Anatomically, the neck is not very forgiving for surgeons. Two of the more common nerves that tend to be problematic are the spinal accessory nerve (SAN, cranial nerve XI) and the recurrent laryngeal nerve, both of which are frequently injured during thyroid surgery.

**Spinal Accessory Nerve:** The course of the SAN is somewhat variable, making it a surgical challenge. Generally, we find it by first locating the greater auricular point, which is at the junction of the upper and middle third of the sternocleidomastoid muscle (SCMM). Usually, the SAN will cross the SCMM approximately 1 cm above that point. The problem comes in the posterior triangle, where the SAN branches in a variable pattern, and it runs a fairly superficial course to innervate the trapezius muscle. Therefore, a careless lymph node biopsy in the posterior triangle can inadvertently injure one of those branches and cause weakness to the trapezius.

**SAN Injury:** In most patients, injury to the SAN is not recognized right away. Instead, it may take several weeks to months for the effects of the injury to develop as the trapezius muscle atrophies. Historically, when Dr. Crile advocated his radical neck dissection, the SAN was sacrificed along with the SCMM. Interestingly, not all of his patients developed shoulder syndrome (weakness of the trapezius, subsequent arthritis, and the inability to abduct the shoulder), which speaks to the variable innervation of the trapezius muscle and the different variations in the course of the nerve. Patients with shoulder syndrome can present with shoulder weakness, a drooped shoulder, and atrophy of the trapezius muscle. Many patients with shoulder syndrome complain of pain; however the SAN is not primarily a sensory nerve. This pain may result from the chronic inflammation that occurs in the muscles that try to compensate (suprascapular muscle and the rhomboids). Or, perhaps the discomfort is associated with the arthritis that develops in the shoulder joint. Surgical exploration and a nerve graft are generally recommended to restore function to the trapezius. In the literature, shoulder syndrome has been reported to reverse itself in some cases, particularly if the initial injury was only a contusion to the branches of the nerve.

**Avoiding SAN Injury:** To avoid SAN injury and shoulder syndrome, I think the surgeon needs to exercise due diligence and recognize that the course of the SAN is variable. We can generally locate its main trunks by identifying the greater auricular point, but from there, we must proceed with caution when working in the posterior triangle of the neck.
Card 2
Nerves of the Head and Neck: Recurrent Laryngeal Nerve

When performing surgery in the neck, especially thyroid surgery, great care must be taken to avoid injuring the recurrent laryngeal nerve (RLN). Although a relatively infrequent occurrence, RLN injury can be devastating for a patient. To avoid RLN injury, I believe it is best to identify it in the tracheoesophageal groove.

**Right RLN:** The right RLN goes either anterior or posterior to the inferior thyroid artery (ITA) in the tracheoesophageal groove. It enters at the cricothyroid membrane to innervate the intrinsic muscles of the larynx. It is rarely found in an abnormal position. Therefore, with careful dissection around the ITA in the tracheoesophageal groove, we can almost always find the right RLN.

**Nonrecurrent Laryngeal Nerve:** The literature contains rare reports of the nonrecurrent laryngeal nerve (nRLN). This anatomical anomaly is a little more common on the right side (incidence, 0.3% to 1%) than on the left (0.004%). The nRLN runs relatively parallel to the trachea in the tracheoesophageal groove and parallels the ITA. On the left side, the nRLN comes around the aorta and travels a route similar to that of the right nRLN, entering the larynx at the cricothyroid membrane.

**Intraoperative RLN Injury:** Because a few patients present with pre-op RLN paralysis of which they are unaware, we should perform pre-op laryngoscopy to determine the status of the vocal processes. Immediately after a thyroid operation, many surgeons advocate doing a laryngoscopy to ensure that the nerves are intact. If the RLN is injured intraoperatively, the cord immediately assumes a paramedian position, but it may look normal, particularly if the patient is still under anesthesia when cord movement cannot yet be detected. Generally, unilateral RLN injury presents as postoperative hoarseness, and laryngoscopy (either direct or indirect) confirms that the cords do not approximate in the midline. With time, we see some rotation of the vocal processes and, perhaps, some compensation from the uninjured cord, which may move across the midline to provide approximation of the vocal processes.

**Treatment:** In patients with unilateral RLN injury, silicone injections sometimes help move the cord toward the midline to provide approximation. Particularly in cases of bilateral vocal cord paralysis, operations on the arytenoids can help lateralize the cord and provide a better airway.

**Intraoperative Injury:** During surgery when we discover that the RLN has just been separated, immediate nerve grafting or primary repair is recommended, if we have not resected too much of the RLN. The results are generally fair. In many patients, we need to provide either silicone injection or stabilization of the vocal cord.
**Card 3**  
**Nerves of the Head and Neck: Superior Laryngeal Nerve and Facial Nerve**

**Superior Laryngeal Nerve:** The superior laryngeal nerve (SLN) runs along with the superior thyroid artery. During surgery, the SLN is frequently injured when a large clamp is placed across the superior thyroid vascular pedicle at the superior pole of the thyroid. To avoid SLN injury, carefully dissect the superior pole vessels and clamp those vessels individually rather than in one big bite with the hemostat. Fortunately, the consequences of SLN injury are not nearly as severe as the laryngeal paralysis associated with injury to the recurrent laryngeal nerve. Nonetheless, SLN injury in a singer means that they will lose the intensity of their voice and they will lose some sensation to the upper larynx and hypopharynx.

**Facial Nerve:** Surgeons must be concerned about injury to the facial nerve during parotid surgery as well as other surgeries, including those that involve the submandibular space. The facial artery is an important landmark in locating the marginal mandibular branch of the facial nerve during surgical procedures: the marginal mandibular branch is superficial to the facial artery and (anterior) facial vein in almost all cases. This nerve will occasionally deviate from its normal course by taking a dive approximately 1 cm below the angle of the mandible. Therefore, to avoid injury to the marginal mandibular branch of the facial nerve, we must exercise great caution when doing submandibular gland work, such as draining abscesses, removing salivary tumors, etc.
Card 4
Head and Neck Cancers: Oropharyngeal Squamous Cell Cancers

Although best known for its role in cervical cancer, human papillomavirus (HPV) plays a role in head and neck squamous cell carcinomas (SCC). Recent genetic studies have identified a subgroup of head and neck SCCs that are positive for HPV type 16 (HPV16). These tumors, like cervical carcinoma, tend to occur in younger patients. The good news is that HPV16-positive tumors have a much better prognosis than do tumors that develop in chronic smokers and heavy drinkers, which are the behaviors with which we traditionally associate SCCs of the head and neck. Of all SCCs of the head and neck, ≥60% are HPV16-positive, particularly in younger patients.

**Sexual Behavior vs SCCs:** High-risk sexual behaviors may have some role in the transmission of HPV associated with oropharyngeal SCCs.

**Effect of HPV Vaccines:** I think that HPV16 is the most common culprit for cervical cancer. Although I am not an expert on the vaccines, I believe that HPV16 is included in the HPV vaccine. However, I have no data regarding the impact of HPV vaccination on development of head and neck SCCs.
Card 5
Abscesses in the Neck: Mandibular Abscesses and Ludwig Angina

The general surgeon gets called many times to look at abscesses in the neck, including mandibular abscesses. Like any other abscess, treatment for mandibular abscesses involves surgical drainage and evacuation of the purulent material. Many mandibular abscesses occur in heavy smokers or patients with very poor dentition. Most submandibular abscesses begin as an apical root infection that then burrows into the submandibular space and presents with a swelling, pain, occasional erythema, and fluctuance. **Ludwig Angina:** Ludwig angina is a cellulitis that bilaterally involves the submaxillary, sublingual, and submental spaces. Simple mandibular abscesses can progress to this very woody edema and erythema of the entire submandibular space, infecting both sides of the neck in the submental region. Treatment of Ludwig angina involves incision and drainage of the abscess and broad-spectrum antibiotics that work against gram-negative or anaerobic bacteria that naturally live in our mouths. Ludwig angina may have been responsible George Washington’s death. Reportedly, he developed this from a peritonsillar abscess and actually died of suffocation and excessive bloodletting. **Extension of Ludwig Angina:** This bilateral woody induration usually extends down to the clavicles. Theoretically, it could extend into the mediastinum, but this is very uncommon. Occasionally, the abscess gets through the pretracheal fascia and then extends to the mediastinum. To treat this, we usually make a supraclavicular incision and drain the anterior mediastinum. Ludwig angina can cause upper airway compromise, and if extensive, a surgical airway may need to be provided for these patients. **Scrofula:** Scrofula is tuberculous lymphadenitis of the neck that can also occur in other locations, such as the axillae, hands, etc. It is usually referred to *Mycobacterium tuberculosis*. Although scrofula is uncommon in the United States, it is seen more frequently in immunocompromised patients and in patients from countries where TB is an endemic problem.
The staging of melanoma of the head and neck is now primarily based on the depth of tumor invasion. The second-to-most recent iteration of the National Comprehensive Cancer Network (NCCN) guidelines also adds ulceration as a component of the staging system: T1A (nonulcerated tumor) versus T1B (ulcerated). Neither nodal staging nor staging of metastases has changed recently.

**Special Characteristics:** Melanoma is a very unpredictable tumor. Generally, melanoma of the head and neck tends to carry a worse prognosis than do melanomas in other parts of the body in terms of recurrence, overall survival, and the earliness of metastases. The prognosis for patients with head and neck melanoma is particularly bad when the tumor occurs in the mask areas of the face. The cosmetic concerns about the face also make dealing with melanoma in this area a big challenge.

**Melanoma of the Scalp:** What are the principles of management for melanoma of the scalp?
Historically, we have been taught that shave biopsies are not good for melanoma. But after evaluating their experiences with thin melanomas at the University of Florida, researchers concluded that a shave biopsy probably does not do a great deal of harm in terms of eventual treatment of the primary tumor. Because a shave biopsy may not allow for accurate staging of the melanoma, most people would recommend an excisional biopsy with ≥3-mm margins for very suspicious lesions. When we cannot do a diagnostic biopsy for larger lesions, we should consider a punch biopsy in the area where the tumor appears to be thickest. For most melanomas of the head and neck that are >0.75 mm thick, the current recommendation is that we strongly consider sentinel lymph node biopsy (SLNB) for these patients. The SLNB is done in much the same way as we would do for a breast lesion. Many surgeons use both technetium sulfur colloid, the radioisotope, and Lymphazurin™ or possibly methylene blue as the vital dye.

**Surgical Margins:** Cosmetic concerns may complicate the excision of a melanoma in the head and neck region. For lesions that are >2 mm thick, the surgical margins should be 2 cm. Historically, very wide margins if 4 to 6 cm have been used, but the data do not suggest that these wide margins provide a survival advantage, if at all. Although the risk of local recurrence increases with the narrower recommended margins, the survival rate is not different for the narrower versus wider margins. For tumors <1 mm thick, probably 1-cm margins are acceptable for in situ lesions, although 5-mm margins are generally acceptable.
Card 7
Head and Neck Melanoma: Satellite Lesions, Treatment, and Lymph Node Management

In patients with melanoma of the head and neck, satellite lesions are seen in the head and neck and can, in fact, be found anywhere. Management of satellite lesions is problematic. The recommendation from the National Comprehensive Cancer Network (NCCN) is for wide local excision when possible. Radiation therapy may have a role in treatment, although most melanomas are not very radiosensitive. Some new chemotherapeutic agents are available for adjuvant therapy, especially for melanomas with the \textit{BRAF} mutation. These new agents include ipilimumab and vemurafenib, and they prolong survival. Although these tend to be relatively toxic agents, we are left with little choice because, once melanomas get into recurrence, satellite lesions, or in-transit metastases, they are very difficult lesions to manage.

**Lymph Node Management:** Historically, we did prophylactic neck dissection, believing that removal of all tumor would be helpful in the presence of clinically negative nodes. However, we learned that this practice was not beneficial. Next, the question was asked about what should be done with the remainder of the regional nodal basin in a clinically negative neck with a positive sentinel lymph node biopsy. Some believe that this is an indication for therapeutic neck dissection. Others disagree and say that the procedure should be delayed until clinic disease develops. Several years ago, a large retrospective study from Duke University evaluated patients with positive sentinel nodes who underwent a completion regional node dissection either right away versus waiting until clinical disease was evident (>3 months after the original operation). Survival was better in patients who underwent delayed regional node dissection. Although the reason for this outcome is unknown, we can speculate that, perhaps, this is related to the immune response mounted against tumor cells that live in regional nodes. Nonetheless, we have no hard data to support the superiority of immediate versus delayed regional node dissection.

**Interferon:** In head and neck melanoma, the use of interferon may improve disease-free survival is of little benefit with regard to overall survival. Although interferon still has a role in the treatment of melanoma, most patients that I have had with metastatic disease will not take it. Patients describe the interferon-related side effects as having the worst imaginable case of the flu for a year. Not all patients experience these side effects, but >50% of patients who started on interferon in my previous practice never completed the course of therapy.
Card 8
Squamous Cell Carcinoma of the Head and Neck

Case: An elderly gentleman with a significant smoking history presents with a nontender, right upper lateral neck mass. How should we approach this case?

Recommendations First, we should perform a comprehensive history and physical examination. For the neck mass, a fine-needle aspiration (FNA) should be performed. The FNA can be done as an in-office procedure using a 22-gauge needle and a 5-mL syringe or an aspirating gun. While not necessary, local anesthesia can be used if the patient is highly apprehensive. Squamous cell carcinoma (SCC) is a fairly common FNA finding for these neck masses. The next step is to perform very comprehensive direct visualization of the hypopharynx, nasopharynx, and larynx via direct laryngoscopy. In this particular case, blind biopsies of the hypopharynx are probably needed as well.

Unknown Cervical Primary: It is not infrequent to find an individual with metastatic disease in a cervical lymph node for which the primary site is never found. The diagnosis in these cases is “unknown cervical primary.” After neck dissection is performed, these patients have a relatively good outcome and survival. Follow-up includes a comprehensive upper aerodigestive examination every 6 months for the first 3 years and then annually until the 5-year anniversary.

Neck Mass Location vs Primary Site: Many head and neck surgeons believe that the location of the neck mass may give clues about the location of the primary site. However, in my experience, the location of the neck mass does not add anything practical to the evaluation.

SCC: When the biopsy findings reveal SCC, patients undergo a selective neck dissection that involves most of the lymphatic tissue in the region or area of concern. Radical neck dissections are rarely performed anymore.

Tonsillar Primary: When a tonsillar primary is found in patients presenting with a neck mass, a radical resection of the primary tumor is performed with or without a node dissection. Recurrences are fairly common with squamous cells of the head and neck, and most will occur within the first 2 years. Therefore, these patients need careful follow-up, usually every 3 months for the first couple of years, then every 4 to 6 months until the 5-year anniversary. After that, annual follow-ups are recommended.

Survival Rates: For all SCCs of the head and neck, the 5-year survival rates range from 50% to 60%. For HPV-positive tumors, the 5-year survival rate ranges from 80% to 85%.

Adjuvant Radiotherapy: Most patients receive adjuvant radiotherapy. Current data suggest a survival benefit in those who receive adjuvant radiation therapy.
Card 9
Basal Cell Carcinoma of the Head and Neck

Basal cell carcinomas (BCCs) of the head and neck are not as aggressive as squamous cell carcinomas in this region. However, there is a misconception that BCCs never metastasize, but this is not true. The morphea types of BCCs tend to be more aggressive. BCCs are now classified as either high-risk or low-risk tumors depending on their location, size, and proliferation indices.

**Treatment Options:** The main treatment for BCC is surgical excision to clear circumferential and deep margins as determined by the pathologist. The goal is to obtain 4 to 5 mm of clean tissue between the primary tumor and the edge of the resection. However, BCCs do allow for some individual treatment preferences, particularly in cosmetically sensitive areas. For example, some topical creams (imiquimod, 5-fluorouracil) have been effective in managing these tumors, although they may not be curative. In addition, photodynamic therapy has some good results for patients who are not surgical candidates. Neither of these treatments have outcomes that are as good as those associated with surgical excision.

**Mohs Technique vs Surgical Extirpation:** Mohs chemosurgery is a technique for excising skin tumors that removes a minimum of normal tissue. As part of the procedure, thin horizontal layers of tissue are removed and frozen sections of the tissue are examined microscopically until all tumor is removed. Although Mohs technique is very time-consuming, many dermatologists like it. I do not think this approach is necessary. As surgeons, if we are uncertain as to what the mass is, we can take a biopsy and then proceed with the surgical extirpation of the tumor. The new guidelines recommend a side-to-side closure rather than a skin graft until clear margins are confirmed by the pathologist. We should mark the margins, or at least draw a picture, so that we will know where to come back and excise tissue if the pathologist finds positive margins.

**Adjuvant Therapy:** Adjuvant radiotherapy is used for BCCs only when we have positive margins that we cannot re-excise. I think re-excision is the best treatment choice until we get clean margins, but the National Comprehensive Cancer Network recommends the use of radiation in special circumstances.
Card 10
Parotid Gland Tumors: Recognition and Treatment

The most common cancer of the salivary glands is a benign mixed tumor (pleomorphic adenoma). Although mixed tumors can be malignant, this is an uncommon occurrence.

**Parotid Cancers:** Approximately 80% of parotid lesions are benign mixed tumors. The most common parotid malignancy is a mucoepidermoid cancer, followed by adenoid cystic carcinomas or mixed malignant tumors. Warthin tumors are one of the more common benign tumors of the salivary glands, and they tend to be bilateral when found in the parotid gland.

**Recognizing Parotid Tumors:** The most common characteristic of parotid tumors is a progressively enlarging painless swelling. Often, patients are unaware of the swelling and a family member actually recognizes the abnormality. Because of its bilateral nature, Warthin tumor of the parotid often presents as a progressive bilateral swelling. For all parotid tumors, the diagnosis is made via fine-needle aspiration.

**Imaging Parotid Malignancies:** If the pathologist identifies a parotid malignancy, then we perform a careful neck examination and proceed to an imaging study to determine if sentinel node biopsy or neck dissection is needed. Many oncologists use a PET scan, although I prefer a CT scan along with a good clinical examination. In my experience, MRI does not offer much additional information.

**Parotidectomy:** For most parotid malignancies, treatment is via superficial parotidectomy. If the deep lobes are involved grossly at the time of operation, then we must decide whether to sacrifice the facial nerve. This is a controversial decision because the functional and cosmetic deformities associated with facial nerve sacrifice are substantial, even with nerve grafting. As a general rule, if the facial nerve is functioning preoperatively, then there is probably no direct tumor invasion of the nerve. However, I have seen facial nerves that were functional preoperatively but, when dissecting along the nerve, I find that the tumor has wrapped around it or extends down the side of it. Peeling the tumor off the facial nerve is difficult. During surgery, I do not routinely use a nerve monitor. No data suggest that nerve monitoring reduces either the risk of injury to the nerve during parotidectomy.
Parotid Gland Tumors: Post-Op Complications, Including Frey Syndrome

For most parotid malignancies, treatment is via superficial parotidectomy, which is associated with transient facial nerve palsy in 40% to 50% of patients. This palsy will resolve in most patients.

**Frey Syndrome:** Another concerning complications is gustatory sweating (auriculotemporal nerve syndrome or Frey syndrome) characterized by flushing or sweating of the face when the patient eats. Theoretically, its cause is related to post-op parasympathetic reinnervation of cutaneous sweat glands, resulting in either intense sweating or flushing of the face on the ipsilateral side when salivation is stimulated. Many attempts have been made to minimize the risk of gustatory sweating by putting dermal allografts and synthetic dermal matrices between the skin and the parotid bed. Injection of Botox® can effectively help control the sweating, but it is rather expensive, and, frequently, the injection must be repeated. Typically, gustatory sweating will resolve if it is not too intense. Because it takes time for these autonomic fibers to reinnervate, resolution of gustatory sweating can be seen as early as several months after surgery, but it may require 1 to 3 years to resolve. Many patients use topical anticholinergics or antiperspirants to stop the sweating, which is more of a social stigma than a health threat.

**Salivary Fistulas:** Parotidectomy can also be associated with salivary fistulas, although this is not a common complication (<10%). Most salivary fistulas resolve on their own without any additional surgical interventions.
Card 12
Managing Penetrating Wounds to Zone 2 of the Neck

Penetrating wounds to zone II of the neck creates the most emotion among trauma surgeons these days. When I started practicing as a surgeon, we explored everybody, including penetrating zone II injuries when there was penetration below the platysma muscle. Then, we looked at our data and we discovered that the therapeutic value of doing those neck explorations was not highly beneficial. The next evolution in management included the “Pan-Ang protocol”: panendoscopy and angiography for penetrating zone II wounds in the neck. Therefore, for a number of years we did not explore the necks unless we found something by endoscopy or on angiography. However, late in my career, we once again evaluated our data and realized that we were spending a lot of money on a workup that provided very little return. When we looked at the cost of taking a patient to the OR for simultaneous exploration and endoscopy, we found that, if there was no injury, we could get these patients out of the hospital within 24 hours at a much reduced cost. Therefore, late in my career, we had come full circle and once again exploring necks in this patient population.

Imaging: Some people recommend getting CT scan without exploration or endoscopy. However, I never trusted myself enough to rely on just a CT scan, so I still perform exploration and endoscopy. Currently, surgeons are conflicted about the correct approach to penetrating wounds to zone II of the neck.
First bite syndrome (FBS) develops after parapharyngeal surgery and also occurs preoperatively in patients with parapharyngeal malignancies of the head and neck. FBS is characterized by an intense, shooting, and sometimes cramping pain that occurs in the side of the face, usually around the parotid area, when a patient takes their first bite. The discomfort resolves over the next four or five bites. Nonetheless, the impact of FBS can be severe. Patients with FBS present with weight loss and sometimes with food aversions: they do not want to eat because they do not want anything to stimulate salivation. Like Frey syndrome, FBS appears to be related to autonomic misinnervation or a loss of the sympathetic innervation of the parotid gland. This misinnervation results in overstimulation of the myoepithelial cells by parasympathetic input, causing these cells to forcefully contract, resulting in spasm and causing the discomfort. This is a difficult problem to manage. FBS is frequently accompanied by Horner syndrome, which is characterized by ipsilateral myosis, ptosis, and facial anhydrosis. FBS can be a complication of surgery in the parapharyngeal space, parotid surgery, and surgery in the chest cavity that sacrificed the sympathetic chain.
Zenker diverticulum is the most common diverticulum of the esophagus. It tends to occur in older patients and is rarely seen in individuals <40 years of age. Men tend to have it more frequently than do women.

**Presentation:** Most patients present with regurgitation of undigested food that may or may not have blood in it, foul breath, and possible dysphagia. Reports of blood in the regurgitated food indicate possible malignant degeneration of this diverticulum, so this is a warning sign that we need to look very carefully at that diverticulum. Ulceration is not uncommon in these diverticuli. From a surgical perspective, the presence of blood in the regurgitated material probably means that we need to do a formal surgical excision of this diverticulum rather than the endoscopic stapling that many surgeons favor.

**Traction vs Pulsion Diverticuli:** Zenker diverticulum is a pulsion diverticulum that occurs in the upper esophageal sphincter (a fairly high-pressure zone), and this pressure (pulsion) tends to cause a little protrusion or herniation of the mucosa where the cricopharyngeus oblique fibers meet. In contrast, a traction diverticulum occurs more distally in the esophagus and is usually caused by an inflammatory process. Pulsion diverticuli are generally more common than traction diverticuli.

**Diagnosis:** A barium esophagram is most commonly used to confirm its presence and determine the size and extent of the diverticulum. Although a less common approach, endoscopy can also be used to make the diagnosis.

**Treatment:** Zenker diverticulum is treated with surgical excision through a lateral neck incision down to the diverticulum. Endoscopy may be used to help with that process, but if blood is present in the regurgitated material, a full surgical excision is required. Most surgeons dissect out the diverticulum, use a stapling device to staple the neck of the diverticulum, and then invert the staple line with sutures. Whether a myotomy (a muscle-splitting procedure) is needed on the cricopharyngeus and how much of a myotomy is needed are somewhat controversial topics among surgeons. Many surgeons simply don’t do a myotomy. I have done myotomies somewhat selectively, depending on the size of the diverticulum. For those electing an endoscopic approach rather than formal excision, the endoscope is inserted, and a stapling device is used to staple the medial wall of the diverticulum. This accomplishes a myotomy as well as opening up the diverticulum so it can drain into the esophagus. The endoscopic procedure should be avoided if there is a remote chance for malignant degeneration or carcinoma in situ in the diverticulum.