



The Role of the Special Centre in Paediatric Laryngology

**The Semon Lecture Trust
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**Robin T. Cotton, M.D., F.A.C.S., F.R.C.S.(C)
Department of Pediatric Otolaryngology
Children's Hospital Medical Center
University of Cincinnati
Cincinnati, Ohio**

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
The Role of the Special Centre in Paediatric Laryngology	<p>The Semon Lecture Trust</p> <p>5 November 1992</p> <p>Robin T. Cotton, MD, FACS, FRCS(C) Children's Hospital/UC</p>	<p>It is a never-to-be-forgotten privilege to present to you today the seventy-seventh Semon Lecture. The pride which I feel at being chosen for this task falls second only to the responsibility to the great tradition of my predecessors and this lectureship. A brief recounting of the life of Sir Felix Semon, in whose honor this lecture was established, has become a periodic litany, prominent in many introductions over the years. It is, I believe, a litany worthy of repetition, possibly to inspire the sort of farsightedness in others that was possessed by Dr. Semon himself.</p>
Sir Felix Semon 1849-1921	Portrait of Sir Felix Semon	<p>Born in 1849 in Danzig, Germany, Felix Semon's childhood was notable for his keen mind and musical talent. After studying music for a time with Wilhelm Taubert, himself a pupil of Beethoven, Semon chose to pursue a career in medicine, enrolling at Heidelberg in 1868. His coursework was interrupted by the Franco-Prussian war of 1870, but he completed his didactic training in Berlin in 1874.</p>
Portrait of Morell Mackenzie	Hospital for Diseases of the Throat	<p>Arriving in London in 1875, with little proficiency in English, Semon was introduced to Morell Mackenzie. He volunteered and then assisted under Mackenzie's instruction, joining him at the Hospital for Diseases of the Throat. Dr. Semon went on to become the first laryngologist appointed to a general hospital as physician to the throat department at St. Thomas's Hospital in 1882.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Caricature of Sir Felix Semon	Men of the Day <i>Spy</i> , No.840 1 May 1902	Many honors were bestowed upon Dr. Semon, among them being knighted by his friend, King Edward VII, in 1897. Sir Felix Semon and his musically talented wife Augusta socialized with the most distinguished and aristocratic figures of their day, and their own home was well known as a center for musical entertainment.
Sir Henry Butlin	Portrait of Sir Henry Butlin	As one of the earliest laryngologists, Semon's surgical realm was initially limited to procedures within the throat. It is fortunate that he aligned himself with Sir Henry Butlin, a general surgeon with an interest in diseases of the throat. Together, they promoted laryngofissure for early cancer of the larynx.
Semon's Law (Semon-Rosenbach Law)	"...in central and peripheral lesions, the abductor muscles are affected sooner than the adductors."	Some of Dr. Semon's most well-known work dealt with the innervation of the larynx. His conclusions are familiar to nearly every medical student and resident as Semon's Law or the Semon-Rosenbach Law.
Manoel Patricio Rodriguez Garcia (1805-1906)	Portrait of Garcia	Sir Felix Semon lived during the formative, and certainly exciting, years of the specialty of laryngology. Along with Sir Henry Butlin and others, he helped to arrange the 100th birthday celebration for Manoel Garcia, known as the "father of laryngology." Dr. Semon's later years were marked by ill health, and he died on March 1st, 1921.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Pediatric Laryngology 	Other Departments 	The famous pathologist Rudolph Virchow was teaching in Berlin during Dr. Semon's time there, and it was Virchow who instilled in him the appreciation of the intimate connection of any specialty with general medicine. <i>It is this intimate connection, between a special care center, its facilities, its personnel, its mission, and the practice of pediatric laryngology, that will be my focus today.</i>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Map slide showing Cincinnati	Artists picture of the Ohio River	My own journey has taken me from Manchester, where I was born, to the University of Cambridge for medical school. I spent three years in the health service in general surgery at the United Birmingham Hospitals; and from there I went to Toronto, where I studied otolaryngology under the guidance of Dr. Bryce. Dr. Bryce delivered the Semon Lecture in 1971, and he is known to many of you personally for his efforts to strengthen the academic ties between our British and Canadian colleagues. At the end of my otolaryngology residency in Toronto, I undertook a head and neck fellowship at the University of Cincinnati, Ohio, and I have remained there ever since. On the left you see Cincinnati's location in the southwest corner of Ohio; on the right is an artist's rendering of the banks of the Ohio River, prior to settlement of the area around 1760.
Photo from Kentucky side	Photo from Kentucky side	The city itself covers seventy-eight square miles; and as you can see, a few more people have moved in since the German immigrant settlers of 1760. According to the 1990 census, Cincinnati is home to nearly 2 million people.
Riverfront Stadium	Cincinnati Zoo	When I travel abroad, it seems that Cincinnati is known for three things: the Cincinnati Reds baseball team, the Cincinnati Bengals football team, and the television show, " <i>WKRP in Cincinnati</i> ." The Reds and the Bengals play at Riverfront Stadium, shown on the left. The Cincinnati Zoo is also well-respected and has a world-wide reputation for its Center for the Reproduction of Endangered Wildlife. The zoo is within walking distance of the Medical Center. Cincinnati is also the site of the General Electric plant where many of the jet engines for Boeing aircraft are manufactured.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Photo of Fountain Square	Photo of P&G Buildings	Downtown Cincinnati is centered around Fountain Square, where many civic and recreational functions are sponsored by the city. Not far from Fountain Square are the world headquarters of the Procter & Gamble Company. The Procter family name has been closely associated with the Children's Hospital from the very beginning, and the corporation of today continues to be a strong supporter. Their general offices in Great Britain are located in Newcastle upon Tyne.
Photo of Delta Queen	Photo of boat and bridge	Many of our local events highlight the city's proximity to the Ohio River, including this year's <i>Tall Stacks Celebration</i> just a few weeks ago. "Tall Stacks" refers to the smokestacks atop the steam-powered, paddlewheel riverboats that were commonly used to ferry passengers, freight, and infectious diseases along the inland waterways of the United States. For the weekend of the festival, seventeen of the best preserved riverboats docked in Cincinnati for on-board tours, sightseeing, and dinner cruises along the river.
Anthony Trollope 1815-1882	Photo of Anthony Trollope	As most of you are familiar with Anthony Trollope, the novelist, you might be interested in his connection to Cincinnati. It seems his mother, Frances, was convinced that she could put the family's financial woes behind them by taking temporary residence in the New World. She arrived in Cincinnati in 1828, with all of her children except Anthony, who had been left behind at Winchester. Mrs. Trollope proposed to make her fortune supplying European art, music, dining, and selected items for sale to the inhabitants of this frontier city.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Trollope's Emporium	Photo of Trollope's Emporium	With money from her husband, Trollope's Emporium was constructed in a wild collage of architectural styles. The business was a dismal failure. When Anthony Trollope visited Cincinnati thirty-three years later, he found the building had become a "Physico-Medical Institute;" and its tenants at that time held little hope for ever achieving financial success, since none before had ever done so. As an aside, the word <i>trollop</i> , which may be an apt description of Mrs. Trollope in her misadventures, actually has its roots in middle high German, not the family name.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Cincinnati 1883	Photo of downtown, late 1800's?	It is not unusual for us to take for granted those things which are the closest to us and most readily available. So it is with our Children's Hospital, one of the four largest children's hospitals in the United States. There are about 75 children's hospitals in the United States, but only a few are as fortunate as we are to have the strong link to academic research that we have in Cincinnati. For the next few minutes then, I would like to give you some highlights from the one hundred and nine year history of our institution. 16
Hospital of the Protestant Episcopal Church in the Diocese of Southern Ohio	Photo of original building in Walnut Hills	In the late 1800's, injured and sick people who had sufficient financial resources were cared for at home. It was only the poor and seriously ill who went to hospitals; there, they usually contracted more severe illnesses or died. Children were stuck wherever there was space in rooms alongside adults, and they were often subjected to abuse and exploitation by older patients. A group of Episcopal women became very concerned about the treatment of children in the adult hospitals, so they met with their bishop to discuss starting a new hospital just for children. Here you see the original building, obtained in March, 1884, for the sum of \$66 per month. 7
Photo of patients	Photo of Mt. Healthy sign	Children with contagious diseases were not admitted, but many epidemics occurred in the close quarters of the converted house. Mount Healthy, a suburb of Cincinnati, is so-called because it was a refuge from the wave of cholera epidemics that were carried up the Ohio river with trade from New Orleans. 18

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Louis Pasteur 1885	Photo of Louis Pasteur	Fortunately, the work of Louis Pasteur was progressing at about that same time. His work on anthrax and rabies brought vaccination into the mainstream, leading to the discovery of the bacteria causing typhoid, cholera, diphtheria, pneumonia, tetanus, and plague. 19
"...no discrimination as to race, creed or color should limit or restrict admission and that the poorest patient should receive as good care as any and the best possible." -Emery Brothers	Photo of children sharing bed in ward	Individual donations sustained the little hospital in its first years, with contributions listed all the way down to four cents from a grateful young patient. It was not long, however, before a shortage of space, heat, and hot water in their facility prompted the donation of a new hospital by the Emery brothers of Emery Industries, which first had been established to convert by-products of Cincinnati's meatpacking industry into lard oil for lamps. The new building opened in 1887 with the brothers' stipulation that no discrimination as to race, creed, or color should limit or restrict admission and the poorest patient should receive as good care as any, and the best possible. 20
Children's Hospital 1926	Photo from Queen City Heritage	In 1921 the Children's Hospital board of lady managers and the board of trustees were dissolved, and a single new board of trustees was elected. That same year, the name of the hospital was officially changed to "The Children's Hospital." The cornerstone at our current Bethesda Avenue location was laid in 1925, and the new building opened in November, 1926. 21

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Photo of W.C. Procter	Photo of CHRF	As mentioned previously, the Procter family has been closely associated with Children's Hospital since its inception. Harley Procter was one of the original incorporators in 1883, and his wife was noted to have supplied soap to the hospital in those early days. His brother, William A. Procter, gave nearly half the money to build an additional wing on the hospital in 1904, and he was well-known for providing twice-weekly automobile rides for the children. William C. Procter, the son of William A., led the planning for the new hospital at Bethesda Avenue and forged an alliance with the College of Medicine in 1926, an alliance which has grown stronger through the years. Convinced of the necessity for research to be closely associated with the hospital, he gave \$2.5 million dollars for the building and endowment of the Children's Hospital Research Foundation, shown here. 22
Photo of Kaplan, Helmsworth, Clark team	Photo of Leland Clark in laboratory	There have been many bright moments in the history of the Research Foundation since it opened in 1931. In 1951, chemist Leland Clark and his colleagues developed the first heart-lung machine for children. Dr. Clark was also the inventor of the oxygen electrode and a pioneer in the development of artificial blood. 23
Photo of Dr. Sabin	Sabin Sunday at CHRF	Dr. Sabin and the development of his live polio vaccine are probably well-known to many of you. The first U.S. tests of the vaccine began on Sabin Sunday in 1960. One hundred eighty-six thousand Hamilton County residents took part; some of them are shown here outside the door of the Research Foundation across the street from my current office. 24

LEFT	RIGHT	SPEAKER'S NOTES
Photo of New Research Building	Pediatric Liver Care Center Perinatal Research Institute Cystic Fibrosis Center Center for Pediatric Molecular Genetics Laryngotracheal Research Laboratory	<p>The eight-story Institute for Developmental Research was added to the original Research Foundation building in 1965. Since then, the growth of the research program required expansion into another new research building in 1991. The additional facilities house laboratories for the Pediatric Liver Care Center, the Perinatal Research Institute, the Cystic Fibrosis Center, the Center for Pediatric Molecular Genetics, and our new Laryngotracheal Research Laboratory. Work by these contemporary centers has included the development of <i>Survanta</i> by the Pulmonary Biology Department, making it possible to supplement lung surfactant protein in infants with respiratory distress syndrome.</p>
Children's Hospital Medical Center 1992 1999	View of CHMC	<p>On the clinical side, Children's Hospital Medical Center remains a non-profit organization managed by a Board of Trustees. The Center is now comprised of the main hospital, the Ambulatory Services Building, the Convalescent and Services Pavilion, and Children's Outpatient North. A tax levied on the residents of Hamilton County has allowed us to maintain the 1883 standard of Bishop Jaggard: "...not only the best medical and surgical treatment, but also the tenderest care, await, without charge, every little sufferer."</p>
View of CHMC	Admissions: 16153 Inpatient Surg.: 5093 Outpatient Surg.: 12799 Ambulatory Visits: 291152	<p>In fiscal year 1992, there were over sixteen thousand admissions resulting in more than ninety thousand inpatient days. It's interesting to note that in 1899, surgical repair of a one child's congenital hernia inguinal resulted in a fifty-three day hospital stay. The same procedure today is performed routinely on an outpatient basis. The number of surgeries performed continues to rise, as does the number of visitors to our ambulatory clinics.</p>

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MINI SKETCH

LEFT	RIGHT	SPEAKER'S NOTES
Stacked bar graph: admissions, inpat.surg, clinic visits	Pie chart: outpatient surgeries	Just to give you some idea of the impact of the Pediatric Otolaryngology Department within Children's Hospital, I share with you some recent figures. Eleven percent of the hospital's admissions were attributed to the otolaryngology department, third highest behind medicine and general surgery. Of the inpatient surgeries performed, 36% were done by the ORL department. There has been increasing emphasis on the efficiency and effectiveness of outpatient surgery, as shown by the 12,799 procedures performed; 60% were done by the otolaryngology department. Visits to our department's clinics accounted for 11% of the non-emergent ambulatory visits.
View of CHMC	Key Values: ■ excellence ■ integrity ■ innovation	<p>Although technical standards for operating a hospital are monitored by many regulatory agencies and review boards, they contribute little to the primary direction of the institution. Therefore, we recently undertook to restate our mission and key values. The resulting statement reads as follows:</p> <p><i>"CHMC is dedicated to serving the health-care needs of infants, children and adolescents and to providing research and teaching programs that ensure delivery of the highest quality pediatric care to our community, the nation and the world."</i></p> <p>Combined with our key values of excellence, integrity, and innovation, this charge has helped guide us through the current major construction project on campus.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Photo of new building	Photo of new building	This new patient tower is scheduled to open in 1994, and includes patient rooms where parents can stay comfortably with their children. Also included are spacious new operating rooms designed to accommodate all of the equipment that is now used. The entire project is the culmination of years of planning, and some may consider it a great achievement in itself; however, in the growing, changing field of health care, it is only another milestone along the way.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
McDonald and Stocks 1965	Trach ward at Toronto Hospital for Sick Children	Having shown you the driving forces behind the continued growth and development of Children's Hospital, I turn now to the role of our hospital and others like it in the support of pediatric laryngology. During the first half of the 20th century, most patients developing laryngotracheal stenosis were older children or adults. After publication of McDonald & Stocks' landmark paper in 1965, long-term intubation of children became the standard of care for ventilatory support resulting in a larger number of pediatric patients with laryngotracheal stenosis. I witnessed this trend firsthand in the tracheotomy ward in Toronto, where I was a resident in 1971. ***RTC COMMENT*** I remember sitting in the staff lounge, brainstorming with Dr. Blair Fearon and others of the otolaryngology staff about the problem of pediatric subglottic stenosis. Up to that time, surgeons had been reluctant to operate on the pediatric larynx for fear of adversely affecting its future growth.
Infant monkey	Cross section of monkey cricoid	Dr. Fearon and I, with funding from the Medical Research Council of Canada, had the opportunity to devise surgical reconstruction procedures in the larynges of infant monkeys. This work was the first step in what has remained a life-long interest for me.
Infant monkey	Increasing LTR cases	Since my arrival at Children's Hospital in Cincinnati, I have performed steadily increasing numbers of laryngotracheal reconstructive procedures, with a projected total of about 80 procedures for this year.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Anterior Costal Cartilage Grafts	Illustration of ACG LTR	Over the course of 20 years of performing these procedures, I have observed many changes in both the clinical problem and our approach to correcting it. Initially, the majority of cases of acquired pediatric laryngotracheal stenosis presented as isolated anterior lesions that responded well to the use of anterior costal cartilage grafts. As you know, my colleague, Mr. Evans, saw similar problems in London and approached them with a different solution, that being the anterior castellated incision and 6 weeks of stenting with rolled silastic. Both methods worked.
Cricoid Split	Cricoid split patient slide	I developed the anterior cricoid split as a treatment for subglottic stenosis in the neonatal nursery in the late 1970's. It was a concept that had intrigued me for some time, since I had used this procedure in some of my infant monkey experiments several years before. Having given it considerable thought, I decided to apply this technique in patients. Only in a special center with the highest quality support services can you try new procedures like this which might benefit neonates. Fourteen years later, anterior cricoid splits are still used, enabling some 3 out of 4 infants to avoid tracheotomy.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Posterior Costal Cartilage Grafts	Illustration of PCG LTR	<p>It soon became more common for me to find scar tissue focused posteriorly, both in isolation and in combination with anterior lesions. Obviously, division of the anterior cricoid cartilage could not be expected to achieve adequate expansion of a posteriorly obstructed airway, so I began to use division of the posterior cricoid cartilage. This technique was based on the work of Dr. Réthi in Budapest; and to the best of my knowledge, was first applied in children in Helsinki by Dr. Grahne, whom I visited in 1980. I initially used the Montgomery laryngeal stent, sometimes leaving it in place for up to 6 months; and later, for a variety of reasons, I began using the rigid Aboulker stents. I still tended to stent for weeks or months, based on the postoperative instability of the airway. I now prefer to use posterior grafts for added structural support, so that short-term stenting can be used.</p>
Multiple Revision Procedures	Photo of patient with no detectable lumen	<p>As time went on, many of my new patients presented with increasingly severe obstructions. In some cases this could be explained by the larger number of patients being referred to our institution for revision surgery, having already had primary reconstructive attempts at other hospitals. Those that failed their initial surgery may have been left more severely obstructed than before. Other factors that contributed to some of the worst stenoses were the use of the CO₂ laser, steroid injection of scar tissue, the urethral resectoscope, and cryosurgery, in vain attempts to remove significant, mature obstructive pathology. The growing body of experience and published data on the appropriate use of these technologies has hopefully precipitated a reduction in the number of completely obstructed airways that I will see.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Four Quadrant LTR	Illustration of Four Quad LTR	The need to achieve expansion in all dimensions in patients with no detectable lumen led to the investigation of lateral division of the cricoid cartilage. For many years, my peers were concerned about interfering with the so-called lateral growth centers of the cricoid cartilage. However, these growth centers seem to be more theoretical than fact, since the cartilage is formed from the outer perichondrium. Therefore, four-quadrant division of the cricoid cartilage has been added to our armamentarium for severe stenoses, with proper placement of the lateral cuts essential to avoiding trauma to the recurrent laryngeal nerves.
Preop 4-Quad patient slide	Postop 4-Quad patient slide	Between 1986 and 1990, 31 four quadrant division procedures were performed out of a total of 185 LTR procedures. At presentation, 72% of the patients undergoing four quadrant division were either more than 90% obstructed or had no lumen at all. Despite the severity of their obstructions, decannulation had been achieved in 76% of these patients at one year postoperatively.
Single Stage LTR	Illustration of Single Stage LTR	I think of many of these most severe obstructions in terms of a 2-stage procedure, first to obtain a lumen and then to enlarge it, rather than a no-holds-barred attempt at a single successful operation. Part of our recent strategy has been to reduce as much as possible the duration of stenting that is required. It has been my impression that rapid epithelialization of the graft is important to the success of the procedure. Stenting may prolong that process by movement of the stent against the mucosa, development of granulation tissue along the edges of the stent, or perhaps even by the pressure of the stent against the tissues.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Preop SSLTR patient slide	Postop or intraop patient slide showing stoma revision	In a select group of patients with moderate obstruction, single stage laryngotracheal reconstruction with endotracheal tube stenting has reduced the duration of stenting to a matter of days. The idea of removing the tracheotomy at the same time is obviously appealing to patients and their families. As of December, 1991, I had performed 55 single stage LTR procedures with an overall success rate of 87%.
1991 LTR Patients Average Age = 5.7 years (3 wks. to 19 yrs.)	1991 LTR Patients Bar Graph for Male/Female	One of our current research efforts is the creation of a comprehensive database, including the prospective collection of all available information related to the care and treatment of our airway reconstruction patients. It is a daunting task, but one that will reward us with easy access to the current postoperative status of hundreds of LTR procedures performed since 1974. Our initial efforts have focused on patients from 1991; they are representative of our current treatment strategies, and adequate follow-up information is available to make reasonable estimates of our success rate. In 1991, 79 LTR procedures were performed. The average age of our patients was 5.7 years, ranging from 3 weeks to 19 years. Fifty-eight patients were male, and 21 were female: a 2.8:1 ratio, consistent with previous reports.

LEFT	RIGHT	SPEAKER'S NOTES												
<p>1991 Primary and Revision LTR Procedures</p> <p>Pie Chart of Primary vs. Revisions</p>	<p>Techniques Used:</p> <table><tr><td>4 Quadrant Split</td><td>2</td></tr><tr><td>Single Stage</td><td>22</td></tr><tr><td>Anterior Graft</td><td>29</td></tr><tr><td>Posterior Graft</td><td>23</td></tr><tr><td>Ant. & Post. Graft</td><td>6</td></tr><tr><td>No Graft</td><td>21</td></tr></table> <p><i>*Some procedures use more than one named technique.</i></p>	4 Quadrant Split	2	Single Stage	22	Anterior Graft	29	Posterior Graft	23	Ant. & Post. Graft	6	No Graft	21	<p>Most of our patients come to Cincinnati for their first reconstructive surgical procedure; those that require revision procedures include patients from both our own institution and others. Of the 79 total procedures, 56 were primary; and 23 were revisions after one or more prior procedures. The surgical techniques used encompassed the entire spectrum of options that I prefer, shown here on the right. This variety of approaches allows each procedure to be tailored to the needs of the individual patient, and no one technique can be used for all or even most patients.</p>
4 Quadrant Split	2													
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<p>Successes to Date:</p> <p>1991 LTR Procedures</p> <p>Bar Graph of Decann., Not Decann.</p>	<p>Long-term success...</p>	<p>As of October of this year, 65 patients, or 82%, were successfully decannulated as a result of their 1991 procedures. Fourteen patients, or 18%, are currently not decannulated, although revision procedures are planned for some. In the future, information recorded in our Laryngotracheal Reconstruction Database will provide a more informative gauge of our success based on the status of the graft, lumen expansion achieved, and pulmonary function, in addition to decannulation. Long-term followup is being attempted for as many patients as possible; we hope to achieve a better understanding of the additional demands placed on the reconstructed airway as our pediatric patients grow into adulthood.</p>												

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
<p>An Interdisciplinary Approach to Pediatric Laryngology</p>	<p><i>"Whether oto-laryngology will subdivide further, or . . . amalgamate with other branches of medicine and surgery, lies in the history of the future."</i></p>	<p>In their book, "A History of Oto-Laryngology," published in 1949, Stevenson and Guthrie commented on the waxing and waning of the scope of our specialty, once limited to laryngology, later united with bronchoesophagology, otology, and formally, though often unstated, with rhinology. They said:</p> <p style="padding-left: 40px;">"Whether oto-laryngology will subdivide further, or . . . amalgamate with other branches of medicine and surgery, lies in the history of the future."</p> <p>Perhaps too few years separate us from their words; perhaps Stevenson and Guthrie witnessed the peak of annexation of specialized functions by laryngology. In any case, while the boundaries between our specialty and many others have become somewhat blurred, patients usually present with a combination of closely related medical conditions, some of which still remain outside our realm of expertise. One of the chief advantages of a special center is the close proximity it provides to colleagues and facilities equipped to deal with any scenario.</p>



<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
<p>Gastroenterology</p> <p>Feeding Team</p> <p>Pulmonary Medicine</p> <p>Speech Pathology</p> <p>Anesthesia</p>	<p>Airway Management Unit</p> <p>Child Life</p> <p>Dietary Services</p> <p>Social Services</p> <p>Pastoral Care</p>	<p>Our approach to laryngotracheal stenosis has, therefore, become a team effort. The initial evaluation of a patient may be confined primarily to endoscopic assessment of his airway, but as surgical intervention becomes likely or necessary, the scope of our investigation widens to include many other factors. Once in the operating room, we find ourselves more frequently part of a surgical team for cases like the repair of complete tracheal rings, which is undertaken in cooperation with the cardiovascular surgeons. Postoperatively, the surgical innovations that have provided more options and more hope for our patients require the highest level of competence in managing all aspects of their recovery. For this last few minutes, I would like to highlight some of the other departments and support services on which we depend.</p>
<p>Gastroesophageal Reflux</p>	<p>Esophagitis: <i>H₂ Blockers</i></p> <p>Failure-to-thrive: <i>Thickeners</i></p> <p>Pneumonia: <i>Nissen Fundoplication</i></p>	<p>Over the past few years, I have increasingly had the opinion that gastroesophageal (GE) reflux is important in the genesis of laryngotracheal stenosis. All children and adults have reflux, but symptomatic reflux in children is fairly uncommon. Children exhibiting symptoms of gastroesophageal (GE) reflux tend to respond differently to therapy, according to their symptoms. Those with esophagitis may respond to H₂ blockers, while those who fail to thrive may simply need food thickeners. Patients with pneumonia will continue to aspirate without more aggressive intervention.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
<p>Photo of pH-Probe Patient</p>	<p>Preoperative GE Workup:</p> <ul style="list-style-type: none"> ▪ Oesophagoscopy ▪ Gastric Emptying Scan ▪ 24-hour Dual pH-Probe 	<p>Animal studies have shown that brief episodes of gastroesophageal (GE) reflux with aspiration into the larynx and trachea cause laryngeal erythema and ulceration. The stents we use in laryngotracheal reconstruction interfere with normal airway protective reflexes, creating a postoperative reflux problem. In an attempt to anticipate possible problems, all of my laryngotracheal reconstruction patients have a preoperative gastroesophageal (GE) workup including oesophagoscopy, gastric emptying scan, and most importantly, a dual pH-probe study. Unfortunately, the normal data for our best indicator, the pH-probe study, is derived from information on adults. Little, if any, normative data exists for the upper pH-probe, especially in children.</p>
<p>24-Hour Dual pH-Probe:</p> <p>Lower Probe pH < 4.0 for > 7% of Test = Positive Result</p> <p><i>Treatment for Esophagitis is Initiated</i></p> <p>Test is Repeated With Medication</p>	<p>Documentation of Any Incident When Upper Probe pH < 4.0 = Positive Result</p> <p><i>Treatment for Esophagitis is Initiated</i></p> <p>Test is Repeated With Medication</p>	<p>The combination of these tests with interpretation by a gastroenterologist has led to a set of loosely defined working parameters which we use to guide the treatment of our patients. The ambulatory pH-probe study is performed over a 24-hour period. Anyone with lower- probe pH readings less than 4.0 for more than 7% of the test period is considered to have gastroesophageal (GE) reflux requiring medical treatment in and of itself. The upper-probe readings are more interpretive in nature, with significant intervals of lowered pH leading to a high index of suspicion for the aspiration of gastric contents. Our current practice is to treat these patients for reflux, whether or not the lower-probe readings require it. After medical therapy is implemented, the pH-probe study is repeated with the patient on medication to verify that the reflux has been controlled. If reflux is still evident on the repeated pH-probe study, surgical intervention such as a Nissen fundoplication is considered before airway surgery.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Feeding Team	<ul style="list-style-type: none"> ■Gastroenterologist ■GE Nurse ■Behavioral Psychologist ■Speech Pathologist ■Occupational Therapist ■Nutrition Specialist 	<p>The gastroenterology department recently established a feeding team with representatives from behavioral psychology, speech pathology, occupational therapy, and nutrition services. Some LTR patients have experienced difficulty initiating swallowing after long-term intubation during critical developmental periods as neonates. Stent placement after LTR surgery can exacerbate these problems. The team meets as a group to observe a patient swallowing, then discusses what, if any, behavior modification or medical intervention may be necessary.</p>
Otolaryngology Referrals to the Feeding Team	<ul style="list-style-type: none"> ■LTR Patients ■Pierre Robin ■Möbius ■Vocal Cord Paralysis ■Anatomical Defects 	<p>We have made increasing numbers of referrals to the feeding team since its inception, with good results. A total 15 patients were referred by the otolaryngology department from June of 1991 to July of 1992. Patients other than LTR cases have included those with Pierre Robin syndrome, Möbius syndrome, vocal cord paralysis, or repair of anatomical defects such as H-fistula, laryngeal cleft, or cleft palate. While the results have been very gratifying, some adjustments are being made in the team's approach, especially to LTR patients.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
<p>Proposed Changes for LTR Patients:</p> <p>Preoperative Dysphagia Workup by Speech Pathology and Occupational Therapy</p>	<p>Full Feeding Team Evaluation and Plan Implementation Postoperatively</p>	<p>Since the LTR procedure can change many aspects of feeding postoperatively, we have questioned the benefit of a comprehensive preoperative evaluation. A combined exam by the Speech Pathologist and Occupational Therapist will provide adequate screening information to identify potential problems. The comprehensive team evaluation may be postponed until after surgery, when the treatment plan that results from their consultation can be implemented with a better chance of continuity and therefore, success. This new approach will be tried in the coming months, with the goal of more efficiently utilizing the team.</p>
<p>Exercise Pulmonary Function Testing</p>	<p>Photo of PFT Patient Seated</p>	<p>In patients who are old enough, Pulmonary Function Tests have become more valuable to me, both preoperatively and postoperatively, since exercise was added to the test conditions. Standard PFT's provide the usual pulmonary measurements, but depend almost entirely on patient compliance and maximum effort while at rest, as shown here.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Photo of PFT Patient on Bike	<p>Preoperative PFT:</p> <ul style="list-style-type: none"> ■Substantiates patient account of symptoms ■Documents the need for treatment ■Identifies associated airway problems 	<p>The exercise PFT places additional demands on the respiratory system, depending on the work being performed. The goal of this assessment preoperatively is twofold: to determine the degree to which airway dysfunction is negatively affecting the patient during different levels of activity; and to determine whether the upper airway is the sole contributor to the dysfunction. Lower airway problems such as diminished lung function must be addressed before undertaking laryngotracheal surgery. New methods are being investigated that may allow even younger patients to be tested by providing them with age appropriate audio and visual feedback of their performance effort.</p>
Photo of Exercise Test	<p>Postoperative PFT:</p> <ul style="list-style-type: none"> ■Assesses improved function ■Determines safe limits of activity ■Exposes need for further treatment 	<p>Postoperatively, the exercise PFT is instrumental in evaluating the efficacy of an LTR procedure. The work capacity of a patient can be objectively defined and used to determine safe limits of activity. The need for an additional procedure or the safety of decannulation may also be assessed. We are currently testing the feasibility of obtaining exercise PFT's in some of our LTR patients who are now 10 years past their procedures. If significant numbers of these tests can be performed, they will be extremely valuable in assessing the long-term benefits of laryngotracheal reconstruction.</p>
Speech Pathology	Photo of Patient With NP Scope	<p>The role of Speech Pathology has already been mentioned in conjunction with the Feeding Team assessment, but this department is also called upon in a more traditional role. With continued improvements in the achievement of basic expansion of the airway, more attention has been directed to the maintenance and improvement of voice quality.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
<p>Photo</p> 	<p>Voice Evaluation:</p> <ul style="list-style-type: none"> ■ Visi-Pitch ■ Laryngeal Stroboscopy 	<p>Pre- and postoperative laryngeal stroboscopy and digitized voice evaluations are obtained in all patients who are old enough. The digitized voice evaluations are performed using a Visi-Pitch system, operated and interpreted by the Speech Pathologist. Laryngeal stroboscopy is performed using a flexible nasopharyngoscope in conjunction with a standard strobe light source and laryngeal microphone. Video recordings of the stroboscopy are reviewed by both the otolaryngologist and the speech pathologist.</p>
<p>Patient Photo of Thyroplasty?</p> 	<p>After LTR:</p> <ul style="list-style-type: none"> ■ Speech Therapy ■ Thyroplasty 	<p>Preoperatively, it has become essential to have objective baseline data on the voice to complement the subjective impression of the patient and family. In the wake of an otherwise successful procedure, poor voice quality may become a focal point of dissatisfaction, even if the voice was previously poor or nonexistent. Intraoperatively, these evaluations have highlighted the need to preserve the anterior commissure whenever possible, and to strive for perfect realignment of the vocal folds anteriorly when division through the thyroid notch cannot be avoided. Postoperatively, voice evaluation and speech therapy help our patients to make optimal use of their vocal mechanism. We have also started performing thyroplasty procedures in some of our older patients.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Anesthesiology	Photo of ICU Isolette	With the emphasis that I place on rigid endoscopic assessment and the number of airway procedures performed by our department each year, it should be obvious that I require a close working relationship with my colleagues in anesthesiology. Their cooperation is essential in the operating room; as Dr. Pracey said, this cooperation halves the responsibility and doubles the safety for the patient. Postoperatively, patients who are intubated go to the intensive care unit, where the anesthesiologists oversee their general medical care during the stenting period.
Airway Management Unit	CHMC Beds Occupied by Tracheotomy Patients: Pie chart showing 10%(36) of Total(361) *During RSV Season	I have approximately 135 tracheotomy patients in my practice at any given time. During the winter months, when respiratory syncytial virus is most prevalent, it is not uncommon for up to 10% of the hospital's 361 beds to be occupied by patients with tracheotomies. Without dedicated space in the hospital for our patients with acute airway problems, the number of chronic care tracheotomy cases would require us to perform LTR's only on a space available basis.
Photo	Photo	Certainly one of the keys to our success in Cincinnati is the Airway Management Unit. With 14 beds and specially trained nursing staff dedicated to the care of acute airway patients, the AMU is one of five high-volume areas equipped to handle patients recovering from airway surgery or respiratory illness.

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
<p>Competency Based Tracheotomy Care Training Program</p>	<ul style="list-style-type: none"> ■Nursing Staff trained on AMU ■Tracheotomy patients admitted to medically appropriate service ■Tracheotomy home care taught by primary nurses 	<p>Tracheotomy patients admitted for non-airway-related problems are assessed individually to determine their respiratory status, the potential respiratory effects of their illness, and their planned treatment. If they merely require normal tracheotomy care and monitoring, they can be placed anywhere in the hospital, thanks to a competency based education program implemented by our airway nurse specialist. This training program provides a baseline level of knowledge for all nurses in the hospital, including home tracheotomy care instruction.</p>
<p>High Volume Units for Acute Airway Cases:</p> <ul style="list-style-type: none"> ■AMU ■Intensive Care ■Neonatal Intensive Care ■Adolescent Care Unit 	<p>Photo</p>	<p>As I mentioned, patients recovering from airway surgery or respiratory illness are placed in one of our high volume units: the airway management unit, the intensive care unit, the neonatal intensive care unit, or the adolescent wards on our fourth floor. Nurses in these units undergo the same training as all nursing staff, with 6 to 12 weeks of additional orientation in the airway management unit. Our airway nurse specialist and the nurses staffing the airway management unit are available around the clock for consultation on tracheotomy patients anywhere in the hospital.</p>
<p>Child Life</p> <ul style="list-style-type: none"> ■Presurgical Education ■Developmental Play ■In Hospital Tutoring 	<p>Photo</p>	<p>Finally, there are several nonmedical specialists who care for our LTR patients. The Child Life department is responsible for preoperative orientation of our patients and their families, acting out the procedures that will be performed using dolls and other materials for demonstration. Postoperatively, Child Life provides daily development activities for patients of all ages, and they arrange tutoring for school age children.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
<p>Dietary Services</p> <ul style="list-style-type: none"> ■ Nutrition requirements ■ Aspiration control 	<p>Photo</p>	<p>Our Dietary Services department works in conjunction with the Feeding Team to provide adequate and hopefully palatable nutrition for those patients with special dietary requirements. Typically, their efforts focus on the control of aspiration and the care of non-thriving patients.</p>
<p>Social Services</p> <ul style="list-style-type: none"> ■ Insurance ■ Government assistance ■ Family dynamics 	<p>Photo</p>	<p>The financial and emotional burdens on families caring for patients with complicated medical problems sometimes require the intervention of the Social Services department. They assist families in the negotiation of insurance and government paperwork, and they monitor the overall dynamics of the family to ensure that adequate care will be provided for the patients when they return home.</p>
<p>Pastoral Care</p> <ul style="list-style-type: none"> ■ Familial support ■ Cross-cultural issues 	<p>Photo</p>	<p>Finally, in addition to the Social Services department, our hospital chaplains tend to the spiritual and emotional needs of our patients and their families. Often it is our patients in the intensive care unit who benefit most from the attention of the Pastoral Care department. When sedation is required during several days of endotracheal tube stenting, it can be very difficult for family members to cope with the unresponsiveness of their child and the frustration of not being able to do anything except wait. The chaplains are especially sensitive to communications problems across international and interfaith boundaries, helping the hospital to meet the dietary and worship requirements of families from other countries and cultures.</p>

<i>LEFT</i>	<i>RIGHT</i>	<i>SPEAKER'S NOTES</i>
Laryngotracheal Research Laboratory	Photo	The link established in 1931 between Children's Hospital and the Research Foundation remains intact today; and it is, as I pointed out earlier, one of the great strengths of our institution. Our own department has taken a renewed interest in research with the addition of the Laryngotracheal Research Laboratory, a part of the new research building opened last year.
Research Photo	<ul style="list-style-type: none"> ■Endoscopic measurements ■Airway protective mechanisms ■Airway patient database 	In the past our research focused on surgical technique, graft survival, and stent utilization. Recently, the addition of a research coordinator and a new research faculty member has propelled our efforts in new directions. Currently underway are projects on endoscopic airway measurement, airway protective reflexes, and the comprehensive database development I mentioned earlier.
Gastroesophageal Reflux Research	<ul style="list-style-type: none"> ■pH-probe results in normal children ■Alternatives to upper pH-probe 	The lack of normative data on gastroesophageal (GE) reflux in children has been both a stumbling block to a previously designed study and the impetus behind a new one into the relationship of gastroesophageal (GE) reflux and laryngotracheal stenosis. One of our major difficulties in this area of research has been the choice of a suitable endpoint for measuring the positive or negative effect of our study variables on the outcome of reconstructive surgery.

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Wound Healing in the Airway	<ul style="list-style-type: none">■ Biochemical characterization of granulation tissue■ Comparison to dermal wound healing■ Epithelialization	The focus of our laboratory research is the biochemical characterization of granulation tissue in the healing airway. This information will be compared with similar research in the dermal wound healing system, with subsequent investigations targeted toward modulating this system for rapid regrowth of epithelium without the development of obstructive granulation tissue or fibrous scars.

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<p><i>Health Care in the United States...</i></p> <p>(3 copies)</p>	<p>Photo of Perot, Bush, Clinton</p>	<p>The board of trustees commented in 1889 that the costs of running their Children's Hospital were growing faster than the generosity of the community. Although the majority of our patients are now private, or paying, patients, the rising cost of health care in the United States continues, according to some, to outstrip the ability of the people and the government to afford it. In a country where the most innovative and technically advanced treatments are considered the standard of care, the escalating battle between patients' demands and expectations and declining reimbursement by insurers threatens to put a chokehold on our hospitals and health care providers.</p>
<p>Photo of billboards/ advertising along crowded boulevard</p>	<p>Photo of commercial products (e.g. Coke can, cigarettes, etc.)</p>	<p>Ironically, the people of the United States daily spend \$3.2 billion on retail goods and purchase one billion, 600 million cigarettes. Over \$3 million is spent advertising beer, wine, and liquor, and 524 million servings of Coca-Cola are consumed each day. Of the \$1 billion spent daily on health care, some 30% may be spent treating patients in their last year of life. The title of a recent article, "<i>Demand for best care produces \$100,000 funeral,</i>" captures the essence of the ethical dilemma of runaway medical expenses. Real choices must be made, unpopular though they will be, between those expenditures which can be classified as luxuries, and quality health care, which must be considered a necessity.</p>

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<p>The Role of the Special Centre in Paediatric Laryngology</p>	<p>The Semon Lecture Trust</p> <p>5 November 1992</p> <p>Robin T. Cotton, MD, FACS, FRCS(C) Children's Hospital/UC</p>	<p>I hope that I have effectively demonstrated how special centers like Children's Hospital provide the most seriously ill children with their best chance at recovery. It is an environment that encourages cooperation, not competition, supporting the development of interdisciplinary teams and fresh ideas in clinical medicine as well as research. It becomes possible to push at the boundaries of pediatric laryngology, expand the envelope of treatment options, and provide comprehensive care for our laryngotracheal reconstruction patients. This special pediatric center with its state-of-the-art facilities, top-quality support services, and my esteemed colleagues in the other pediatric specialties, all work together with the Pediatric Otolaryngology Department, enabling us to achieve together what we could never dream of doing on our own.</p>