



# Do You Know That Nanorobot Could Save Your Life?

Mohammed Alsanousi , Year 2 Medical Student

Faculty Of Basic Medical Science  
Libyan International Medical University



## Introduction

Robots is a machine can be guided by an external control device or the control may be embedded within (1). Use the term medical micro/nanorobots to refer to all nano- to micron-size structures (300 nm–300 μm) capable of converting power sources into kinetic energy. The clinical aspirations of medical micro/nanorobots are still beyond the current capabilities of nanotechnology and bioengineering. Nevertheless, recent engineering breakthroughs have led to the successful in operation of medical micro/nanorobots, illustrating initial proofs of concept for biopsy, delivery, and releasing cells .(figure1)

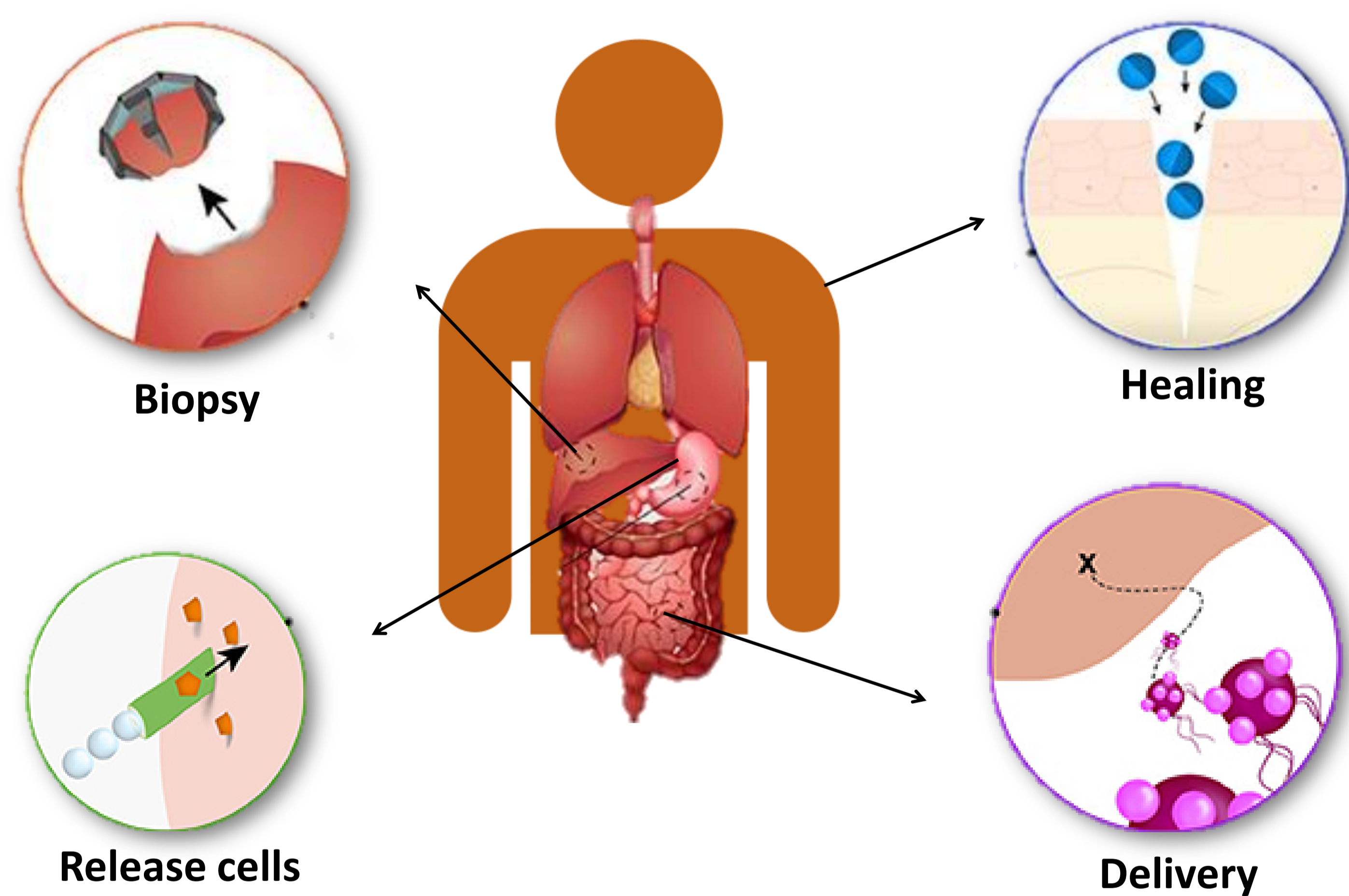


figure1 application of medical micro/nanorobots

## Groups of powered Nanorobot

**1-Biohybrid systems** integrate synthetic nanostructures with motile microorganisms as the **engine** of the micro/nanorobot. (2)

**2-Chemically powered micro/nanorobots** use **asymmetric catalytic engines** to selectively convert chemical fuels into locomotion that enhancement of the swimmer's diffusion properties upon powering-up both engines simultaneously is observed. (3)

**3-Physically powered nanorobots** convert external energy inputs (e.g., magnetic, ultrasound, or light fields) into translational motion based on engine geometry and material designs . (4)

## Medical application of nano/micro robot

### • Delivery of therapeutic for cancer therapy

magnetically guided nanorobots were used toward the delivery of *fluorouracil* medication for reducing tumor growth in a mice model. Biohybrid nanorobots have also been used for targeted delivery of payloads inside living animals. *Listeria monocytogenes* has been used to deliver attached nanoparticles containing a payload of genes and proteins within a mouse. These payloads were used to monitor gene expression. Magnetotactic bacteria, which naturally produce magnetic iron oxide nanoparticles, have been coupled with liposomes loaded with therapeutic payloads *in vitro* (5), as shown in (Figure 2)

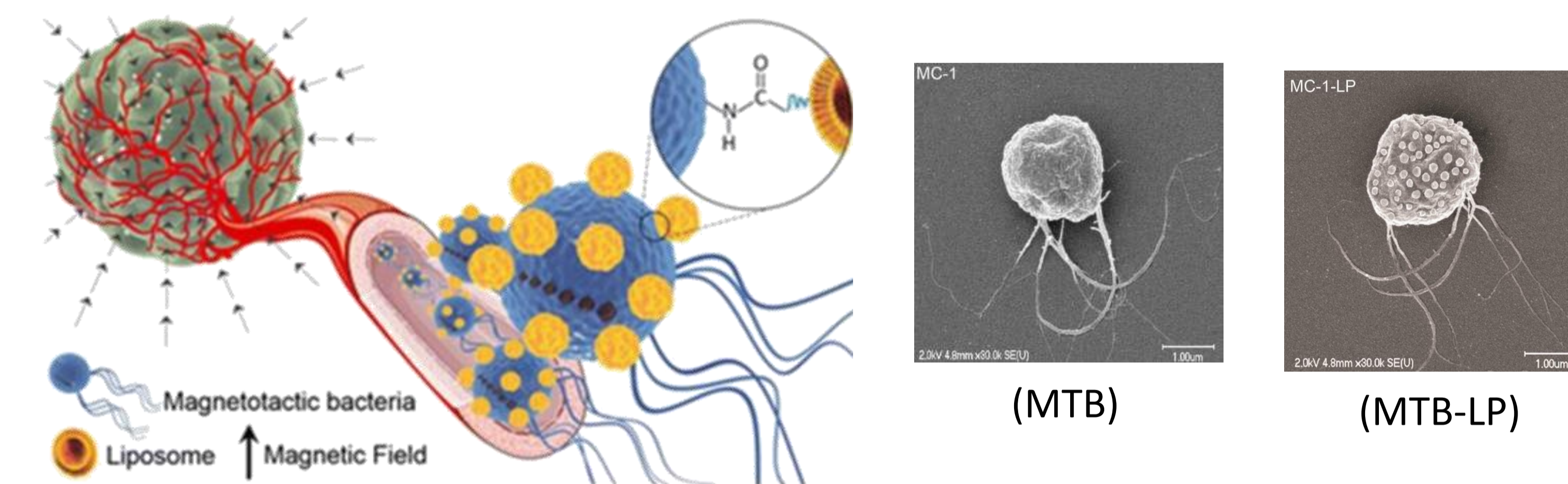


Figure2 attachment of liposomes to Magnetococcus marinus MC-1 magnetotactic bacteria (MTB) (5)

### •Transport and release of cells

Magnetically guided microrobots have been reported toward carrying and delivering live cells to targeted areas in the body. *In vivo* transport and proliferation of *HeLa* cells in a nude mouse model demonstrated that the carried cells could be spontaneously released from the microrobot to the surrounding tissues and proliferate (6) shown in (Figure3).

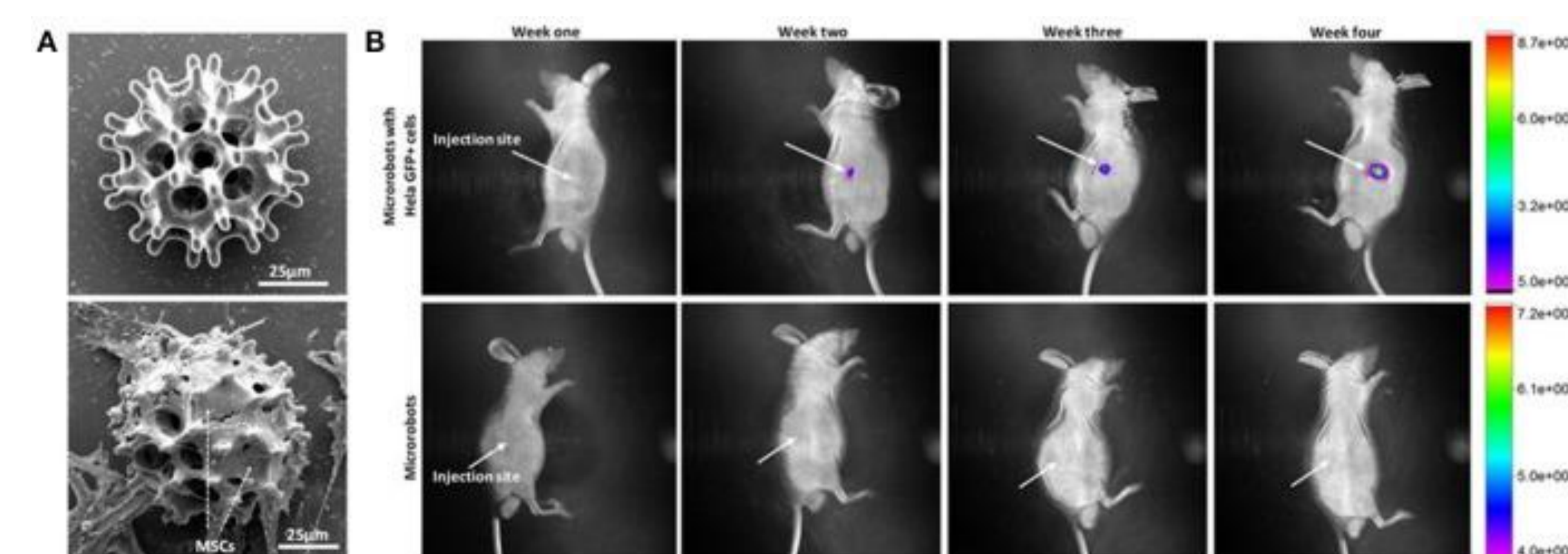


Figure3 Use of microrobots for cell transport and proliferation of cells (6).

### •Biopsy

Microrobots with star-shaped grippers, which can reach narrow conduits in the body, have been used to excise tissue samples from a porcine liver.

The tissue obtained by the μ-grippers was visible under optical microscopes (figure4-D). Our experiments prove that the μ-grippers can respond selectively to thermal cues and additionally be used to excise tissue samples without any external controls, wires or tethers.(7)

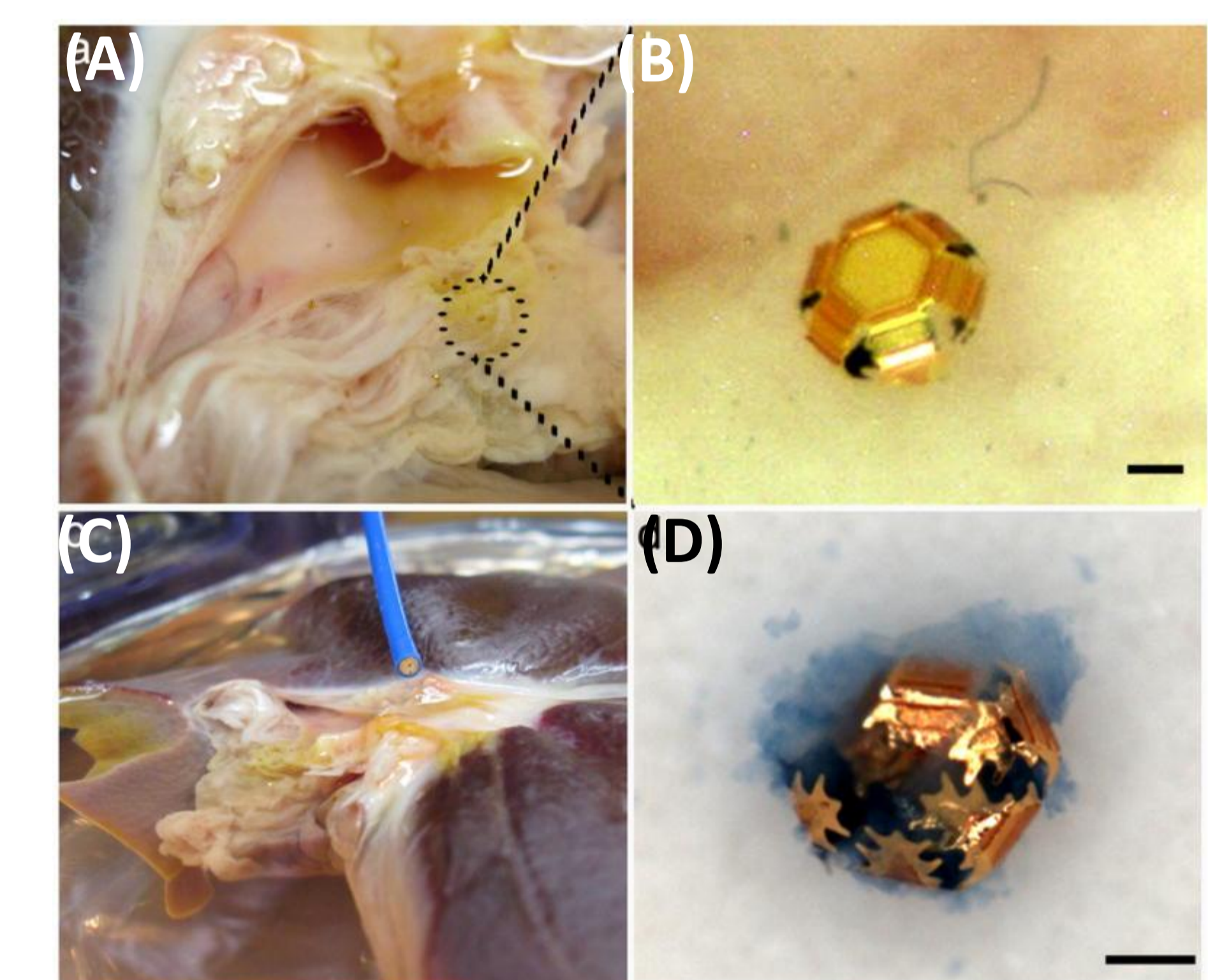


figure4 Tissue excision using untethered μ-grippers (7)

## Conclusion

In conclusion, Nanorobots may play a vital role in making diagnosis and healing process less complex because it facilitates some medical procedure, such as biopsy, delivery drug, and releasing cells.

## References

1. Definition of 'robot'. Oxford English Dictionary. Retrieved November 27, 2016
2. Bente K, Codutti A, Bachmann F, Faivre D. Biohybrid and Bioinspired Magnetic Microswimmers. *Small*. 2018;14(29):1704374.
3. Schattling P, Ramos-Docampo M, Salgueiriño V, Städler B. Double-Fueled Janus Swimmers with Magnetotactic Behavior. *ACS Nano*. 2017;11(4):3973-3983.
4. Pal M, Somalwar N, Singh A et al. Maneuverability of Magnetic Nanomotors Inside Living Cells. *Advanced Materials*. 2018;30(22):1800429.
5. Hoop M, Ribeiro A, Rösch D et al. Mobile Magnetic Nanocatalysts for Bioorthogonal Targeted Cancer Therapy. *Adv Funct Mater*. 2018;28(25):1705920.
6. Li J, Li X, Luo T et al. Development of a magnetic microrobot for carrying and delivering targeted cells. *Sci Robot*. 2018;3(19):eaat8829.
7. Gulpepe E, Randhawa J, Kadam S et al. Biopsy with Thermally-Responsive Untethered Microtools. *Advanced Materials*. 2012;25(4):514-519.