and with the utmost precision, which means less bleeding, faster healing, and a reduced risk of infection. The system allows control of operating instruments using two or three robotic arms through a remote location.

Robotic surgical systems offer several technical advantages: high magnification, three-dimensional imaging, and a degree of freedom in movement that surpasses the possibilities of the human hand and laparoscopic instruments. The system has revolutionized cardiac, urologic, gynecologic surgery, coronary revascularization and other types of surgery.

Exercises

Match the words to make collocations.

1. interchangeable	a. feedback
2. reusable	b. location
3. telerobotic	c. instruments
4. tactile	d. instruments
5. increased	e. precision
6. visual	f. surgery
7. utmost	g. trocar
8. operating	h. inputs
9. remote	i. reliance

Find all the words describing the words port and system.

Translate the following words into Polish.

1. capability	
2. convey	
3. definition	
4. forceps	
5. trocars	
6. obtuse	
7. handbreadth	

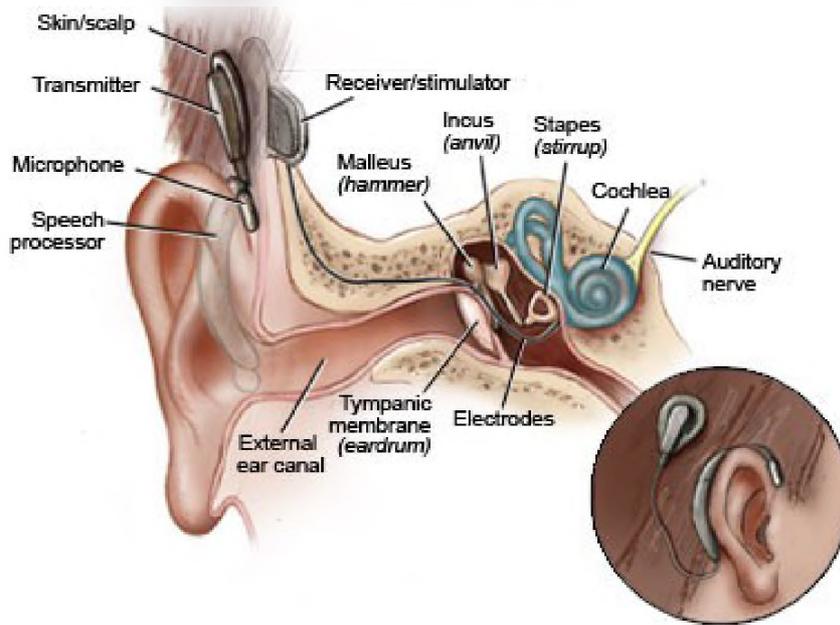
8. reliance	
9. incisions	
10. magnification	
11. surpass	
12. coronary revascularization	

Answer the questions.

1. What are the main elements of the robot?
2. What functions does it have?
3. What are the medical and technical advantages of the robot?

Neuroprosthetics

Cochlear Implant



Neuroprosthetics (also called neural prosthetics) is a discipline related to neuroscience and biomedical engineering concerned with developing neural prostheses. Neural prostheses are a series of devices that can substitute a motor, sensory or cognitive modality that might have been damaged as a result of an injury or a disease.

Cochlear implants provide an example of such devices. These devices substitute the functions performed by the eardrum and stapes while simulating the frequency analysis performed in the cochlea. A microphone on an external unit gathers the sound and processes it; the processed signal is then transferred to an implanted unit that stimulates the auditory nerve through a microelectrode array. Through the replacement or augmentation of damaged senses, these devices intend to improve the quality of life for those with disabilities.

At the MIT Biomechatronics lab, researchers have created gyroscopically actuated robotic limbs that are capable of tracking their own position in three-dimensional space and adjusting their joints upwards of 750 times per second. On top of this, they have developed bionic skins and neural implant systems that interface with the nervous system allowing the user to receive tactile feedback from the prosthetic and volitionally control it as you would with a normal limb.

Exercises

Translate all the words describing the cochlear implant in the picture.

Translate the words into Polish.

1. neural	
2. substitute	
3. cognitive	
4. modality	
5. auditory	
6. array	
7. augmentation	
8. volitionally	

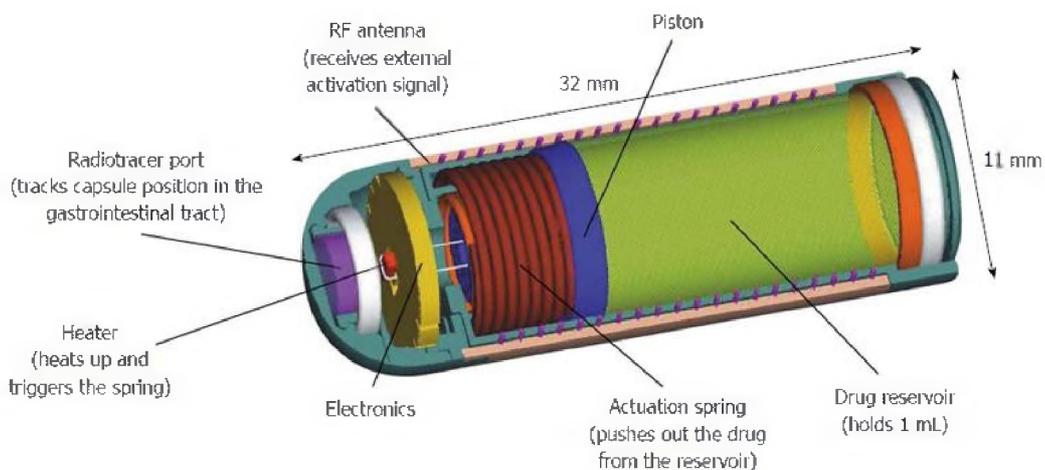
What prepositions follow the following words?

1. related _____
2. concerned _____
3. performed _____
4. stimulate _____
5. capable _____

Answer the questions.

1. What is neuroprosthetics?
2. What are neural prostheses?
3. What three examples of inventions in this area are mentioned in the text?

Endoscopy bot



An endoscopy is a procedure where a small camera on a long wire is inserted into the body through a “natural opening” to search for damage, foreign objects or traces of a disease. It’s an uncomfortable and delicate procedure that might also be a thing of the past. New improvements to the procedure make use of slender, flexible robots that can be driven to the exact spot the doctor needs. They can then hold there without the tremor of human hands, and deploy a wide range of tools for anything from taking a biopsy to cauterizing a wound.

Capsule endoscopy was developed in the mid-1990s and involves a wireless camera. The camera is small enough to fit into a capsule (roughly the size of a vitamin tablet) and can, therefore, be swallowed. As the capsule travels through the digestive tract, it takes thousands of pictures, which are transmitted to a device attached to a wearable belt. Capsule endoscopy is used to image the small intestine, a region that is difficult to image using standard endoscopy. It is also very useful for examining the small intestinal mucosa and diagnosing Crohn’s disease. The capsule usually passes through the digestive system within 24-48 hours.

Similar to robotically assisted surgery, robots in endoscopy are developed to overcome the limitations of standard diagnostic and therapeutic procedures. The main goal of this innovative biotechnology is

to improve precision, effectiveness, safety and reliability, enhance the interventional capabilities of endoscopists and to augment the field of possible interventions.

The range of diagnostic and therapeutic possibilities that endoscopy robots can be involved in is potentially unlimited. Endoscopy robots can calculate and reduce or increase the pressure on flexures and with this reduce or increase the amount of force applied to intestinal walls, bend and see backwards behind folds for 180°, calculate the best type of light for exposure for certain mucosal lesions etc. Furthermore, operative instruments as graspers, clips, electrocautery devices, loops and needles can emerge from the tip of the endoscope into the operative field and operate with movements in three dimensions.

Exercises

Match the names of medical examinations with the parts of the body they concern.

1. laparoscopy	a. lower respiratory tract
2. colonoscopy	b. urinary tract
3. bronchoscopy	c. ear
4. cystoscopy	d. abdominal cavity
5. otoscopy	e. organs of the chest
6. thoracoscopy	f. large intestine or colon

Find the words in the text that correspond to the definitions.

1. wire	a. thin or slim
2. to insert	b. to burn the skin or flesh of a wound with a heated instrument to stop bleeding
3. trace	c. to use or employ
4. slender	d. about
5. to enhance	e. a thin flexible rod made of metal
6. to deploy	f. an organ or tissue which has suffered damage through injury or disease, such as a wound, ulcer or tumour
7. cauterize	g. to succeed in dealing with a difficulty
8. roughly	h. a very small quantity of something
9. to overcome	i. a bent or curved part
10. lesion	j. to place, fit, or push
11. flexures	k. to intensify, improve the quality or value

Find the English equivalents for the Polish words.

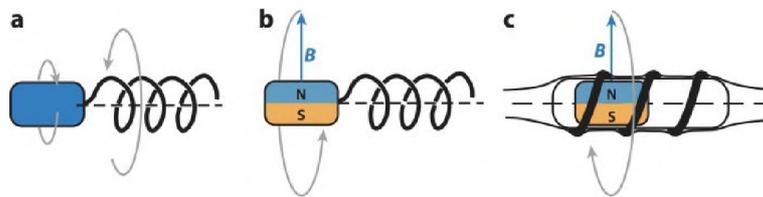
1. elektrokoagulacja	
2. zwiększać	

3. drżenie	
4. układ pokarmowy	
5. jelito cienkie	
6. błona śluzowa	

Answer the questions.

1. What is endoscopy?
2. What are the developments of this procedure in the field of robotics?
3. What are the advantages of endoscopy robots?
4. What possibilities do endoscopy robots give?

Targeted therapy micro-robot



Read the text and complete the gaps with the correct words.

layers, target, helical, relatively, radiation, uncovered, vessels, propels, variety, tract, particles

These are highly promising, though (1)_____ new types of medical robots. The basics of how they work is to use near-microscopic mechanical (2)_____ to localize a drug or other therapy to a specific (3)_____ site within the body. This could be used to deliver (4)_____ to a tumor, or simply to reduce the side effects of medication by confining it to the organ where it might be needed. What's really interesting here though is how the particles get to the target. There are a (5)_____ of possible methods, but new research has generated micro-bots with tiny, (6)_____ tails that can be directed by magnetic fields to spin themselves forward through blood (7)_____ to a specific spot in the body.

The microrobots are intended for treating tumors in the digestive (8)_____. The microrobots consist of microscopic spheres of magnesium metal coated with thin (9)_____ of gold and parylene, a polymer that resists digestion. The layers leave a circular portion of the sphere uncovered, kind of like a porthole. The (10)_____ portion of the magnesium reacts with the fluids in the digestive tract, generating small bubbles. The stream of bubbles acts like a jet and (11)_____ the sphere forward until it collides with nearby tissue.

Exercises

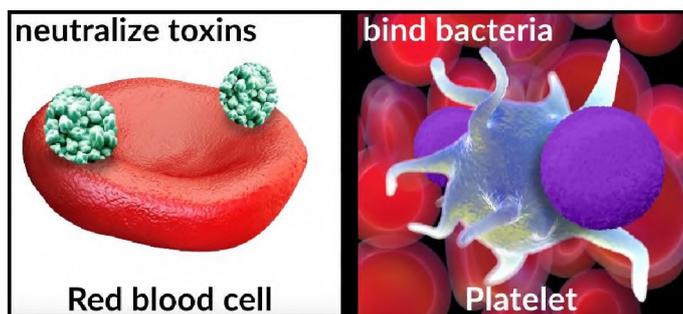
Find the English equivalents for the Polish words.

1. skutki uboczne	
2. ograniczyć	
3. wirować	
4. pokryty	
5. okienko	
6. zderzyć się	

Answer the questions.

1. What are the applications of this type of microrobot?
2. What does it consist of?
3. How does it move?

Antibacterial nanorobots



Antibacterial nanorobots are tiny machines made of gold nanowires (bling-bling) and coated with platelets and red blood cells that can actually clear bacterial infections directly from a patient's blood. They do this by basically mimicking a bacterium (and its toxin's) target, then ensnaring them in their nanowire mesh when the bacteria gets near. They can even be directed through a patient's body with targeted ultrasounds to speed up the clearance process and to treat localized infections. Best of all, because they take advantage of the bacteria's natural responses to clear them from the system, nanorobots can potentially be used in place of broad-spectrum antibiotics which could have an immense impact in our fight against the rise of antibiotic-resistant diseases.

Exercises

Find the synonyms in the text.

1. very small	
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2. covered with	
3. really	
4. imitate	
5. catch	
6. network	
7. accelerate	
8. make use of	
9. reaction	
10. huge	
11. influence	
12. impenetrable	

Answer the questions.

1. What are nanorobots made of?
2. What is their function?
3. How do they work?

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