Welcome to the Department of Otolaryngology Resident Research Day at the University of Colorado School of Medicine. The major educational function of the Department is to train the complete otolaryngologist – head and neck surgeon. Under supervision of the medical staff, residents participate in all phases of patient care, education, and research.

Patient care discussions go on every day. However, today the residents will have the opportunity to present their scholarly research activities to the group. We are aware that most are not going to do hands on research in the future, but you must be consumers of research in your daily practice. Developing critical judgment promotes better patient care. Understanding the basic scientific method principles is the first step. Most of the projects today were begun in the 2nd year of residency and completed over the course of the training.

Thank you for participating in our program today and we look forward to seeing everyone in June 2014 for the 7th Annual Resident Research Day.

Special Thanks
We would like to acknowledge our educational grant sponsor for our Annual Resident Research Day. We appreciate their continued support and commitment towards our resident educational endeavors.
# Resident Research Day 2013 – Schedule

University of Colorado School of Medicine  
Department of Otolaryngology

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Justin M. Wudel MD: Bone Morphogenic Protein (rhBMP-2) Repair of Alveolar Clefts

J. Eric Lupo MD, MS: Active Mitigation of Acoustic Trauma: A Temporal Bone Model

Henry P. Barham MD: Prognostic Factors in the Outcome of Invasive Fungal Sinusitis Infection in a Pediatric Population

Matthew J. Whinery MD: Thyroid Dysfunction Following Treatment for Laryngeal Squamous Cell Carcinoma

Scott E. Mann MD: Hearing Preservation with Linac-based Stereotactic Radiosurgery for Vestibular Schwannoma

Sarah E. Cooper MD: Solitary Chemosensory Cells in Human Nasal Epithelium

Katherine K. Green MD, MS: Creation of a Panel of microRNA Markers to Validate Quantitative PCR as a Reliable Method of Detecting Human Head and Neck Squamous Cell Carcinoma


Herman A. Jenkins MD: Chiefs’ Special Presentation in Memory of Dr. Clayton Mammel

Richard A. Chole MD, PhD
Professor and Chairman, Department of Otolaryngology, Washington University School of Medicine in St. Louis

Bacterial Biofilms: Are Bacteria a Higher Form of Life?

Geoffrey R. Ferril MD: Comparing Sinus and Pulmonary Cultures in Patients with Bronchiectasis and Chronic Rhinosinusitis

Leah J. Hauser MD: Prevalence and Abundance of Staphylococcus aureus in the Middle Meatus of Patients with Chronic Rhinosinusitis, Nasal Polyps, and Asthma

Justin T. Casey MD: Retropharyngeal Abscesses: Surgical vs. Medical Management

Benjamin M. Milam MD: Atypical Presentations of Pediatric Nasal Septal Hematoma

Closing Remarks & Transition to Poster Display Q & A Session

2nd Floor Research Complex Bldg 2
Poster Display in Traversable Atrium

LUNCH

Visiting Professor Case Discussions with Richard A. Chole MD, PhD
AO1 Building, Room 3101
Richard A. Chole MD, PhD
Lindburg Professor and Department Chairman of Otolaryngology - Head and Neck Surgery
Washington University School of Medicine in St. Louis

Richard A. Chole, MD, PhD is the Department of Otolaryngology – Head and Neck Surgery Chair at Washington University School of Medicine in St. Louis. He is a clinician/scientist, board certified in Otolaryngology with a sub-certification in Neurotology. Dr. Chole received his medical degree from the University of Southern California and completed his residency and graduate training at the University of Minnesota. He was a past president of the Association for Research in Otolaryngology (ARO) and previously elected to the Board of Directors of the American Board of Otolaryngology (ABOto).

Dr. Chole currently serves as Principal Investigator on two NIH grants. His P30, “Research Center for Auditory and Vestibular Studies,” goal is to advance understanding of development, aging and disease mechanisms, as well as normal and recovered function primarily related to hearing and balance. The major goals of Dr. Chole’s RO1, “Cellular and Molecular Biology of Cholesteatoma,” are directed at an understanding of the mechanisms of bacterial-host interactions in the pathogenesis and virulence of cholesteatoma infected with otopathogenic Pseudomonas aeruginosa (PA).

Dr. Chole has been published in several national journals. He has also received numerous honors and awards for his educational and research pursuits.
Sue C. Kinnamon PhD
Professor
Department of Otolaryngology Research Division, Department of Cell & Developmental Biology, and Department of Physiology & Biophysics

Dr. Kinnamon received her PhD from Kansas State University and completed postdoctoral fellowships at the University of Colorado Health Sciences Center. In 1985 she joined the faculty at Colorado State University, Department of Biomedical Sciences. In January, 2009, she became a tenured Professor at the UC Department of Otolaryngology, with joint appointments in Physiology & Biophysics and Cell & Developmental Biology. She is also a member of the Neuroscience Graduate Faculty at UC Denver.

Research Interests:
Dr. Kinnamon’s research focuses on the gustatory system and the common chemical sense. We are interested in how taste cells detect chemical stimuli, how stimuli are transduced into receptor potentials, and how this information is transmitted to gustatory afferent fibers. Studies on the common chemical sense include the function of solitary chemoreceptor cells in the nasal respiratory epithelium. These cells are innervated by the trigeminal nerve and detect noxious chemicals and the presence of bacteria in the airways. Activation of these cells provokes protective airway reflexes. Current studies are focusing on their role in human nasal tissue.

Publications:

Awards:
Dr. Kinnamon has been continuously funded by the NIH since 1987. Currently she has an R21 from NIDCD to study mechanisms of taste transduction & signaling, is PI on a subcontract from the University of Miami to study sweet taste, and is Co-PI with Dr. Tom Finger on the role of solitary chemoreceptor cells in the detection of pathogenic bacteria. Dr. Kinnamon has served on NIH and NSF study sections and was awarded the Association for Chemoreception Sciences Award for Outstanding Achievement in 2001. She is currently serving on two editorial boards and is a member of Faculty of 1000.
Shi-Long Lu MD, PhD
Assistant Professor
Department of Otolaryngology Research Division, Department of Dermatology, and Department of Pathology

Dr. Lu received his PhD from Tokyo Medical and Dental University, and his MD from China Medical University. He completed his post-doctoral training in the Howard Hughes Medical Institute Lab at the Case Western Reserve University. He was a Research Assistant Professor of Otolaryngology and Dermatology at the Oregon Health & Science University. He is currently an Assistant Professor of Otolaryngology, Dermatology, Pathology, and a member of the Cancer Biology Graduate Faculty, and the Cell and Developmental Biology at UCD. He is also a faculty member of the Head and Neck Cancer Research Program, and the Regenerative Medicine & Stem Cell Biology Program.

Research Interests:
Dr. Lu's research interest is on head and neck squamous cell carcinomas. The goal is to understand the molecular mechanisms underlying the development and progression of HNSCC. It is hoped that these studies will lead to identification of novel molecular markers for future clinical diagnosis and experimental therapy.

Publications:

Awards:
Dr. Lu is currently funded by a R01 from NIDCR to study the role of PI3K pathway in head and neck cancer invasion and metastasis. Dr. Lu has also received grant awards from the American Cancer Society; the Thyroid, Head and Neck Cancer (THANC) Foundation; the Dermatology Foundation; Cancer League of Colorado; and the Oregon Medical Foundation. He is also a recipient of a Research Career Development Award from the Dermatology Foundation.
Dr. Rennie received her PhD from the University of Bristol, Avon, U.K. and completed a post-doctoral fellowship in the Department of Otolaryngology at the University of Texas Medical Branch in Galveston. She is currently an Associate Professor of Otolaryngology, Physiology & Biophysics, and a member of the Neuroscience Graduate Faculty at the University of Colorado.

**Research Interests:**
Dr. Rennie’s research is focused on the peripheral vestibular system. The goal is to identify ion channels present in vestibular cells in order to understand how signals are transformed from a mechanical stimulus at the hair cell bundle into electrical activity of the primary vestibular neurons. Electrophysiological (patch clamp), molecular and mathematical modeling approaches are used. We have identified several different types of potassium channels in vestibular cells and are currently assessing synaptic mechanisms. It is hoped that results from these studies will clarify some of the mechanisms underlying vestibular disorders.

**Publications:**
Mann S., Johnson M., Meredith F.L., Rennie K. J. *Inhibition of K+ currents in type I vestibular hair cells by gentamicin and neomycin.* (submitted to Audiol Neurotol).


**Awards:**
Dr. Rennie has received several grant awards from the NIH (NRSA postdoctoral fellowship, R03 & R29 FIRST Award) and is currently funded by the American Otological Society. She has also received funding from the Deafness Research Foundation, the American Hearing Research Foundation and the National Organization for Hearing Research Foundation and is a former recipient of a Research Career Enhancement Award from the American Physiological Society. Dr. Rennie has reviewed grants for the NIDCD (NIH), National Science Foundation, Wellcome Trust, RNID and Deafness Research Foundation and reviewed articles for Acta Pharmacologica Sinica, American Journal of Physiology-Cell Physiology, Experimental Neurology, JARO, Journal of Comparative Neurology, Journal of Neurophysiology, Journal of Neuroscience, Journal of Physiology, Journal of Vestibular Research and Neurochemical Research.
Kristin M. Uhler PhD
Assistant Professor
Department of Otolaryngology

Dr. Uhler received her PhD in 2008 from the University of Colorado, Boulder. She joined the Department of Otolaryngology in 2009 as an Assistant Professor of Otolaryngology, University of Colorado, Denver.

Research Interests:
Infant speech perception in deaf and hard-of-hearing children and the implantable hearing devices for listeners of all ages and their impact on speech understanding abilities.

Publications:
Uhler, K, Burns, S, Dalpes, M. & Yoshinaga-Itano, C (2011) An Auditory Spoken Language Matrix for Differential Diagnosis of Spanish-speaking Children Who are Deaf or Hard of Hearing, Special interest group 14, communication disorders and sciences in culturally and linguistically diverse populations.

Presentations:

Awards:
AAA-AAAF - Principal Investigator - July 1, 2012 - June 30, 2013
HRSA6T7MC110044-04-01 - Project Coordinator - June 22, 2011 - June 30, 2013
2013 Resident Research Day
Panel of Judges

Mona M. Abaza MD, MS
Associate Professor & Program Director

Melissa A. Scholes MD
Assistant Professor

Marcia E. Eustaquio MD
Assistant Professor

Katie J. Rennie PhD
Assistant Professor

Richard A. Chole MD, PhD
Lindburg Professor and Department Chairman of Otolaryngology - Head and Neck Surgery
Washington University School of Medicine in St. Louis

Awards
There will be a 1st and 2nd place award given for “Outstanding Resident Research Presentation” for best demonstration of either basic science or clinical research.

The criteria for selection will be based upon the significance of the research finding to the field of Otolaryngology, the quality of work performed and the quality of presentation.
Past Resident Research Day Award Recipients

2012  **Outstanding Resident Research Presentation**
   1st Place - Matthew Whinery MD
   2nd Place - Henry Barham MD

**Best Case Review** - Katherine Green MD, MS
**Honorable Mention** - Justin Wudel MD

2011  **Outstanding Resident Research Presentation**
   1st Place - J. Eric Lupo MD, MS
   2nd Place - Justin Wudel MD

**Best Case Review** - Matthew Whinery MD
**Honorable Mention** - Scott Mann MD

2010  **Outstanding Basic Science Research**
   Jacob Minor MD

**Outstanding Clinical Research**
   Marcia Eustaquio MD

2009  **Outstanding Basic Science Research**
   Adam Terella MD

**Outstanding Clinical Research**
   Henry Chen MD, MBA

2008  **Outstanding Basic Science Research**
   Henry Chen MD, MBA

**Outstanding Clinical Research**
   Melissa Scholes MD
Objective:
Laryngeal clefts (LC) are congenital malformations of the upper aerodigestive tract that can cause dysphagia and aspiration with resultant pulmonary complications. The management of low grade clefts (LC 1-2) includes both medical and surgical interventions, with studies placing varied emphasis of each modality in their treatment algorithm. Reported metrics for surgical success are variable as well. In this study, we explore our success with the surgical management of LC 1-2 as well as our approach to diagnosis and surveillance.

Methods:
A retrospective / prospective review of an aerodigestive program quality assurance database of a tertiary-level academic children’s hospital was performed of all patients who received the diagnosis and management of a Type I-II laryngeal cleft (LC-1,2) by a single surgeon. Most patients underwent initial evaluation within the multidisciplinary aerodigestive program. Signs and symptoms of aspiration were further evaluated with a swallow evaluation, most commonly via modified barium swallow (MBS). Definitive repair was performed endoscopically in all cases. Post-operative surveillance consisted of microlaryngoscopy / bronchoscopy (MLB) and MBS. Improvement or resolution on post-operative swallow was noted along with the interval of post-operative MBS.

Results:
Twenty five patients were identified with LC-1,2 and underwent surgical management. There were 20 patients with LC-1, 5 with LC-2. The mean age of diagnosis was 3.5 years of age (range – 13 days to 13.5 years). Most common presenting symptoms were aspiration on MBS (72.7%, 16) and recurrent pulmonary infections (52%, 13). Gastroesophageal reflux disease was a concurrent co-morbidity in 76% (19). Three patients had a history of neurological disease. Seven patients had a history of prematurity. Of the 25 patients, 2 have yet to have post-operative MBS and one did not have pre-operative MBS, therefore the cohort examined in this study consisted of 22 total patients. The mean age of repair was 4.3 years. The mean hospitalization was 1.8 days. The mean time of first post-operative and most recent post-operative MBS was 46.3 days (range 7-90) and 183.5 days (range 41-548).
Of the 16 patients that had preoperative aspiration, 9 (56.3%) had evidence of improvement on their first MBS (6 with resolution of aspiration, 3 with improved tolerance of consistencies). This improved to 10 (62.5%) at the time of their most recent MBS (7 with resolution of aspiration, 3 with improved tolerance of consistencies). Three patients failed to improve from surgical repair and 3 actually demonstrated worsened aspiration on most recent MBS. Six patients did not aspirate on postoperative MBS. None of these patients aspirated on their most recent postoperative MBS, however 2 did have transient aspiration on their first postoperative MBS which resolved with subsequent re-evaluation.

Conclusion:
The management of LC-1,2 include both medical and surgical strategies. Our study supports that endoscopic repair of low grade LC has favorable results. However, surgical intervention can cause transient or long term decline of aspiration score. Application of our diagnostic algorithm can contribute to consistency in reporting surgical success rates.
Bone Morphogenic Protein (rhBMP-2) Repair of Alveolar Clefts

Justin Wudel MD1, Sondra Valdez RN, BSN2, Jonathan N. Perkins MD1,2, Ashley Blanchard BA3, Gregory C. Allen MD1,2
1University of Colorado School of Medicine, Department of Otolaryngology
2Children’s Hospital Colorado, Division of Pediatric Otolaryngology, Aurora, CO
3University of Colorado School of Medicine

Objective:
An alternative to autogenous bone grafting for maxillary alveolar cleft repair is the application of recombinant human bone morphogenic protein in a collagen sponge matrix. Our aim was to quantify bone growth, examine parental satisfaction following the procedure, and evaluate dental/orthodontic outcomes for patients who underwent rhBMP-2 alveolar cleft repair.

Methods:
A retrospective review was performed on all patients who underwent alveolar cleft repair at a tertiary children’s hospital from 2007-2010. Satisfaction questionnaires were completed by parents, dentists, and orthodontists. Degree of bone fill was determined by independent grading of postoperative Panorex films.

Results:
32 of the 42 patient cohort had postoperative Panorex films. Independent grading demonstrated 36.7% had >75% of the alveolar cleft filled, 47.8% had 50-75% filled, and 17.3% had <50% filled. Mean length of follow up was 24.4 months. One minor complication of bony overgrowth into the nasal cavity was reported.

Parent and patient satisfaction regarding surgical outcome was 93.3% and 83.3% respectively. Of dentist respondents, 87.5% reported the graft enabled treatment, and 68.7% felt the graft prevented tooth root exposure and resorption.

Conclusion:
Alveolar cleft repair using rhBMP-2 provides adequate bone growth to support dental and orthodontic treatment with minimal complications, while alleviating the need for autogenous bone grafting and its morbidity. In addition, the majority of patients and parents are highly satisfied with the surgical outcome.

Comments: This is the first study evaluating parental satisfaction related to speech, facial appearance, post-operative pain, nasal regurgitation, and nasal blockage after rhBMP-2 cleft repair. It is also the first to examine dental/orthodontic outcomes after surgery.
Active Mitigation of Acoustic Trauma: A Temporal Bone Model

J. Eric Lupo MD, MS1, Kanthaiah Koka PhD2, Daniel J. Tollin PhD1,3, MAJ Travis J. Pfannenstiel MD4, James Easter MS, PE5

1University of Colorado School of Medicine, Department of Otolaryngology
2Advanced Bionic LLC, Valencia, CA
3University of Colorado School of Medicine, Department of Physiology and Biophysics
4Brooke Army Medical Center, Fort Sam Houston, TX
5Cochlear Corp. Boulder, CO

Introduction:
Acoustic trauma may occur in many different settings including occupational or recreational settings. Severe acoustic trauma typically results in a mixed hearing loss with a sensorineural component that incompletely resolves and a conductive component that may be amenable to surgical intervention. Contemporary protection against acoustic trauma occludes the ear canal or blocks acoustic energy from entering the canal resulting in a fixed attenuation of acoustic energy with associated decrease in localization capability and difficult interpersonal communications. An active middle ear implant, connected to the ossicular chain, may provide a means to mitigate damaging auditory input while providing access to normal acoustic sound and acoustical cues.

Method:
Blast-level acoustic stimulus was delivered directly to the EAC with a custom built speaker and condensing cone which produced stimuli as high as 180 dB SPL at the tympanic membrane. Ossicular velocities were measured with a single axis laser Doppler vibrometer. Baseline measurements of ossicular motion during simulated acoustic events and with harmonic tonal stimulation were obtained. An active middle ear implant was then fixed to the temporal bone and either loaded to the incus body or clipped to the incus long process (ILP). The mitigation effect of the active middle ear implant was then tested by driving it with direct current (DC) or a signal 180° out of phase, and in its passive state. Ossicular velocities were studied in the time domain and the frequency domain, and compared between the baseline condition and with active mechanical mitigation.

Results:
There was no significant decrease in stapes velocity with the mechanical transducer loaded to the incus body or ILP in the passive state. Powering the transducer with DC resulted in a drop of 2-3 dB which was not significant for either impulse or harmonic stimuli. Driving the transducer with a signal 180 degrees out of phase did not significantly reduce the stapes velocity of a simulated blast event. When the transducer was driven by a signal 180° out of phase with a harmonic acoustic stimulus, 6-10 dB of active attenuation was observed.

Conclusion:
Active mitigation of incident harmonic noise was shown to be feasible provided the transducer can be driven with a signal 180° out of phase to the harmful stimuli. The technique of active mitigation in this model does not appear to protect against the highest levels of acoustic input. Future work will be directed to improving the mitigating signal waveform to reproduce the damaging signal with good fidelity and phase matching.

Support: Defense Medical Research and Development Program Grant: W81XWH-10-2-0112 (to JE)
Introduction:
Invasive fungal sinusitis (IFS) in children is rare and its prognosticators are poorly understood. This study aims to determine important factors affecting outcome.

Methods:
A 10-year retrospective review at a tertiary academic children’s hospital was performed using a combined ICD-9 and procedure-based search following institutional review board approval. All relevant demographic and clinical information was collected. Confirmation of IFS was based on endoscopic, histologic and microbiologic findings. Survival was defined as clearing IFS.

Results:
Twelve immune-compromised patients (M:F = 5:7; mean/range = 11/2-16 years) were identified that included hematologic malignancies (10), diabetes mellitus (1) and unknown (1). Fungal species included: aspergillus (5), mucor (3), alternaria (2), rhizopus (1) and scopulariopsis (1). The cohort underwent an average of 6.3 (median= 5.5) endoscopic sinus surgeries (ESS) and was treated with aggressive anti-fungal therapy. Four (2 related and 2 unrelated to IFS) deaths occurred in the study population, with 10 survivors and 2 deaths by study definition. There was a significant difference in the absolute neutrophil count (ANC) at follow-up after treatment of IFS between the survival and mortality sub-groups, with mean ANC being 3934/mm2 and 169/mm2, respectively (p=0.016).

Conclusion:
Despite the small sample size, this study represents one of the largest case series on pediatric IFS. Age, gender, immunodeficiency etiology and causative fungal agent were not important prognosticators. ANC appears to be the only factor responsible for survival as supported by the adult literature. While surgical debridement is deemed essential in IFS management, its role for disease survival is indeterminate.
Objective:
Clinical and Subclinical hypothyroidism following treatment of Head and Neck Squamous Cell Carcinoma is a well documented phenomenon. However, much less has been published regarding hypothyroidism following treatment of Laryngeal Squamous Cell Carcinoma in isolation. As such, we are performing a retrospective chart review of all patients with a Laryngeal Squamous Cell Carcinoma primary (Glottic, Supraglottic, Subglottic, Transglottic) treated at the University of Colorado since 2005. Specifically, we are investigating sex, treatment modality, use of hemithyroidectomy in treatment, neck nodal status, and presence of thyroidal invasion as prognosticators for development of post treatment hypothyroidism. Hypothyroidism is of high clinical significance as it may lead to poor wound healing, pharyngocutaneous fistula, poor speech outcomes, and depression.

Methods:
Retrospective Chart review with Redcap utilization.

Results:
Chart review in progress currently. We anticipate an overall hypothyroidism rate (clinical and subclinical combined) of 25% in Surgery alone patients, 35% in Chemoradiation alone patients, and 60-70% in combination Surgery and Chemoradiation patients.

Conclusion:
Hypothyroidism following treatment of laryngeal carcinoma is a quite common complication. Given the ease of diagnosis and potential wound healing as well as depressive complications of hypothyroidism, this entity should be closely monitored against in all laryngeal cancer patients. Treatment of both clinical and subclinical hypothyroidism with Levothyroxine/Synthroid is effective and safe.
Objective:
Vestibular schwannomas (VS) are benign tumors of the eight cranial nerve. Stereotactic radiosurgery (SRS) is increasingly being utilized in the treatments of VS. The two major forms of SRS used are Gamma Knife, and Linear-accelerator based (Linac) systems. The major treatment goals include control of tumor growth and hearing preservation in the affected ear. Although much has been published regarding the outcomes of Gamma Knife SRS, there is little evidence available regarding Linac-based systems. This study examined the efficacy and hearing preservation of patients treated at a single institution with Linac-based SRS.

Methods:
Records of patients treated at the University of Colorado department of Otolaryngology for VS were examined retrospectively. Patients treated with single fraction Linac SRS were identified and included in the study. Audiograms and MRIs were analyzed for changes over time. If serviceable hearing was present in the affected ear at time of treatment, dosimetric analysis was performed to further examine radiation exposure to tumor and pertinent surrounding structures.

Results:
54 patient’s records were examined. 2 patients (3.7%) were found to have tumor progression and required further treatment. No patients developed facial nerve dysfunction after treatment. Of the 22 patients with serviceable hearing before treatment, 14 (64%) retained serviceable hearing over time. Treatment dose was 12-14 Gy at the 90% isodose line. Mean total dose to cochlea was 7.4 Gy. Comparing patients that retained hearing to those who lost hearing, there was no significant difference in dose to cochlea, distal IAC, or brainstem.

Conclusions:
Single fraction Linac-Based SRS is very effective at achieving tumor control in the treatment VS. Hearing preservation was equivalent to that of Gamma Knife systems when compared to published outcomes. Dose to cochlea or internal auditory canal were not associated with hearing loss over time.
Introduction:
Solitary chemosensory cells (SCCs) use the bitter taste transduction cascade to detect potential irritants in the airway. In rodents, SCCs are innervated by the trigeminal nerve and when stimulated evoke protective airway reflexes such as sneezing, apnea and local inflammation. Research has expanded to looking for these cells in humans and their clinical implications. Reports have been published of cells resembling SCCs in human biopsy material near the vestige of the vomeronasal organ as well as within the turbinates. However, the exact distribution and abundance of SCCs in humans is unknown.

Methods:
To map the distribution of SCCs, we obtained middle and inferior turbinate mucosa from human patients that were free of sinonasal disease, but were undergoing surgical procedures requiring removal of this tissue. Whole mount tissue was stained with antibodies against TRPM5 and villin, which is expressed at the apex of microvillous, but not ciliated, epithelial cells.

Results:
TRPM5-immunoreactive cells were scattered heterogeneously in the sinonasal tissue. The cells were most abundant on the ridges of the turbinates and less abundant on the lateral margins. Many TRPM5 immunoreactive cells also labeled with the villin antibody, suggesting that TRPM5 is present in microvillous but not ciliated cells of the epithelium.

Conclusion/Discussion:
SCCs are more abundant along the ridges of the turbinates and less so on the lateral margins. Additionally, villin staining is present in many TrpM5 immunoreactive cells suggesting the TrpM5 is present in microvillous but not ciliated epithelial cells. Studies are in progress to determine if disease state alters the distribution or abundance of these cells and whether SCCs in humans are innervated by the trigeminal nerve, as in rodents.

Support: AAO, ARS Resident Research Grant # 235218 (to HP)
Creation of a Panel of microRNA Markers to Validate Quantitative PCR as a Reliable Method of Detecting Human Head and Neck Squamous Cell Carcinoma

Katherine K. Green MD, MS¹, Neil Gross MD², John Song MD¹, Shi-Long Lu MD, PhD¹

¹University of Colorado School of Medicine, Department of Otolaryngology
²Oregon Health & Science University, Department of Otolaryngology, Portland, OR

Introduction:
Early detection of HNSCC improves long-term survival. More than half of patients with HNSCC present with locoregional or metastatic disease at the time of diagnosis. MicroRNAs are promising markers for early detection as they are stable, tissue-specific, and known to be involved in processes critical for tumor development and progression. Methylated microRNA sequences have been studied in early detection of lung and GI cancers.

Methods:
Genomic DNA was extracted from 30 SCC samples, 24 samples of grossly normal adjacent mucosa from those tumor patients, and 8 samples from normal controls (no cancer). The gDNA was treated with bisulfate to identify the methylation pattern, and quantitative polymerase chain reaction was run for 6 microRNA markers (9-1, 9-3, 124-1, 124-2, 124-3, 137) to determine the level of expression in each sample.

Results:
Overall expression of each marker was significantly higher in the tumor group when compared to the controls (p<0.001) and the adjacent mucosa (p<0.001). Using the expression levels within the controls as a baseline, a positive cut-off value was determined for each marker to create 100% specificity. The sensitivity of each individual marker ranged from 60-76%, but when used in combination as a diagnostic panel, the sensitivity increased to 90%.

Conclusions:
We have successfully created a diagnostic panel of methylated microRNA markers that demonstrated 90% sensitivity and 100% specificity in the detection of HNSCC. This panel is currently being tested on saliva, blood and tissue samples of tumor-positive and tumor-negative (control) patients as part of a larger early detection clinical study.

Brook McConnell MD\textsuperscript{1}, Stephen Boyes PhD\textsuperscript{2}, Sven-Olrik Streubel MD, MBA\textsuperscript{1,3}

\textsuperscript{1}University of Colorado School of Medicine, Department of Otolaryngology
\textsuperscript{2}Colorado School of Mines, Department of Chemistry and Geochemistry, Golden, CO
\textsuperscript{3}Children's Hospital Colorado, Division of Pediatric Otolaryngology, Aurora, CO

Background:
Critical-sized segmental bony defects of the face pose a difficult reconstructive dilemma. Generally, reconstruction of these defects requires the use of titanium hardware in conjunction with other methods such as autologous tissue transfer, allogenic grafts, xenografts, and prosthetic devices, none of which is free from associated morbidity. Alternatively, tissue engineering has offered reconstructive options that aim to minimize or eliminate morbidity associated with conventional methods. Numerous tissue-engineering studies have evaluated scaffold materials and their affect on bone regeneration. However, many of these materials offer poor mechanical properties, which limit their use. Nanotechnology has recently offered alternative materials with enhanced cellular interaction and bone regeneration potential, as well as mechanical properties that may make the material more suitable for use in the face.

Methods & Results:
The synthesis of a novel amphiphillic block copolymer derived from poly(lactic acid) and the preparation of a nanofiber scaffold system, via electrospinning, from this polymer are presented. Electrospinning is a process whereby high voltage electrical current is applied to a stream of polymer solution to form micro- and nanofibers. Multiple variables are altered to produce a scaffold containing the desired fiber diameter, tensile strength, pore size etc. Challenges associated with this process will be discussed, as well as elemental and structural analysis of the copolymer and scaffold.
Comparing Sinus and Pulmonary Cultures in Patients with Bronchiectasis and Chronic Rhinosinusitis

Geoffrey R. Ferril MD¹, Todd T. Kingdom MD¹, Jeffrey D. Suh MD², Vijay R. Ramakrishnan MD¹

¹University of Colorado School of Medicine, Department of Otolaryngology
²University of California - Los Angeles, Department of Otolaryngology, Los Angeles, CA

Introduction:
Bronchiectasis is an uncommon disease of the lower airways characterized by bronchial wall destruction and permanent bronchiolar dilation. Several etiologic categories exist, and in general, patients with bronchiectasis have an increased incidence of chronic rhinosinusitis (CRS). The present study investigates the association between bronchiectasis and CRS using bacteriologic data.

Methods:
Retrospective chart review from a tertiary care respiratory hospital was performed. Upper and lower airway cultures from patients with both bronchiectasis and CRS were compared using the chance adjusted agreement, or Kappa statistic.

Results:
A statistically significant correlation of upper and lower airway bacterial cultures in patients with both bronchiectasis and CRS was also found with respect to the five most common bacteria identified (Kappa=0.323; p=0.014). Pseudomonas was the most commonly identified bacterium identified in both sinus and pulmonary cultures.

Conclusion:
The current study supports the Unified Airway. A high prevalence of pseudomonas and other gram negative bacteria were found. The findings carry implications for disease pathogenesis, clinical care, and future research.
Prevalence and Abundance of *Staphylococcus aureus* in the Middle Meatus of Patients with Chronic Rhinosinusitis, Nasal Polyps, and Asthma

Leah J. Hauser MD¹, Vijay R. Ramakrishnan MD¹, Leah M. Feazel MS², Daniel N. Frank PhD³

¹University of Colorado School of Medicine, Department of Otolaryngology
²Division of Infectious Diseases
³Microbiome Research Consortium

**Background:**
Chronic rhinosinusitis (CRS) is an idiosyncratic and multifactorial disease process. Bacteria play a role in some patients, by infection or stimulation of inflammation. *Staphylococcus aureus* (SA) appears to be implicated in a number of infectious and inflammatory mechanisms, and may be particularly relevant in CRS patients with nasal polyps and asthma.

**Methods:**
Middle meatus swabs from control and CRS patients collected during endoscopic sinus surgery were analyzed by quantitative polymerase chain reaction (QPCR). Total bacterial count, SA prevalence, and SA abundance were examined with respect to patient demographics and disease characteristics.

**Results:**
Total bacteria, as measured by QPCR, was not statistically different between controls, CRS without nasal polyps (CRSSNP), CRS with nasal polyps (CRSwNP), or CRS with asthma groups (p < 0.09). Total bacterial counts did not correlate with disease severity as measured by Lund-Mackay computed tomography (CT) scores (p = 0.65). The prevalence of SA was similar between groups (15-25%); however, the abundance increased in CRS patients with allergic rhinitis, nasal polyps, and asthma.

**Conclusion:**
The paranasal sinuses are not sterile. SA is implicated in a subset of CRS patients with nasal polyps and/or asthma. Further study is required to predict this subset of patients, and to define the mechanisms of SA pathogenesis.
Objective:
Retropharyngeal abscesses are the most common abscess in the pediatric population. Despite this, there is some debate on how to best treat these patients, be it intravenous antibiotics or immediate surgical incision and drainage. The purpose of this study was to evaluate patient and abscess characteristics associated with failure of medical management.

Methods:
We retrospectively examined 46 patients between 1999 and 2009 at Arnold Palmer Children’s Hospital in Orlando, FL. Patient charts were reviewed and data collected included age, gender of the patient, size of the abscess, days of admission to the hospital, admission to the Intensive Care Unit, and surgical intervention, if applicable. All patients first received 24-48 hours of IV antibiotics, at which point a clinical decision was made to proceed with surgery or continue conservative management.

Results:
When comparing antibiotic treatment failure across age, gender, and abscess size, statistically significant correlation occurred only with the size of the abscess. It was noted that abscesses larger than 2 cm were more likely to fail medical management and need surgery. Additionally, hospital stay was not statistically different between the medical and surgical groups.

Conclusion:
Our data demonstrate statistical significance for the ability to treat retropharyngeal abscesses 2 cm or less in diameter with intravenous antibiotics alone, without complications, and with a statistically similar average hospital stay compared with surgery. Abscesses over 2 cm may be managed medically as well, but are more likely to fail antibiotic therapy alone and need surgical intervention. Of note, this was one of the largest studies in the literature on management of retropharyngeal abscesses.
Atypical Presentations of Pediatric Nasal Septal Hematoma

Benjamin Milam MD1, Tendy Chiang MD1,2, Gregory Allen MD1,2, Peggy Kelley MD1,2, Patricia Yoon MD1,2

1University of Colorado School of Medicine, Department of Otolaryngology
2Children’s Hospital Colorado, Division of Pediatric Otolaryngology, Aurora, CO

Objective:
To present a case series of atypical manifestations of nasal septal hematoma in the pediatric population.

Setting:
A tertiary care children’s hospital.

Methods:
The clinical course of two infants, one child is reviewed along with radiographic findings, intraoperative images and a review of the literature.

Results:
Three cases of delayed manifestations of septal hematoma are reported. Two cases presented as an infant in respiratory distress secondary to nasal obstruction and presence of a midline mass. There was no recent history of trauma in either patient. Both patients required urgent intubation and surgical drainage. The third patient, presented as a child with left periorbital swelling, ophthalmoplegia, and mental status changes secondary to complicated sinusitis and cavernous sinus thrombosis. This patient also required urgent surgical intervention.

Conclusion:
Nasal septal hematomas and/or nasal septal abscesses are exceedingly rare, accounting for 0.8% to 1.6% of nasal traumas. Although their incidence is well described in the pediatric literature, delayed manifestations without history of trauma have not been reported. Urgent surgical intervention is necessary to prevent long-term impact on maxillofacial growth as well as potential acute intracranial manifestations. Given that this clinical entity is exceedingly rare in infants, multidisciplinary evaluation for non-accidental trauma is mandatory prior to discharge.
Tendy Chiang MD, PGY-6

Education/Honors & Awards:

**Fellowship:**
University of Colorado SOM, Pediatric Otolaryngology — 2013

**Residency:**
The Ohio State University Medical Center, Otolaryngology — 2012

**Medical School:**
The Ohio State University COM — 2007

**Undergraduate:**
The Ohio State University — 2002

Abstracts/Presentations:


Publications:


Henry P. Barham MD, PGY-4

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology
Outstanding Resident Research Day - Second Place - 2012
CORE AAO-HNSF Resident Research Grant — 2012
AAO-HNS Resident Leadership Grant— 2011, 2012

Medical School:
Louisiana State University HSC — 2009
AMA Foundation Scholars Fund Recipient
Key Note Speaker to the Louisiana State University Board of Supervisors

Undergraduate:
B.S. Louisiana State University — 2004
Louisiana State University Board of Supervisors Scholarship, Lifetime

Abstracts/Presentations:

Ferril GR, Barham HP, Prager JD. Novel airway findings in a patient with 1p36 deletion syndrome. The Society for Ear, Nose and Throat Advances in Children annual meeting in Charleston, South Carolina, December 1, 2012.


HP Barham, MK Dishop, JD Prager. Idiopathic sclerosing inflammation presenting as sinusitis. The American Rhinologic Society annual meeting in Washington DC, September 2012.


Henry P. Barham MD (cont)

Abstracts/Presentations:


Publications:


*Curcumin inhibits HNSCC by modulating the Akt/mTOR pathway*, C. A. Clark, Y. Rong, X. Rong, S. Shah, **H. Barham**, C. O. Nathan Oral Oncology, ISSN: 1368-8375, Vol: 3, Issue: 1, Date: 2009-01-01
Justin T. Casey MD, PGY-2

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology

Medical School:
Florida State University SOM — 2011

Undergraduate:
B.S. Rensselaer Polytechnic Institute — 2006

Abstracts/Presentations:


Publications:


Sarah E. Cooper MD, PGY-4

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology

Internship:
University of California at San Francisco, Department of Surgery — June, 2009 - June, 2010

Medical School:
Texas Tech University HSC — 2009
Alpha Omega Alpha
Dean’s Recognition Award

Undergraduate:
B.S. The University of Notre Dame — 2003

Abstracts/Presentations:

Publications:


Geoffrey R. Ferril MD, PGY-3

Education/Honors & Awards:
Residency:
University of Colorado SOM, Otolaryngology

Medical School:
The University of Mississippi SOM — 2010

Undergraduate:
B.A. The University of Mississippi — 2006
Magna Cum Laude
Phi Beta Kappa
Phi Kappa Phi

Abstracts/Presentations:


Publications:
Ramakrishnan, Vijay, Ferril, Geoffrey, Suh, Jeffrey, Woodson, Trudi, Green, Tyler, Kingdom, Todd. Upper and lower airways associations in patients with chronic rhinosinusitis and bronchiectasis. International Forum of Allergy & Rhinology. “(Submitted)


Katherine K. Green MD, MS, PGY-3

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology
Outstanding Resident Research Day - Best Case Review - 2012

Medical School:
University of Southern California Keck SOM — 2010

Graduate:
M.S. Rush University — 2006

Undergraduate:
B.A. Northwestern University — 2004

Abstracts/Presentations:


Death after adenotonsillectomy secondary to massive pulmonary embolism. 40th Annual SENTAC Meeting. November 2012, Charleston, SC.

Publications:


Katherine K. Green MD, MS (cont)

Publications:


In submission: *The efficacy of treatments for autoimmune inner ear disorder*. Derebery, M.J., Green, K., Chung, J., & Fisher, LM.
Leah J. Hauser MD, PGY-2

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology

Medical School:
Northwestern University, Feinberg SOM — 2011
Alpha Omega Alpha

Undergraduate:
B.S. University of Southern California — 2006
Cum Laude

Abstracts/Presentations:


Publications:

J. Eric Lupo MD, MS, PGY-5

Education/Honors & Awards:

Fellowship:
Neurotology Fellowship — Starting July, 2013
House Research Institute

Residency:
University of Colorado SOM, Otolaryngology — 2013
Gold-Humanism Honor Society — 2013
American Otological Society- Resident Travel Award — 2013
Outstanding Resident Research Day - First Place — 2011
Association for Research in Otolaryngology Travel Award — 2009 - 2013
CORE AAO-HNSF Resident Research Grant — 2009

Medical School:
University of Colorado SOM — 2008
UCD Professional Development Award

Graduate:
M.S. Stanford University — 2001

Undergraduate:
B.S. University of Colorado Boulder — 1997
Colorado Engineering Council Certificate of Merit

Abstracts/Presentations:


Lupo JE, Koka K, Tollin DJ, Easter J. 2013. Intracochlear pressure measurement using commercially available sensors. ARO abs: 775


J. Eric Lupo MD, MS (cont)

Abstracts/Presentations:


Optimizing the Performance of Active Middle Ear Implants: Basic Studies. University of Colorado Department of Otolaryngology MidWinter Meeting. Vail, CO 2/7/12


Lupo JE, Koka K, Jenkins HA, Tollin DJ. 2011. Third Window Vibroplasty: Assessment of Physiologic Responses in a Model of Stapes Fixation AOS Abs accepted
J. Eric Lupo MD, MS (cont)

Abstracts/Presentations:


Lupo JE, Leuin S, Kelley PE. 2010. Anterior Laryngofissure Approach to an Airway Foreign Body After Migration Into the Paraglottic Space. ABEA Abs #10


Active middle ear implant cochlear stimulation in experimental models of stapes fixation: Otosclerosis Study Group 72nd Annual Meeting. Boston. 9/25/10


J. Eric Lupo MD, MS (cont)

Abstracts/Presentations:


The Effects of experimentally-induced conductive hearing loss on spectral and temporal aspects of sound transmission through the ear. American Federation for Medical Research Western Regional Meeting. Carmel, CA 2/1/2008

Publications:


J. Eric Lupo MD, MS (cont)

Publications:


Scott E. Mann MD, PGY-4

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology
Outstanding Resident Research Day - First Place - 2012
Outstanding Resident Research Day - Honorable Mention - 2011

Medical School:
University of Colorado SOM — 2009
Alpha Omega Alpha
Excellence in Medical Humanities Award
Presbyterian/St. Luke's Hospital Auxiliary Scholarship

Undergraduate:
B.M. University of Denver — 2003
Magna Cum Laude
Phi Beta Kappa

Abstracts/Presentations:

Scott Mann, Hayley Ross, Matthew Johnson, Frances Meredith, Katie Rennie. Inhibition of K+ Currents in Type I Vestibular Hair Cells by Aminoglycosides. Association for Research in Otolaryngology 35th Mid-winter meeting, February 2012

Frances Meredith, Scott Mann, Katherine Rennie. Characterization of a Hyperpolarization-Activated Current (Ih) in Vestibular Calyx Terminals. Association for Research in Otolaryngology 35th Mid-winter meeting, February 2012

Mann SE, Dhawan R, Rennie KJ. Signaling Mechanisms at the Type I Hair Cell/Calyx Synapse. Association for Research in Otolaryngology Midwinter Research Meeting, Baltimore April 19, 2009.

Publications:


Jameson K. Mattingly MD, PGY-1

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology

Medical School:
University of Louisville SOM — 2012
Summa Cum Laude
Gold Humanism Honor Society
Alpha Omega Alpha
Dean’s Award

Undergraduate:
B.S. Western Kentucky University — 2008
Summa Cum Laude

Abstracts/Presentations:


Jameson K. Mattingly MD (cont)

Publications:

Cheadle W, Lenz A, Carrubba C, Mattingly J. Array analysis of macrophage tolerance in peritonitis. Inflammation Research, 8th World Congress on TSIS, abstract. 2010 Mar;59(Supplement 1):S51

Brook K. McConnell MD, PGY-3

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology

Medical School:
University of Colorado SOM — 2010

Undergraduate:
B.A. University of Colorado Boulder — 2005

Abstracts/Presentations:


Chiang T, McConnell BK, Ruiz AG, Prager JD. *Multidisciplinary approach to the diagnosis and management of Type I-II laryngeal clefts*. American Society of Pediatric Otolaryngology Annual Meeting poster, 2013/


Publications:

McConnell BK, Said MS, Ramakrishnan VR. *Nasal septal perforation associated with pyoderma gangrenosum*. Ear Nose & Throat Journal submitted for publication.

Benjamin M. Milam MD, PGY-2

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology

Medical School:
University of Virginia SOM — 2011

Undergraduate:
B.S. University of Virginia — 2006
Phi Beta Kappa

Abstracts/Presentations:
Shonka Jr DC, Milam BM, Jameson MJ. Suprafascial harvest of the radial forearm free flap decreases the risk of postoperative tendon exposure. Abstract presented at the American Head and Neck Society meeting which is part of the Combined Otolaryngological Spring Meetings in May 2011 in Chicago.


Publications:


Benjamin M. Milam MD (cont)

Publications:


S. Craig Quattlebaum MD, PGY-1

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology

Medical School:
University of Oklahoma COM — 2012
Gold Humanism Honor Society
Dean’s Scholar
Alpha Omega Alpha

Undergraduate:
B.S. Harding University — 2008

Abstracts/Presentations:

Quattlebaum, SC, Schinnerer, E. (2010, June.) Identifying patients at risk for OSA. Poster presented at: Oklahoma Academy of Family Physicians Annual Scientific Assembly; Tulsa, OK

Quattlebaum, SC, Mold J, Schinnerer E. (2009, August). SCHIP (Stephens County Health Improvement Project): Low Dose Aspirin Therapy Awareness Project. Oral presentation to the Oklahoma State Department of Health; Oklahoma City, OK

Publications:


Carly J. Stewart  MD, PGY-1

Education/Honors & Awards:

**Residency:**
University of Colorado SOM, Otolaryngology

**Medical School:**
Northwestern University, Feinberg SOM — 2012
Alpha Omega Alpha

**Undergraduate:**
B.S. Brown University — 2008
Magna Cum Laude
Phi Beta Kappa

Abstracts/Presentations:


**Stewart CJ,** Dungan JS, Singh DK, Collins C, Shulman LP. *Unaffected Women with BRCA 1/2 Mutations and Their Use of Family History in Making Decisions Concerning Prophylactic Surgery.* Poster presentation at Northwestern University for the Medical Student Summer Research Program, Chicago, IL. October 2009.

Publications:

Matthew J. Whinery MD, PGY-4

Education/Honors & Awards:

Residency:
University of Colorado SOM, Otolaryngology
Outstanding Resident Research Day - First Place - 2012
Outstanding Resident Research Day - Best Case Review - 2011
Highest In-Service Exam - 2011, 2012

Medical School:
UT Southwestern — 2009
Alpha Omega Alpha

Undergraduate:
B.S. Texas A&M University — 2005
Summa Cum Laude
Phi Beta Kappa
Phi Kappa Phi

Abstracts/Presentations:

Justin M. Wudel MD, PGY-5

Education/Honors & Awards:

Fellowship:
Plastic Surgery and Reconstructive Fellowship — Starting July, 2013
University of Michigan Health System

Residency:
University of Colorado SOM, Otolaryngology — 2013
Administrative Chief Resident — 2012 - 2013
Outstanding Resident Research Day - Honorable Mention - 2012
Outstanding Resident Research Day - Second Place - 2011

Medical School:
University of Minnesota — 2008
Alpha Omega Alpha

Undergraduate:
B.S. University of Minnesota — 2004

Abstracts/Presentations:

Wudel J, Brown N, Mariner, P, Anseth K, Streubel S. *In vivo application of polyethylene glycol hydrogel to promote wound healing in full thickness skin defects.*


Wudel J, Kingdom T. *Seronegative sinonasal Wegener’s granulomatosis: A clinical challenge.* 2010 September - Boston, MA

Wudel J, Kingdom T, Durairaj V. *Outcomes after dacryocystorhinostomy in patients with nasolacrimal duct obstruction secondary to sarcoidosis.* American Rhinologic Society, April 2010 - Las Vegas, NV

Wudel J, Sidman J, Landers T, Rimell F. *Efficacy of balloon sinuplasty in the pediatric population.* American Society of Pediatric Otolaryngology, May 2008 – Orlando, FL
Resident Research Day 2013

University of Colorado School of Medicine
Department of Otolaryngology

Justin M. Wudel MD (cont)

Abstracts/Presentations:

Wudel J, Wuertz B, Ondrey F. Inhibition of Adenoid Cystic Cancer via Combination Chemotherapy and PPAR Gamma Activation in Vitro. Triological Society Middle Section Meeting, January 2008 – Chicago, IL

Publications:


Poster Display Session
Viewing from 11:45am – 12:15pm

1. Intracochlear Pressure Measurement Using Commercially Available Sensors
   Lupo JE, Koka K, Tollin DJ, Easter J.

2. Assessment of Tympanic Membrane-Coupled Ossicular Integrity on Mechanical and Physiologic Responses in a Middle Ear Effusion Model
   Harbison A, Lupo JE, Koka K, Tollin DJ.

3. A Combined Laryngeal, Tracheal, and Esophageal Malformation: A Report of Two Cases
   Brook K. McConnell, MD, Jeremy D. Prager, MD

4. Nasal Septal Perforation Associated with Pyoderma Gangrenosum
   Brook K. McConnell, MD, Carrie B. Marshall, MD, Vijay R. Ramakrishnan, MD

5. Multidisciplinary Approach to the Diagnosis and Management of Type I - II Laryngeal Clefts
   Tendy Chiang, MD, Amanda Ruiz, BA, Brook McConnell, MD, Jeremy D. Prager, MD

6. Prognostic Factors in the Outcome of Invasive Fungal Sinusitis Infection in a Pediatric Population
   Katherine K. Green, MD, MS, Henry P. Barham, MD, Gregory A. Allen, MD, Kenny H. Chan, MD

7. Sinus Microbiome in Health and Disease: Chronic Rhinosinusitis
   Vijay R. Ramakrishnan, MD, Leah J. Hauser, MD, Daniel Frank, PhD

8. Deletion of Smad4 Results in Enhancement of Lymphangiogenesis and Node Metastasis in Head and Neck Squamous Cell Carcinoma
   Masako Oka, Xi Chen, Xiao-Jing Wang, Shi-Long Lu

9. Variations in Electrophysiological Properties of the Vestibular Calyx Across the Mammalian Crista
   Meredith F, Mann S, Rennie K

10. Disruption of FMRP-p70 S6 Kinase-PP2A Complex by Early Life Seizures Underlies Enhanced mLTD in Adult Rats
    P.B. Bernard, A.M. Castano, T. Benke
11. **A Selective P2X3 Receptor Antagonist Abolishes Responses to All Taste Stimuli**  
Aurelie Vandenbeuch, Catherine Anderson, Anthony Ford, Steve Smith, Thomas E. Finger, Sue C. Kinnamon

12. **Cholinergic Neurotransmission Links Solitary Chemosensory Cells to Nasal Inflammation**  
CJ Saunders, Thomas E. Finger, Marco Tizzano

13. **Peptidergic Trigeminal Nerve Fibers are Required for Solitary Chemosensory Cell-Mediated Inflammation Following Chemical Insult of the Nasal Mucosa**  
Marco Tizzano, Michael Christensen, Thomas E. Finger

14. **Transduction for Pheromones in the Main Olfactory Epithelium is Mediated by the Ca$^{2+}$-Activated Channel TRPM5**  
Diego Restrepo, Fabian Lopez, Roberto Lopez, Juan Bacigalupo

15. **Excess Oligodendrocytes in Proteolipid Protein Null Olfactory Bulb**  
Elizabeth Gould, Wendy Macklin, Diego Restrepo