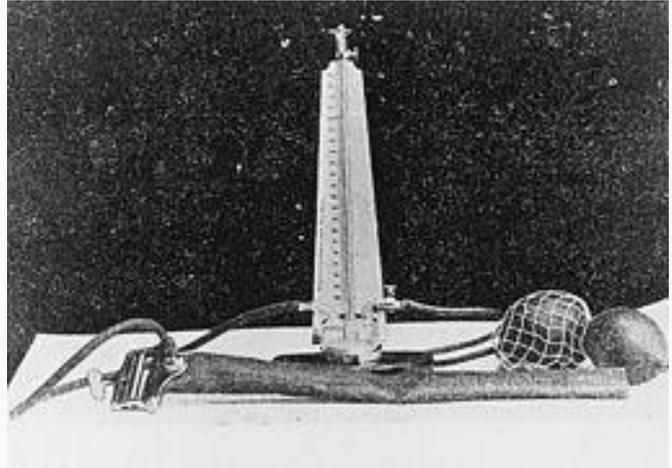


Historical Interface of Physics and Medicine: the Future of this Combination found in Surgical Robotics

There has long been an integration of physics into medical practice and understandings. From blood pressure cuffs, to X-rays, to MRIs, many of the tools used in medicine today would not have been possible without the background of physics. The work done by Dr. Christos Bergeles on surgical robotics advancements is no exception to this disciplinary combination.

Even as far back as the 1700s, physicists were influencing medicine by studying the pressure created by the blood in our bodies. In 1733, the first ever blood pressure was taken on a horse by Reverend Stephen Hales. A glass tube was inserted into an artery and the pressure was determined as the blood was forced upwards into the tube by the pumping of the heart. This influenced the production of a method to measure blood pressure. Thus, the sphygmomanometer was created and developed over a period of about 200 years to become widely used today (History of the Sphygmomanometer, n.d.)



An early sphygmomanometer.
(History of the Sphygmomanometer, n.d.)



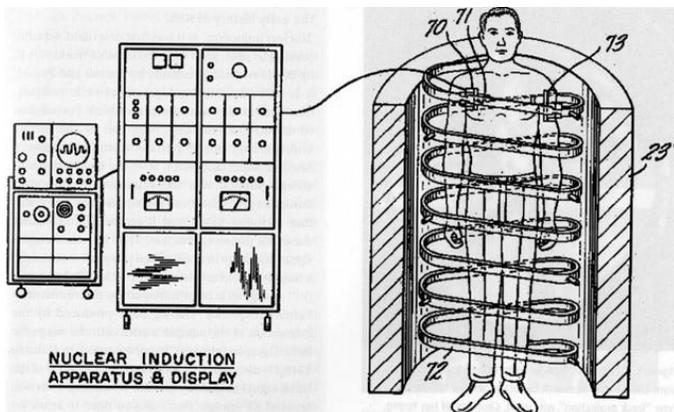
Roentgen and the X-ray of his wife's hand with her wedding ring clearly visible.
(November 8, 1895: ROENTGEN'S discovery of x-rays, n.d.)

The development of X-rays occurred later on during 1895 in the physics lab of Wilhelm Conrad Roentgen. During his experiments on light and emissions, he stumbled across 'invisible rays' that he later determined could penetrate human soft tissues, but not bone or metal. One of his first X-rays was done on his wife's hand, distinctly showing her wedding ring and bones. In less than four months after this discovery, X-rays were already being utilized by some physicians (November 8, 1895: ROENTGEN'S discovery of x-rays, n.d.). The rays found by Roentgen are known as electromagnetic waves and they pass through certain mediums differently, hence the images that X-rays can create of the human body. Today, the use of X-rays is everywhere and a generic practice that can be utilized to diagnose certain orthopedic injuries. It can also be utilized in mammograms or when diagnosing pneumonia (X-rays, 2020).

A more recent technology development with a historical physics basis is Magnetic Resonance Imaging (MRI). In 1937, a physics professor known as Isidor Rabi determined that nuclear magnetic resonance was possible. This was a method for measuring atomic nuclei movements. Other doctors and physicists applied this new method to imaging different substances such as human tissue, but physician Raymond Damadian was the first to successfully produce an image of the human chest in 1977 (Featured history: Magnetic resonance imaging, 2016). There have been changes made to the MRI technology since then and currently there are about 60 million exams that MRIs carry out per year (Featured history: Magnetic resonance imaging, 2016).



Columbia University physics professor, Isidor Rabi (far right).
(Featured history: Magnetic resonance imaging, 2016)

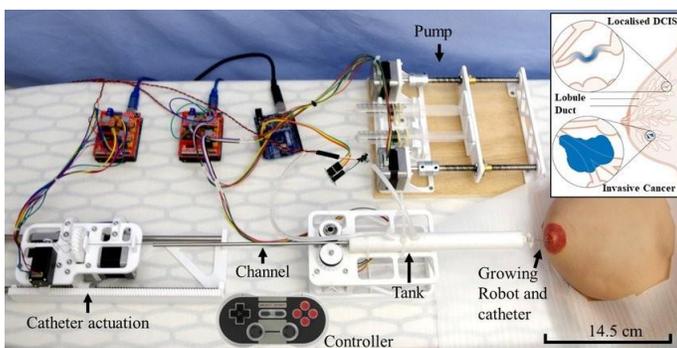


An early MRI sketch by Dr. Raymond Damadian.
(Featured history: Magnetic resonance imaging, 2016)

These prime examples of physics' influence and integration into medicine over time serve as precedents for what can be achieved with surgical robotics. Dr. Christos Bergeles is creating what his predecessors could only dream of and making history in the process.

His work involves developing new microrobots to surgically access incredibly difficult-to-reach areas by human standards. This allows for minimally invasive surgeries and decreased patient recovery time. It can also allow for diagnoses of certain diseases without biopsies. Just this year, work from Dr. Bergeles revealed research into a new microrobot that is able to access the mammary ducts of the breast. This bot can be steered through the breast tissue and was created specifically to help physicians make breast cancer diagnoses (Berthet-Rayne, P, et. al, 2021).

This revolutionary research and robotic development is made possible by the historic combination of physics and medicine. Using robotics in this fashion is destined to change the course of surgical intervention and continue to expand upon the relationship between the two disciplines.



The set up of the mammary robot (MAMMOBOT) created by Dr. Christos Bergeles and his team.
(Berthet-Rayne, P, et. al, 2021)

References

Berthet-Rayne, P., Sadati, S., Petrou, G., Patel, N., Giannarou, S., Leff, D. R., & Bergeles, C. (2021). MAMMOBOT: A Miniature Steerable Soft Growing Robot for Early Breast Cancer Detection. *IEEE Robotics and Automation Letters*.

Featured history: Magnetic resonance imaging. (2016, July 21). Retrieved March 05, 2021, from <https://rad.washington.edu/blog/featured-history-magnetic-resonance-imaging/>

History of the Sphygmomanometer. (n.d.). Retrieved March 05, 2021, from <https://www.adctoday.com/learning-center/about-sphygmomanometers/history-sphygmomanometer>

November 8, 1895: ROENTGEN'S discovery of x-rays. (n.d.). Retrieved March 05, 2021, from <https://www.aps.org/publications/apsnews/200111/history.cfm>

X-rays. (2020, November 05). Retrieved March 05, 2021, from <https://medlineplus.gov/xrays.html>

Photo References

Berthet-Rayne, P., Sadati, S., Petrou, G., Patel, N., Giannarou, S., Leff, D. R., & Bergeles, C. (2021). MAMMOBOT: A Miniature Steerable Soft Growing Robot for Early Breast Cancer Detection. *IEEE Robotics and Automation Letters*.

Featured history: Magnetic resonance imaging. (2016, July 21). Retrieved March 05, 2021, from <https://rad.washington.edu/blog/featured-history-magnetic-resonance-imaging/>

History of the Sphygmomanometer. (n.d.). Retrieved March 05, 2021, from <https://www.adctoday.com/learning-center/about-sphygmomanometers/history-sphygmomanometer>

November 8, 1895: ROENTGEN'S discovery of x-rays. (n.d.). Retrieved March 05, 2021, from <https://www.aps.org/publications/apsnews/200111/history.cfm>

X-rays. (2020, November 05). Retrieved March 05, 2021, from <https://medlineplus.gov/xrays.html>