



Scuola Superiore
Sant'Anna

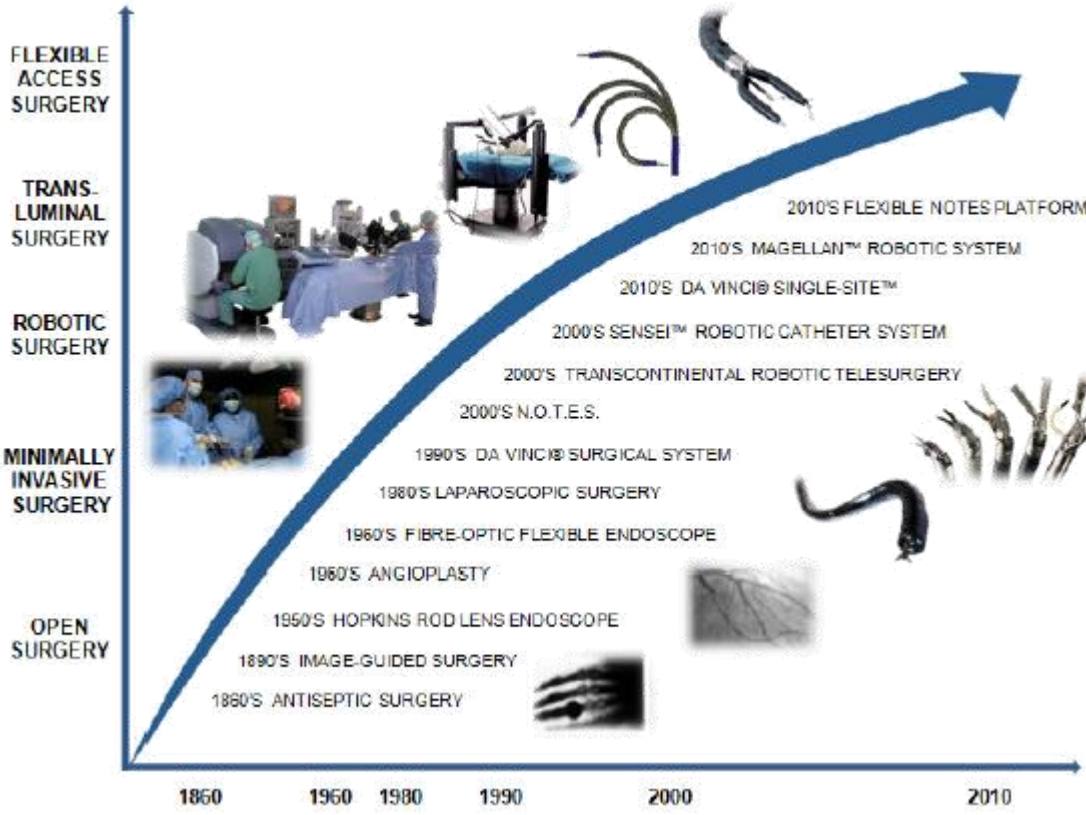
A modular soft manipulator with variable stiffness for minimally invasive surgery

Tommaso Ranzani, Matteo Cianchetti, Giada Gerboni,

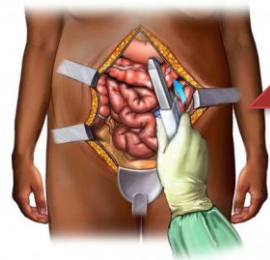
Iris De Falco, Cecilia Laschi, Arianna Menciassi

The BioRobotics Institute
Scuola Superiore Sant'Anna - Pisa, Italy

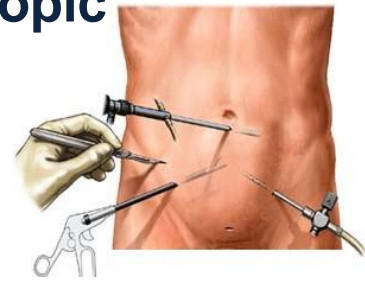
Minimally Invasive Surgery



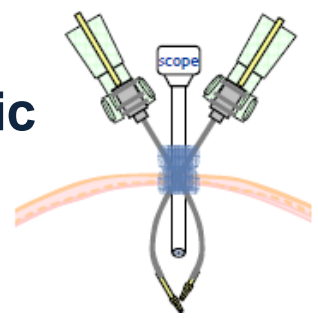
Open surgery



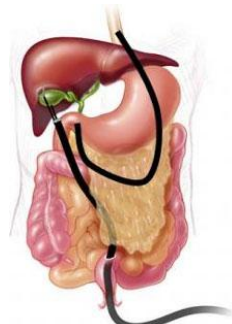
•Laparoscopic surgery



•Laparo-endoscopic single site surgery



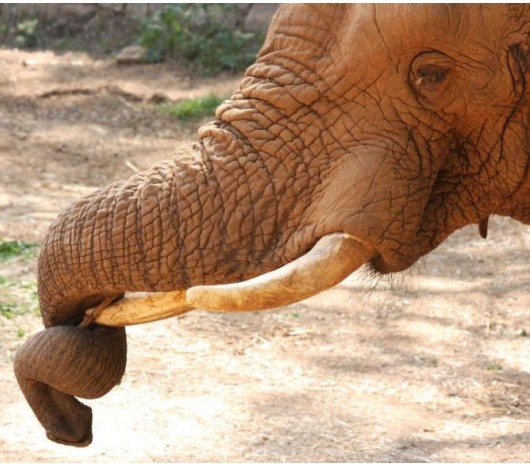
•Natural Orifice transluminal endoscopic surgery



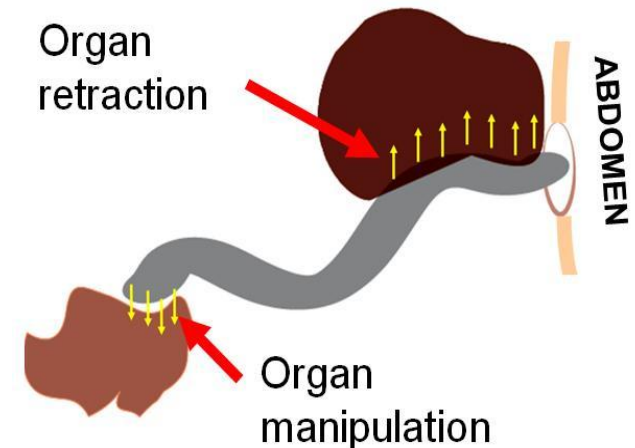
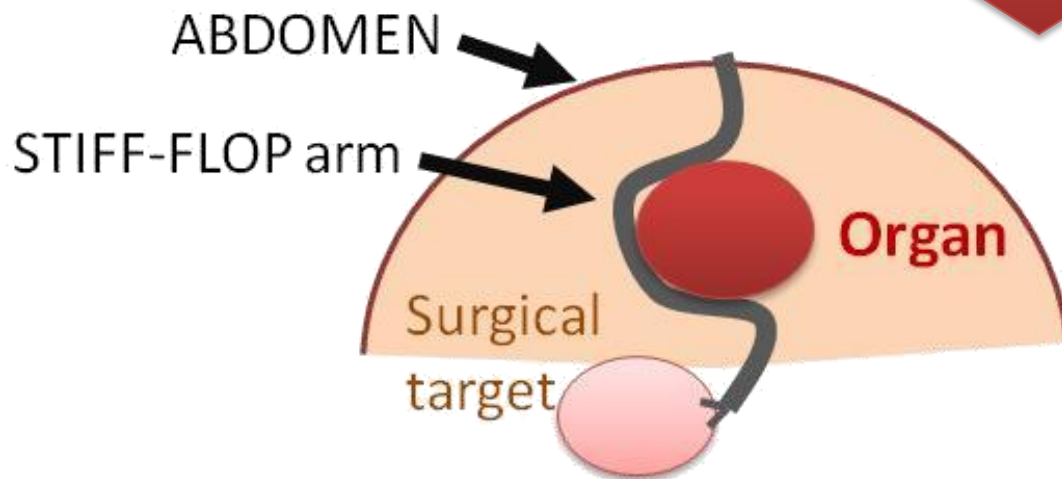
I N V A S I V E N E S S

Vitiello, V.; Su-Lin Lee; Cundy, T.P.; Guang-Zhong Yang, "Emerging Robotic Platforms for Minimally Invasive Surgery," *Biomedical Engineering, IEEE Reviews in*, vol.6, no., pp.111,126, 2013

Biological and bioinspired manipulators



The key aspect:
manipulate objects while
controlling the stiffness of
selected body parts and
being inherently compliant
when interacting with
objects



NOTES and Single port procedures

- Squeezability

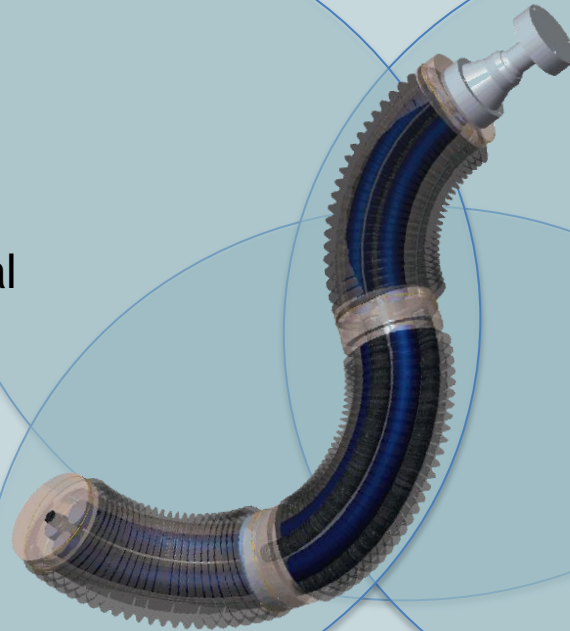
High dexterity

- Multi directional bending
- Elongation
- Precise maneuvers

Force
for reliable
traction

Controllable stiffness

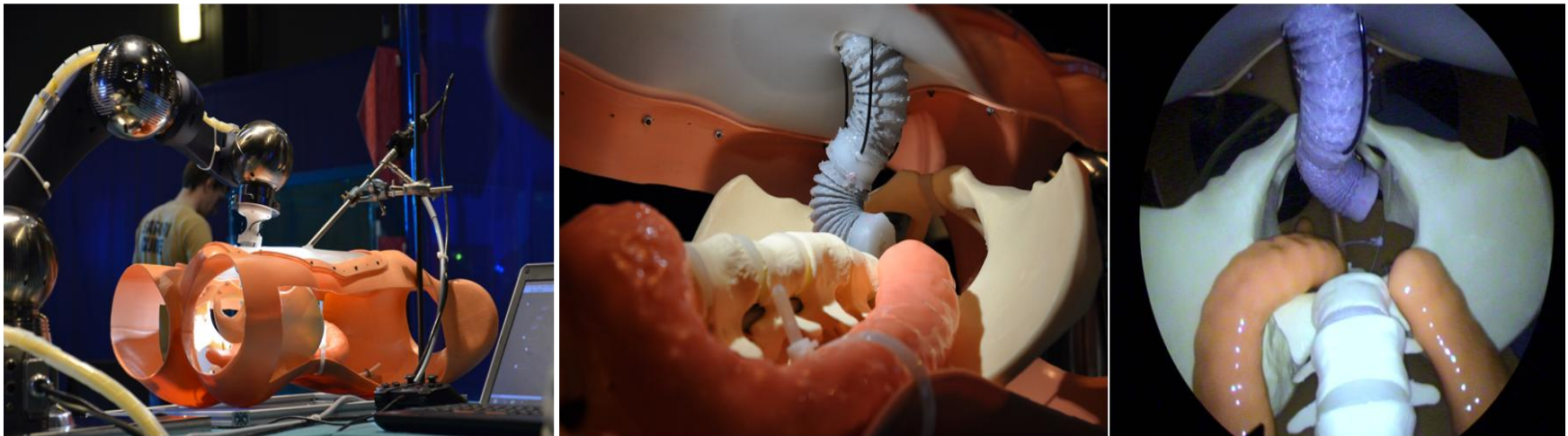
Adaptation of compliance
to different organs





Scuola Superiore
Sant'Anna

Thanks for your attention



M. Cianchetti, T. Ranzani, G. Gerboni, I. De Falco, C. Laschi, A. Menciassi "STIFF-FLOP Surgical Manipulator: mechanical design and experimental characterization of the single module", In proceeding of: 2013 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

M. Cianchetti and T. Ranzani, G. Gerboni, T. Nanayakkara, K. Althoefer, P. Dasgupta, A. Menciassi. SOFT ROBOTICS TECHNOLOGIES TO ADDRESS SHORTCOMINGS IN TODAY'S MINIMALLY INVASIVE SURGERY: THE STIFF-FLOP APPROACH. Accepted for publication on Soft Robotics (SoRo) 2014

M. Zimmermann, T. Ranzani, A. Menciassi, B. Kellner. "Development of a Cable Actuated Joint for a Surgical Robotic Flexible Arm." **Biomedical Engineering / Biomedizinische Technik**. ISSN (Online) 1862-278X, ISSN (Print) 0013-5585, DOI: 10.1515/bmt-2013-4406, September 2013