

The evolution of gynecologic endoscopic surgery over 50 years – a pleasant adventure

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Abstract:

Endoscopic surgery spans the wings from 1901 (Georg Kelling) till the cutting edge years with Raoul Palmer, Kurt Semm , Hans Frangenheim , Hans Lindemann and Jordan Philipps in 1985 in gynecology , It did experience further multispeciality progress from 1985 – 2017 with higher dexterity, precision , loss of anxiety, micro and robotic surgery, single , multiple ports and robotic technology. The evolution has just begun and will lead to a bright future. The influence of industry, which has kept pace and actively supported this development for years, is the driving force besides the heroes of doctors and engineers that bring up new ideas. Without suitable technology, this dissemination would

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not have been possible. Endoscopic development and its future does depend on new inventions, on the audacity of leading heroes, their input into this field but also on their management of life to continue to survive and on a healthy and successful cooperation with the medical technical industry and the governments of our countries which grant us the freedom of research and development for the best of all our patients.

In 1967 I attended a Medical meeting in Munich, Germany, and heard a lecture of Kurt Semm on Laparoscopic Surgery, it fascinated me.

Kurt Semm became the chairman of the Kiel University Department of Obstetrics and Gynecology in 1970. This was where I graduated from medical school. At that time working in the jungles of Peru in General Surgery at the Amazon Hospital Albert Schweitzer I applied for a residency position in Gynecology and Obstetrics at Kiel university. He wrote me back that I can start any time, mentioning that a “jungle girl” should know what she wants and he did not need to see any application papers. That makes up my 50 years with Endoscopic Surgery (1967-2017)

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1. History

Historically on the twenty-third of September 1901, Georg Kelling gave the historic lecture on ‘Tour of the oesophagus and stomach by flexible instruments’ to natural history scientists and doctors’ seventy-third meeting in Hamburg. He also introduced his new procedure that he called ‘Coelioscopy’ [1]. Kelling had used his oral air insufflation apparatus for the intra-abdominal insufflation together with a Nitze-cystoscope for illumination to see the abdomen of a dog, in animal experiment for the time.

“I question myself, how the organs will react to the air introduced inside? To find out, I have developed a method to introduce the endoscope in the closed abdominal cavity (Coelioscopy) (Kelling 1901).

After an interval of a century and considering the status of endoscopy today, one can evaluate Kelling’s endoscopic work of as follows:

- Contradicting the spirit of times, Kelling had favored the endoscopic procedure to exploratory laparotomy [2]
- With far sight Kelling challenged the stage wise treatment of malignancy and for this purpose sent repeated reminders for the primary use of endoscopic procedure [3].
- In 1901, Kelling advised –clearly foreseeing the problems in training young doctors, to practice endoscopic procedures on cadavers. A hundred years ago, dummies were not available to the pioneer of endoscopy
- Kelling, a visionary, had predicted use of endoscopic interventions particularly, laparoscopy as day care procedures (1901) [4].

In 1911 internist Hans Christian Jacobaeus (1879-1937) from Stockholm introduced the term, ‘laparothoracoscopy’ [5]. He was first to view thorax and abdominal cavity by endoscopy and recommended endoscopic technique to view other body cavities. In contrast to Kelling, he inserted the trocar directly without creating pneumoperitoneum. Jacobaeus began like Kelling by breaking down the adhesions under thoracoscopic vision.

Heinz Kalk (1895-1973), a gastroenterologist from Berlin, known as the founder of German school for laparoscopy, developed a 135 ° lens system and double trocar [6]. He used laparoscopy as a diagnostic method in diseases of liver and gallbladder. In the publication of his experiences in 1939, he reported over 2000 liver punctures under local anesthesia with no fatalities. He broke down adhesions by laparoscopy.

The insufflation of abdominal cavity by instruments was problematic for a long time. Kelling carried it out with the Fiedler trocar, which had a blunt “mandrin” to avoid injuries; Otto Goetze (1886-1957) who coined the term “pneumoperitoneum”, in 1918 produced a similar instrument with spring mechanism for air insufflation for contrast radiograms [7].

In the year 1938, the Hungarian, Janos Veress (1903-1979) developed a special cannula with spring mechanism –with the aim to create pneumothorax and consequently to treat tuberculosis which was prevalent at that time [8]. With little modifications the Veress needle is used still today to create pneumoperitoneum for laparoscopy. Its special mechanism prevents injury to the internal organs during needle insertion through the anterior abdominal wall.

In the 19 sixties gynecologists first began small operative interventions. However, the French gynecologist Raoul Palmer had already carried out laparoscopy in the Trendelenburg position in 1944. In this

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position the intestines were displaced out of the pelvis and consequently could be better assessed during the operation. Additionally, he required continuous gas insufflation, which was controlled automatically. Palmer also carried out the first laparoscopic sterilization in Paris.

The piercing of the umbilicus for the laparoscope by Raoul Palmer in 1946 was a groundbreaking procedure in gynecology. Like Kelling, he called the endoscopic diagnostic procedure ‘Coeloscopy’ and developed several methods to insert endoscope. The abdominal access involved many technical difficulties because of mainly blind insertion technique through the anterior abdominal wall [9].

In 1950 Hans Frangenheim (1920 – 2001) (Fig. 1) began his training in gynecology in Wuppertal, Germany with Anselmino and in 1951 came in contact with laparoscopy for the first time. He was called to the medical clinic in Cologne where a lower abdominal tumor was diagnosed during hepatoscopy and further line of treatment had to be decided. Looking back he wrote:

‘I sensed there, that a new aid had presented itself for the field of gynecology and so began to look into literature. A remark made by Kalk in a textbook had impressed me the most, which said, it is certain that gynecology would open a big field of indications for laparoscopy’.

From Wuppertal we visited the Paris lectural Raoul Palmer. For the development of laparoscopy he concentrated on regulating uncontrolled gas insufflation, developing new instruments and photographic documentation of endoscopic findings. He had difficult time with German endoscopy firms. Finally, with modified anesthesia equipment from Draeger, he succeeded in reducing the gas pressure from the customary 50mm Hg to 15 mm Hg. and restricting the carbon-di-oxide gas flow to maximum of 5 liters per minute. Frangenheim

even defined indications for the diagnostic laparoscopy in extrauterine pregnancy, chronic lower abdominal pain, sterility and ovarian tumours.

His monographs, ‘Laparoscopy and Culdoscopy in Gynecology’ [10], ‘Laparoscopy in gynecology, surgery and paediatrics’ [11], ‘Diagnostic and operative laparoscopy in gynecology- atlas with color illustrations’ [12] as well as countless publications and lectures contributed to further spread of the method. As clinic director in Konstanz he organized a European congress on endoscopy in Konstanz. On the occasion of his eightieth birthday Semm praised Frangenheim for his contribution with these words: ‘today the name, Frangenheim is inseparably associated with the gynecologic laparoscopic methods. His achievements for Germany and for the world are epoch making and will go down in the annals of history’ [13].

Kurt Karl Stephan Semm (1927-2003) (Fig. 2) is regarded in Germany as the real father of operative laparoscopy, which he started to evolutionize from 1970 – 1995 as chairman of the department of Obstetrics & Gynecology at the University Clinics Kiel, Germany. Already working under Richard Fikentscher (1903 – 1993) in Munich he developed a new universal abdominal insufflation equipment [14, 15]. He developed a pressure controlled apparatus called “CO₂ Pneumo” for insufflating CO₂ gas during laparoscopy to minimize operative risks of endoscopy [16]. This machine was already used from 1964 onwards at the second university clinic for women in Munich and created the pneumoperitoneum automatically [16]. The cold light (extracorporeal light that shone across a bundle of fibreglass) was simultaneously developed. Together, they eliminated intestinal burns and gas embolus that were the main dangers of gynecological laparoscopy. In spite of all the progress, world

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over the gynecological diagnostic laparoscopy was universally rejected.

At this time Semm was able to convince the German Insurance Companies to accept infertility treatment as a medical treatment. Laparoscopy was only considered as a diagnostic procedure. In order to be able to bill for an operative procedure, Kurt Semm created the word “Pelviscopy” for any procedure performed in the minor pelvis right after taking the chairmanship in Kiel. He completed the work already started in Munich since 1965. This new method spread quickly within Germany as a diagnostic procedure of female infertility. In 1967 Semm developed an electronic version called CO₂ – “Pneu Automatic” with the quadrotest for operative Pelviscopy [17].

After Semm demonstrated the “CO₂-Pneumo” at the congress of the American Fertility Association in Washington in 1969, Cohen published a book on this procedure in 1970. In USA, the acceptance of this new method of pelviscopic procedures in gynecology was phenomenal. Even though the method was used a million times, it was employed in 95% of the cases only for tubal sterilization, unlike in Europe [18], where Boesch already accomplished this 35 years before [19]. The ignorance about the laws of physics while using the high frequency energy in closed body cavities was the cause of many grave accidents causing burns to the internal organs like intestines and ureter. Such incidents once more deeply incriminated this method.

Fascinated by the idea, that pelviscopy can be used not only for sterilization but also for other operative purposes, Semm introduced in his new regimen for hemostasis in New Orleans in 1974. The use of high frequency current for creating destructive heat was not required in endocoagulation. The human body did not come in contact with the electrical energy. Optimal controlled hemostasis takes place at 110 °C. Between 1970 - 1980, the

high frequency current in the mono and bipolar techniques using inadequately covered apparatus led to uncontrollable burns, today, in clinical endoscopic practice also, it is ensured that the electro energy used under vision does not lead to burns. The modern coagulation and cutting equipment which work on mono and bipolar current have control mechanisms that minimize the risk of unintentional burns. Bi and monopolar instruments have a controlled, restricted coagulation zone [20].

Semm, who produced his own instruments, as he was a skilled instrument maker himself, built an automatic CO₂ insufflator in 1963, introduced thermo coagulation in 1973 and used for the first time the Roeder loop to stop arterial bleeding. For the laparoscopy he developed special suction irrigation equipment and an electronic insufflator. Difficult interventions were possible because of the methods of hemostasis (endosuture with intra and extra corporeal knots) developed by Semm and his range of instruments. However, many physicians, gynecologists as well as surgeons criticized Semm for his vehement use of the so-called “key hole” surgery. They were of the opinion that due to the modern anaesthetic techniques, big operations by laparotomy posed no problems and Semm had exaggerated the problems with subsequent adhesions. Some treated the news of the new spectrum of operations (oophorectomy or the removal of complete uterine appendages, treatment of tubal pregnancy) with disbelief and concluded that Semm has started his operation as laparoscopy and then ended it as conventional operation by laparotomy.

Semm was exposed to the most intense hostility of the German gynecologists (and endoscopic surgeons) when he carried out the first laparoscopic appendectomy in 1983 [21]. The surgeons especially saw no need to abandon the established operative method and to replace it with technically more difficult one. Semm’s first attempt at publishing his

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method therefore met with rejection. The fact that a gynecologist wanted to show the surgeons, how an operation should be carried out was simply unthinkable at that time. Semm had crossed the limit that was till then considered as sacrosanct. But he knew that endoscopic surgery had enormous potential not only in gynecology but especially in surgery and therefore continued with his endeavors in laparoscopy, unperturbed towards the goal, of reducing the surgical trauma to the patients. Two German surgeons, Friedrich Gotz and Arnold Pier followed Semm's intent and provided a wider base to laparoscopic appendectomy [22]. In the early nineties they had already carried out hundreds of appendectomies in this way and perfected the technique, which they could now use even in acute appendicitis [23].

In 1976 a 10mm morcellator (Semm 1976) was produced for pelviscopy purposes. However, in today's operative pelviscopy where even fist size myomata are removed from the uterus with little blood loss, this instrument is not very effective. So in 1988, the manually operated SEMM (Serrated Edged Macro Morcellator) of 15 to 20 mm diameter was introduced. The instrument could reduce a myoma of about 5cm size to small pieces within few minutes. The posterior colpotomy for removal of myoma or even a small abdominal incision was not required any more [24]. Since the introduction of horizontal morcellation, the morcellators are motorized and are available in 10 mm to 24 mm diameters.

Just like laparotomy, intra-abdominal irrigation equipment is necessary in laparoscopy also to guarantee good view. The aquapurator of 1974 gave way to CO₂-aquapurator in 1990. Today the aquapurator biotherm has removed many problems of hypothermia-even in operations of longer duration. In 1994, insufflation of preheated CO₂ was introduced to preserve isothermia.

In September 1985 a surgeon from Böblingen, Erich Mühe, (1938 – 2005) performed laparoscopic cholecystectomy for the first time in the world using Semm's instruments [25]. In 1986, Mühe reported 97 successful laparoscopic operations [26]. In the year 1989, Reich et al. described the first laparoscopic assisted vaginal hysterectomy [27]. Erich Mühe could not publish it as the German general surgeons dismissed him from his job. Later 7 years after his first laparoscopic cholecystectomy, the German Surgical Society recognized the significance of Mühe's work by awarding him the GSS Anniversary Award. Then in 1999, the SAGES officially recognized Mühe's LC and he presented "The First Laparoscopic Cholecystectomy: Overcoming the Roadblocks on the Road to the Future" in San Antonio, TX in 1999. Worldwide the French General Surgeon, Philippe Mouret from Lyon, considered as the first cholecystectomy surgeon performed by laparoscopy.

In 1983, the British urologist John E. A. Wickham (born in 1927) used the concept "minimally invasive surgery" for the first time. The concept attracted attention in 1987 after Wickham published his visions of extensive endoscopic treatment in the famous British Medical Journal [28]. In spite of the strong criticism it mirrored the general trend of the 80s as the minimally invasive techniques had greatly fascinated the doctors and their patients.

This development was further accelerated by crucial technological innovations. The introduction of new light sources (Palmer 1953), the Hopkins-optics (1960) and the cold light source had already improved the illumination in endoscopic operations in the 60s [29]. The video technique was also important. The new video camera was much smaller and therefore easier to manage than its predecessor and the videocassettes also were

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simpler for everyday use than the 8mm or 16mm film. In the 80s more surgeons used video cameras, but even the latest and smallest of the camera together with endoscope proved unwieldy because it altered the balance and made precision work difficult. Electronic minicamera brought the breakthrough: a 4 mm optoelectronic transducer (CCD) converted the view from inside the body cavity to electronic impulses and transferred them to the monitor. The combination of optic trocar and video camera opened new possibilities for the surgeons because now with both the hands free, they could operate ambidextrously and simultaneously follow on the monitor what was happening along with the entire team.

Another milestone of the realization of appendectomy by laparoscopy, which Kurt Semm started in patients that showed besides their gynecological problems sub-acute appendicitis, was the acceptance by U.S. general surgeons. Although we performed laparoscopic appendectomies since 1981 and numerous German general surgeons had visited Kiel for that purpose, only when Semm presented his laparoscopic appendectomy in Baltimore in 1988, J.B. Mckernan and W.B. Saye took it up and in June 1988 they reported the first laparoscopic cholecystectomy and appendectomy in USA using Semm's instruments and combining the procedure with laser technology. As a result many successful endoscopists visited both the protagonists in Nashville to learn the new technique. At the same time, Sung Tao Ko from Chicago upheld the laparoscopic appendectomy by Semm and brought his instruments to America. A paper on laparoscopic appendectomy that Kurt Semm and I submitted to the American Journal of General Surgery was rejected by declaring this as an unethical surgical technique. The same experience we also had in Germany when a lecture of Kurt Semm to the college of general Surgeons on Laparoscopic

Appendectomy was rejected as an unacceptable technology. The news about these sensational methods reached even the media in USA. During a TV talk show it was made public with the help of gall bladder operation. After that the Nashville surgeons received hundreds of calls not only from the patients but also from doctors.

The production of endoscopic instruments in the industry showed an upswing and the interaction and interest of the various medical specialties –surgery, urology and gynecology, increased. Today the interest of the industry, doctors and patients worldwide is reflected in a common endeavor, betterment of surgery in many aspects through modern technology. That is reflected in further developments in the use of digital picture control, robotic instruments, computers and tele surgery. The numerous specialties which have emerged and which deal increasingly with the oncological fields also reflect these efforts. That is why in 1965 the German Society for Gynecologic Endoscopy and in 1971 the American Society for Gynecologic Endoscopy were founded. The World Society for gynecologic surgery (1986), the European Society for Gynecologic Endoscopy (ESGE, 1990), the Asian Society of Gynecological Endoscopy, the International Society for Gynecologic Endoscopy and the International Society of gynecological Endoscopy (ISGE, 1991) came into being with yearly or two-yearly meetings.

The development of hysteroscopy and falloposcopy must be mentioned here. After Lindemann (1971) [30] and Semm (1974) established the CO₂ hysterectomy, the real breakthrough in the operative hysteroscopy came after 1980 -basically as fluid hysteroscopy. Today hysteroscopy is a routine procedure and one cannot imagine diagnostic and therapeutic interventions without it.

From today's point of view, the ideal entry for viewing the tubal lumen is by hysteroscopy, through a transcervical and transuterine

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catheter with 0.8 – 0.3 mm thick telescope or flexible falloscopes .

The worldwide evolution for improvement of endoscopic surgery has begun; its end is still not in sight [31]. The aim of this surgery is to achieve better surgical results as with conventional operative techniques and definitely less side effects. On the wider international level let us mention Jordan M. Philipps under who's organization Kurt Semm, Liselotte Mettler and various other team members of the Kiel School of Gynecological Endoscopy, which we really founded in the year 1990 only, but it existed under Kurt Semm's driving patronage since 1970, were able to teach in 85 Endoscopy courses all over the USA and worldwide our endoscopic surgery between the years of 1985 – 2005. In 2005 numerous centers around the world had started to teach their own courses, which they continue to do. Single port entries and particularly Robotics have moved in with high demands and striking results. Contained in bag morcellation has substituted controlled electronic morcellation. Let us see what the future brings.

Jordan M. Philipps (1923-2008) [32] founded the American Association of Gynecological Laparoscopy (AAGL) now the International Society of Minimal Invasive Gynecology in 1971 The AAGL is the leading association promoting minimally invasive gynecologic surgery among surgeons worldwide. When established in 1971 it was known as the American Association of Gynecologic Laparoscopists. As the field of minimally invasive gynecologic surgery grew, the membership of the AAGL quickly expanded around the globe and came to encompass more than laparoscopy alone.

Although the organization had outgrown American roots, its name and acronym "AAGL" had become highly recognized worldwide. To best portray its expanding mission and international constituency, while

still preserving its heritage and brand recognition, the organization eventually dropped its full name, "American Association of Gynecologic Laparoscopists" and became known simply as the AAGL, along with the phrase "Advancing Minimally Invasive Gynecology Worldwide."

Today with a membership extending to over 110 countries, the AAGL is an internationally recognized authority in minimally invasive gynecology. With over 7,000 members worldwide, the association counts among its membership the foremost authorities in gynecology and pioneers in technique and procedures and continues besides renounced and as active other previously mentioned international and national societies in our field.

As extremely active colleagues on the American continent in the USA since 30 years let me also mention the 3 Iranian pioneers in Endoscopic Gynecologic Surgery that influenced our field like none others by their intuition, love and dedication to their work, the laparoscopic surgery, totally dedicated to their new country ,the USA, the NEZHAT brothers: Camran Nezaht, Farr Nezhat and Ceana Nezhat [33] and the initiator of Total Laparoscopic Hysterectomy, Harry Reich

Our late German colleague Thoralf Schollmeyer (1964-2014) (Fig. 3-4) was from 2007 onwards the director of the Kiel School of Gynecological Endoscopy and the President of the German Society of Gynecological Endoscopy (AGE) when he died in 2014. He deserves to be especially mentioned in an historical outline as his professional life was fully dedicated to the education in Endoscopic Gynecological Surgery. He was the first editor of our second edition of PRACTICAL MANUAL for LAPAROSCOPIC and HYSTEROSCOPIC SURGERY of the KIEL SCHOOL in 2013 and a truly believing endoscopic surgeon till

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the end of his early death by the age of 52 years in 2014. Being a patient himself over 8 years he showed us how a dedication to the profession and family moves rocks. The development of gynecological endoscopy in clinic, research and science and the support of young researchers characterized his life. He followed his own way which was marked by extreme passion, audacity and endurance of pain with high ethical and medical values [34].

2. Milestones for the development of gynecological endoscopic surgery

What have been the milestones in the development of endoscopic surgery? Let me first mention a few of our already passed away colleagues who set the intellectual and technical basis for endoscopic surgery:

- 1) Philipp Bozzini (1773 – 1809) and the light guide
- 2) Antonin Jean Desormeaux (1815 – 1894) and his endoscopes
- 3) Georg Kelling (1866 – 1945) and his air insufflation apparatus
- 4) Max Nitze (1848 – 1906), an early urological endoscopist who developed cystoscopy
- 5) Heinrich Kalk (1895 – 1973) and his insufflation apparatus which allowed abdominal biopsies of the liver etc.
- 6) Raoul Palmer (1904 – 1985), the European father of endoscopy in the lithotomy position
- 7) Hans Frangenheim (1920 – 2001) built his first abdominal insufflator in 1959 (Fig. 1)
- 8) Harold Hopkins (1918 – 1994) developed the rod lens system of modern endoscopes
- 9) Karl Storz (1911 – 1996) was responsible for the development of the cold light source in 1960
- 10) Patrick Steptoe performed many laparoscopies in Great Britain and developed

the human in vitro fertilization and embryo transfer technique (IVF – ET) together with Robert Edwards

11) Hans-Joachim Lindemann, born in 1920, laid the groundwork for hysteroscopy

12) Kurt Semm (1923 – 2003), the father of operative gynaecological endoscopy

13) Erich Mühe (1938 – 2005) first cholecystectomy – however, Philippe Mouret (born 1938) from Lyon, France is worldwide known for his first cholecystectomy in 1987 as he was able to publish it.

14) Jordan M. Phillips (1923 – 2008), propagator and “prophet” for gyne endoscopic surgery world-wide.

15) Maurice Bruhat (1934 – 2014)

16) Thoralf Schollmeyer (1962 – 2014)

3. The last 50 years – a rocky road, what do I know about it and who are the present and future giants in our field?

There arises the question what gives life and a certain professional field a meaning? It is always only the connection to human beings in our field, colleagues, co-workers and technical advisers that make our work meaningful.

After my nearly 50 years in gyne endoscopic surgery (1967 – 2017), I look back on this evolution with great respect and happiness.

Just as life is full of adventures, sadness and joy, so has our field of endoscopic surgery experienced its ups and downs before finally finding its wide acceptance of today. For all of us working in gynaecological endoscopic surgery the development has been a rocky road. Many of us had to accept blasphemy, professional inconveniences and mistrust but of course also a lot of understanding, joy, success and acceptance from our patients, our colleagues, hospitals, governments and families. Unlike in any other field the international family of colleagues and friends has grown rapidly and it is interesting how everyone has given new contributions into this

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evolution. Let me mention my close friends like Harry Reich, Jacques Hamou, Jacques Donnez, Dennis Querleu, Mark Possover, Arnaud Wattiez, Christopher Sutton, Ray Garry, Ellis Downes, Frank Loffer, Harry Reich, Tom Lyons, Camran Nezhat, Farr Nezhat, Ceana Nezhat, Robert Zuravin, Linda Bradly, Karl-Werner Schweppe, Diethelm Wallwiener, Hans Tinneberg, Ivo Meinhold-Heerlein, Ibrahim Alkatout, Günter Noe, Bernd Holthaus, Thilo Wedel, Bruno van Herendael, Prashant Mangeshikar, Prakash Trivedi, Bhaskar Goolab, Artin Ternamian, Chi Long Lee, Hirohiko Yamada, Peter Maher, Robert O'Shea, Adel Shervin, Lotte Clevin and many others.

Kurt Semm was my teacher for 25 years. He dedicated his life to the development of endoscopic surgery.

Today, our numbers have grown and we are a big medical technical family with increasing success in the treatment of our patients.

After 3 years of medical work in the Peruvian jungle, Kurt Semm hired me upon my return in 1969. In 1970 I met Elizabeth and Raul Palmer, in 1971 Patrick Steptoe and Bob Edwards and in 1972 Melvin Cohen in Chicago. From 1971-72 I was the coordinating doctor for the "Society of Patients Damaged by Laparoscopy" in Kiel. At this time Prof. Ober who was President of the German Society of Obstetrics and Gynecology told me after I presented a short lecture on laparoscopic ovarian cystectomies "Young lady get yourself away from this dreamer Semm and perform valuable gynaecological surgical procedures by laparotomy and vaginal surgery.

Jordan Phillips, in the founding years of AAGL from 1971 – 1973, adhered to the principle that "Laparoscopy is a diagnostic tool and assists sterilization (coelioscopy)". In the International Federation of Fertility

Societies (IFFS) the surgical field was still dominated by micro surgery via laparotomy and only slowly laparoscopy and hysteroscopy were accepted as valuable surgical tools.

During my gynaecologic speciality training from 1970 – 1976, the field of gynaecologic endoscopic surgery gained ground in Germany. The breakthrough came with the first cholecystectomy performed by Erich Mühe in 1985 and by Phillippe Mouret in 1987. During my IVF research experience with Bob Edwards in Cambridge from 1975-76, I frequently participated with Patrick Steptoe in laparoscopic follicular punctures. Medical societies and Journals coming up on "new" topics best reflect the impact new strategies have.

- 1968 – 1984, formation of ESCO, from which started ESHRE in 1984.
- 1970 – 1975, development of gynec endoscopic surgery, sterilizations.
- 1972, foundation of AAGL. Congratulation to the original American-Canadian Pioneers: Jordan Phillips, Louis Keith, Jacques Rioux and Richard Soderstrom. The Journal of Minimally Invasive Gynecology is the most respected journal in our field today.
- 1975, in Kiel we began to use a teaching scope for laparoscopy and started video projection on monitors for visitors; however, the worldwide propagation of video laparoscopy was undertaken by Camran Nezhat 10 years later. By 1976 all ectopic pregnancies in Kiel were performed by laparoscopy.
- 1975, Kurt Semm was accused of mal medical praxis with laparoscopic surgery. There followed a CTG scan of Semm's brain and legal fights.
- 1975 – 1976, I carried out six months' training in physiology with Robert Edwards in Cambridge, UK.

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- 1975, at a training course in Italy, Jordan Phillips realized that operative laparoscopy had a future and congratulated Kurt Semm and me for promoting it.
- 1976, attainment of my postdoctoral lecture qualification (habilitation) on IVF.
- 1980 – 1996, 85 trips to the US for endoscopy courses on the East and West Coasts and in the Mid-West, organized by Jordan Phillips and AAGL.
- 1981, the first laparoscopic appendectomy in Kiel. Kurt Semm and I were threatened to be thrown out of the German Society of Obstetrics and Gynecology.
- 1986, Camran Nezhat describes video laparoscopy
- 1989, formation of the International Society for Gynaecologic Endoscopy (ISGE)
- 1989 first LTH and TLH (Reich, SEMM)
- 2004 Introduction of Robotic surgery, the DaVinci systems being the so far most advanced ones – others to come
- 2014 First pregnancy after uterine transplantation (Matt Branstroem)
- 2017 First laparoscopic uterine explantation at successful uterine transplantation in Pune, India (Sheilesh Putambekar)
- Many gyne endoscopic national societies have now been formed. The old German Society of Gyne Endoscopy was revitalized in 1984 as the AGE (Arbeitsgemeinschaft Gynäkologische Endoskopie e.V.). To name just a few, a French society, the Australian AGES, an Asian-Oceanic, a Latin-American, and a Canadian society have developed, in addition to multidisciplinary societies of endoscopic or minimally invasive surgery/medicine (SLS, ITS, ISGE).
- 1994, formation of the European Society for Gynaecological Endoscopy (ESGE).

From 1970 – 1990 we developed gyne laparoscopic surgery in Kiel under Kurt Semm. I participated in numerous national and international endoscopy courses in Kiel, Clermont Ferrand, Brussels, Lyon, Strasbourg and world-wide. We had many visitors in Kiel from all over the world. In 1973 Jan Behrman, one of the many past presidents of AAGL, came just for one day to Kiel, entered the operation theatre, observed a laparoscopic adnexectomy, said thank you and left for a hunting trip to Austria. He wanted to see with his own eyes that adnexa were extirpated laparoscopically. His spreading of this news in the USA helped to start gaining recognition worldwide.

4. The Kiel School of Gynecological Endoscopy

In 1990 the **Kiel School of Gynecological Endoscopy** was founded by Liselotte Mettler. From 2007 - 2014 Thoralf Schollmeyer was the director of the Kiel School. In those 7 years he dedicated an immense amount of his time to structure, educate and train doctors in gynaecological endoscopy. He left us as president of the German Society of Gynecological Endoscopy, way too early! Our thoughts are with him at present. Ibrahim Alkatout and Göntje Peters as leaders of the Kiel School are performing an excellent job in the clinic within the German Society of Gynecological Endoscopy. We are holding 10 annual courses for German International participants for basic advanced and robotic and endoscopic training. Our centre is one of the well-recognized endoscopic training centres by the AGE (Arbeitsgemeinschaft gynäkologische Endoskopie) and ESGE (European Society of Gynecological Endoscopy).

The Kiel School, based on the early developments of Kurt Semm, has published numerous textbooks over the last 25 years [17,

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31, 35-39]. In 2016 the “Kurt Semm Centre for laparoscopic and robot assisted surgery” was newly established in Kiel. It is the first interdisciplinary endoscopic centre in Germany serving the three aims of patient’s treatment, surgical education and training in Germany. Further development of the modern assistant surgery and its potential for the future is one of the present activities.

5. Gynecological endoscopic surgery today and tomorrow. What are the goals of good surgery?

These goals are identical whether we perform laparotomy, laparoscopy or endoscopic procedures; regardless of the angle, location or means of access: They are identical for all fields of endoscopic surgery reaching today into robotic single and multiple part surgery. Robotic tools, three dimensional vision and force feedback are essential features in surgery. They make surgery more precise and easier. The surgical goals remain as:

- Recognition of relevant pathology
- Possibility of radical treatment in endometriosis and cancer
- Minimal trauma, bleeding and tissue laceration
- Adhesion prevention
- Preservation of urogenital tract in women of reproductive age
- Utilization of the best instruments (with as many degrees of liberty as possible, robotic transmission, etc.)
- Preventing organ decent

Let us continue along the path of minimal trauma, maximum vision and good tactile feeling to ensure optimal surgical success until the time of better image guided surgery, the application of “magic bullets” to destroy cancer without side effect becomes reality and better molecular-genetic recognition of disease will make extensive surgeries unnecessary in the future. Tissue extraction in

contained bags or in homogenized tissue, to be genetically examined after its extraction, will be easily possible.

Bloodless surgery with articulated and robotic instruments with multiple degrees of liberty and precision coagulation will be possible. Computer-assisted instruments tips will allow the surgeon to position the angles to the desired tissue planes and give tactile feedback.

In conclusion, it must be stressed that the history of laparoscopy and hysteroscopy and its introduction in the surgical practice is a story of many researchers, who for years battled against prevalent general thinking and partly against rejection of their brainchild of performing ‘gentle operations.’ Many of the pioneers were ignored, called dreamers or regarded as crazy. It is only through their persistence, their tenacity, their strong personalities and their intense dedication to life and love, that they could stand firm in the face of adversities [40].

The history of laparoscopy is a unique mixture of various trends in different fields, spurred by the activities of established societies as well as opportunities of their publication and influenced by the world’s progress, recession, war, piece and the love of the individuals for life. The influence of industry, which has kept pace and actively supported this development for years, is the driving force besides the heroes of doctors and engineers that bring up new ideas.(41) Without suitable technology, this dissemination would not have been possible. Endoscopic development and its future does depend on new inventions, on the audacity of leading heroes, their input into this field but also on their management of life to continue to survive and on a healthy and successful cooperation with the medical technical industry and the governments of our countries which grant us the freedom of

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research and development for the best of all our patients (42,43,44)

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Legend to Figures

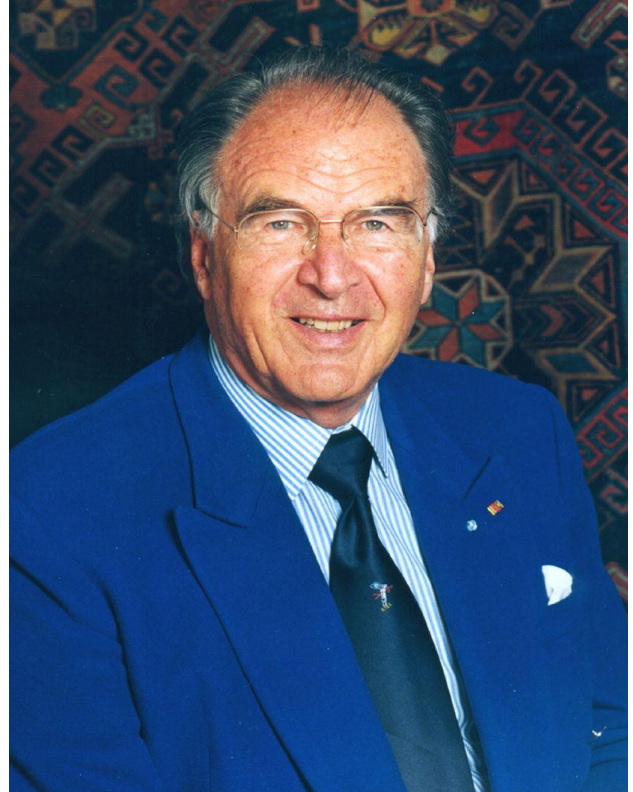
Figure 1

Hans Frangenheim (1920 – 2001)



Figure 2

Kurt Semm (1923 – 2003)



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Figure 3

Thoralf Schollmeyer (1962 – 2014)



Figure 4

Thoralf Schollmeyer with C.Y. Liu and wife and Liselotte Mettler and husband

