

2024 PSBR High School Essay Contest
1st Place

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I first heard the term “laparoscopic surgery” in eighth grade. Its primary descriptor, “minimally invasive,” offered a degree of comfort; I had just been diagnosed with an exceedingly rare adrenal tumor and would be operated on. With little interest then in details, I soon realized how lucky I was to live in this age when the procedure is diffuse—a result of over 200 years of development.

In 1805, German physician Phillip Bozzini (1773-1809) took the first significant steps towards endoscopy and laparoscopy in observing canine bladders with his lechleiter (light conductor). A leather-wrapped lead contraption around 35 cm tall, Bozzini described how a wax candle and mirror lenses would “introduce a sufficient amount of light into...cavities” in the body and “bring the reflecting light-rays back to the eye of the examiner.” Although never using it on humans, Bozzini laid the foundation for the cystoscope and minimally invasive surgery.

A century later, at the 73rd meeting of the Society of German Natural Scientists and Physicians, physician Georg Kelling (1866-1945) also examined dog abdomens, aiming to understand how organs react to air. He recalled his 1901 experiments: “I devised a method of using an endoscope on an unopened abdominal cavity.” Carrying out the first celioscopy, Kelling recorded that pneumoperitoneum caused organs to shrink and lose color.

“Mr. Kelling has earned the right of being the first to have the idea of performing laparoscopic operations,” acknowledged his contemporary, Hans Christian Jacobeus (1879-1937), who built upon the groundbreaking work in 1910: he took benchwork and put it to practice, performing laparoscopy on humans. But “because he [Kelling] did not pursue it, I am claiming the right to be the first to describe it in clinical application of the laparoscopy,” he added.

Now considered the “father of laparoscopy,” Jacobeus recognized that the operation left organs prone to damage (it is primarily used on the abdominal area) and recommended refining the procedure using animals and corpses. Modern laparoscopy was emerging, and, as Jacobeus had suggested, animal research would remain crucial in its development.

Ultimately, laparoscopic surgery’s innovative and unique properties lie in its execution. Surgeons make small incisions and insert a fine rod with an attached camera into the target area; images appear on a monitor that the surgeon watches during surgery. Compared to open surgery, laparoscopy requires fewer stitches and dramatically reduces scarring, bleeding, pain, hospital stay, and recovery time. Several types of animals continue to be in research and training contexts for the procedure.

The different animals employed in laparoscopy research offer various benefits. Mice are cheap, have short life spans, and are stored efficiently. However, their size can be limiting when

trying to use standard laparoscopic tools and during imaging. Rats are better; their size is more suitable for practice, and their genetics (especially regarding cancer) and inflammatory responses can mirror those of humans.

Even larger porcines are increasingly common for laparoscopic animal experimentation, enabling the use of standard laparoscopic tools. Furthermore, their organs and genetics model human comorbidities and responses; one study by Dr. Eric M. Walters and Dr. Randall S. Prather stated that “the porcine genome is three times closer than the mouse genome to that of the human.” Additionally, they can be subjected to clinical procedures like CT scans.

As technology advances, low-maintenance and largely effective virtual reality (VR) simulations will likely usurp animal models in laparoscopic training; VR helps students internalize anatomical structures and improve spatial awareness. One 2021 study published in *Medicine* wrote that trainees who “reached proficiency in simulation-based training performed better and faster in patient-based settings than their counterparts without simulation-based training.” Additionally, VR targets areas of weakness without the ethical issues and costs associated with animal research.

Still, animal research remains valuable, as it allows students to hone their responsiveness to live tissue. For complex work and advanced trainees, wet lab practice is often superior to virtual simulations.

In 2023, over 15 million laparoscopic procedures were performed to diagnose conditions like appendicitis, facilitate weight-loss surgery, remove organs, masses, and more, all while reducing the risks posed by more complex procedures.

The development of this area of biomedical research is a product of innovation from past and present researchers. Animal research has been integral to advances and practices in laparoscopic surgery since its early days. As the biomedical field, and, specifically, surgical procedures, advance, it is undeniable that model animals will facilitate developments—even in the face of rapidly evolving technology—to create even safer and more effective techniques.

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