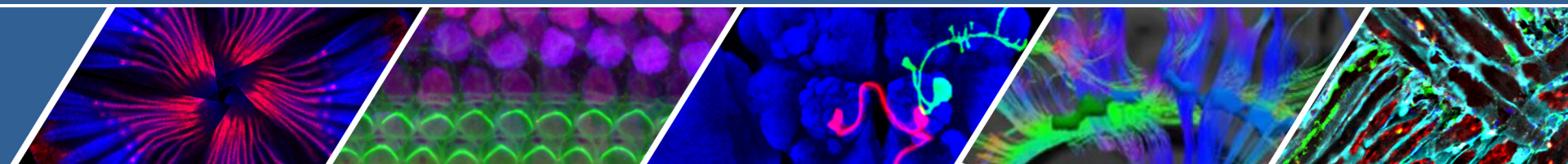
National Advisory Child Health and Human Development (NACHHD) Council

Child Health and Human Development Research at the National Institute on Deafness and Other Communication Disorders (NIDCD)

Debara L. Tucci
NIDCD Director

June 7, 2021



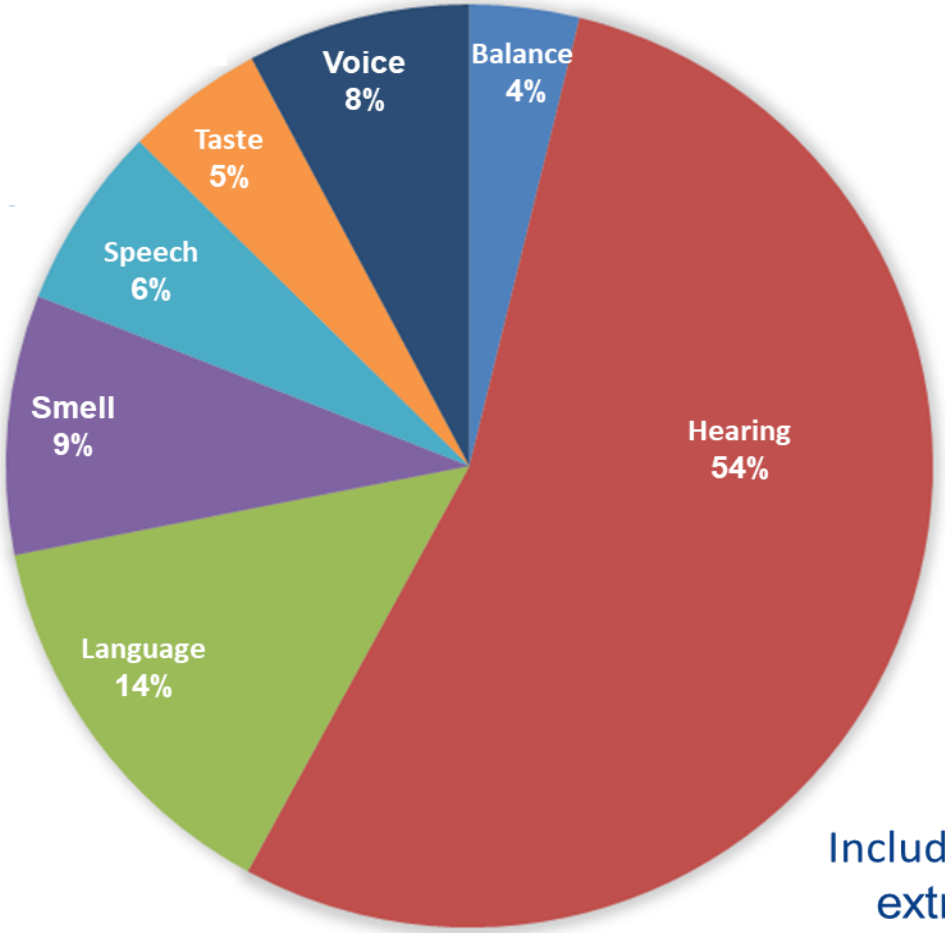
NIDCD Mission and Vision

- **Mission:** To conduct and support research and research training in the normal and disordered processes of **hearing, balance, taste, smell, voice, speech, and language**.

- **Vision:** Advancing the science of communication to improve lives.

NIDCD Budget

FY 2020 Funding by Mission Areas



- FY 2019 Enacted: $474,404,000
- FY 2020 Enacted: $490,692,000
- FY 2021 Enacted: $498,076,000

Includes intramural and extramural funding

Hearing and Balance

Tinnitus & hyperacusis

Otitis Media

Presbycusis

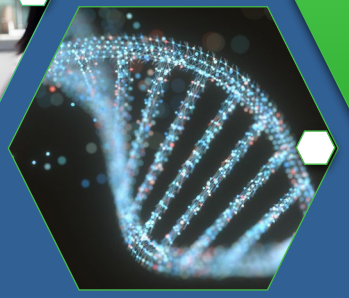
Auditory and Vestibular Processing

Vestibular System

Gene Therapy and Gene Delivery

Hearing Aids

Cochlear Implants & Implantable Hearing Devices



Management of Infants and Children with Hearing Impairment

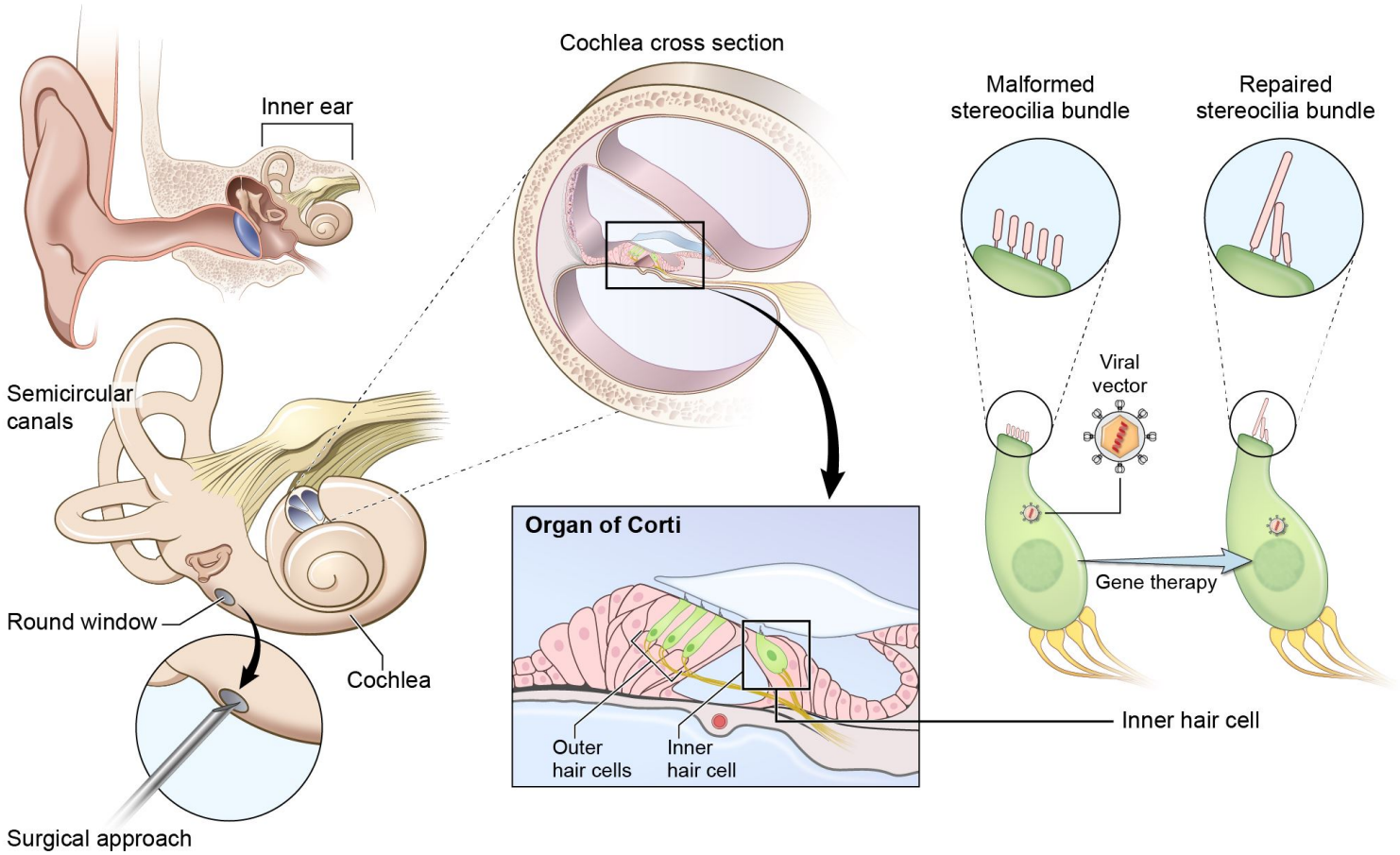
Hearing Screening & Healthcare

National Institute on Deafness and Other Communication Disorders

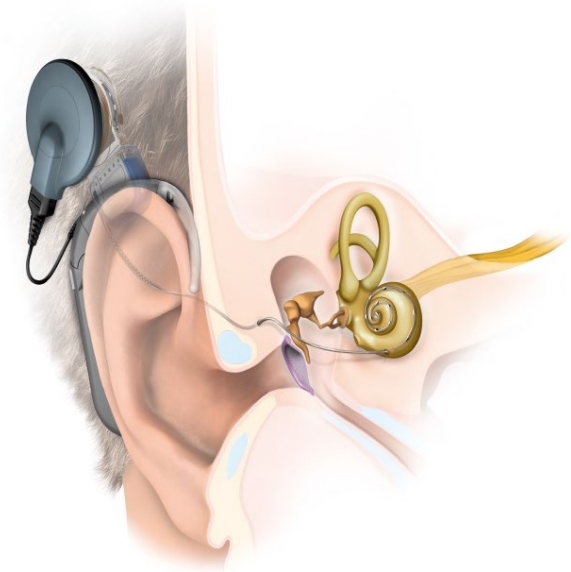
NIDCD Scientists are Developing Gene Therapy for Inherited Deafness

Wade Chien, M.D., FACS
Otolaryngology Surgeon-Scientist
Principal Investigator, Inner Ear Gene Therapy Program

- Dr. Chien's laboratory is delivering gene therapy to the mammalian inner ear *in vivo*.
- They tested delivery of normal copies of the mutated genes into the deaf whirler mouse model (a model of human Usher syndrome) of hereditary hearing loss to try to restore hearing and balance.



Cochlear Implantation

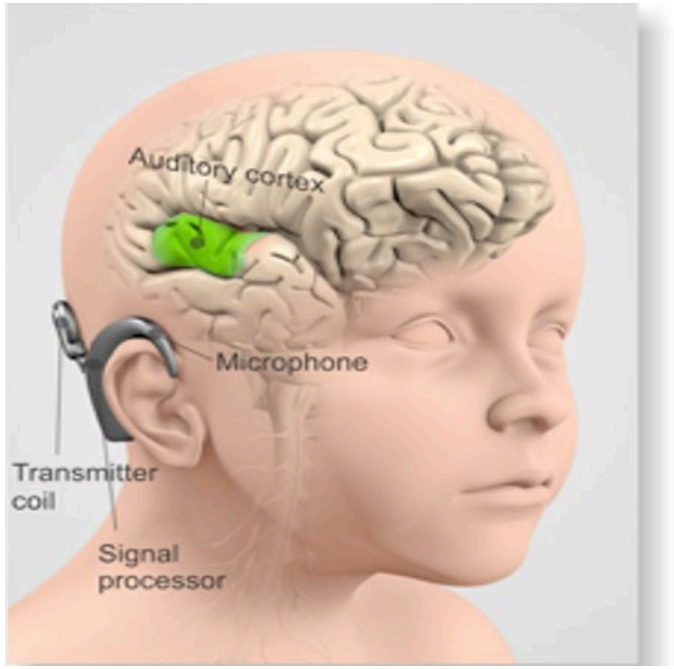


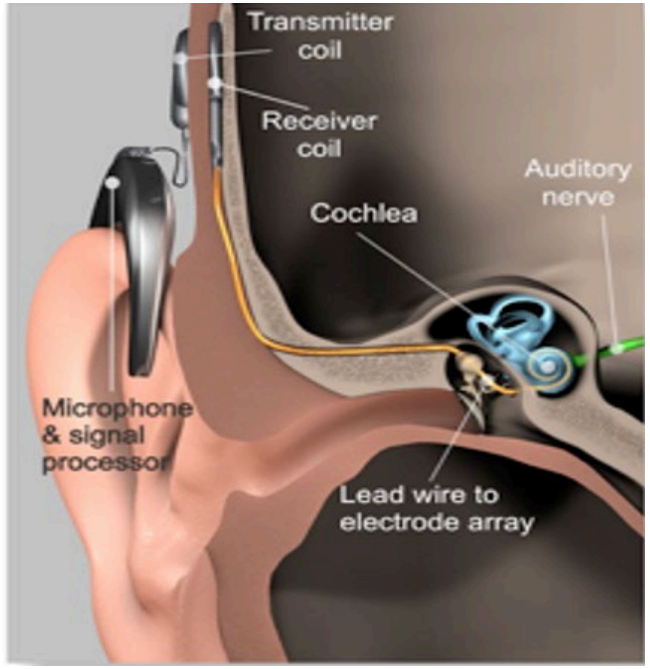
- Cochlear implantation is utilized when hearing is too poor to benefit from hearing aids
- Since 2000, cochlear implants have been FDA-approved for use in eligible children beginning at 12 months of age.
- Children who receive a cochlear implant followed by intensive therapy before they are 18 months old typically

- Are better able to hear, comprehend sound and music, and speak than their peers who receive implants when they are older
- Develop language skills at a rate comparable to children with normal hearing, and many succeed in mainstream classrooms.

Cochlear Implantation in Children with Asymmetric Hearing Loss or Single Sided Deafness Clinical Trial

Jill Firszt, U01DC018942





Designed to provide evidence-based data regarding the development of binaural hearing abilities in children with AHL or SSD who receive a CI in the poor hearing ear, which is integral to the establishment of standardized treatment.

Otitis Media

5 out of 6 children experience otitis media by age 3

- South-East Asia and the Western Pacific regions have both the highest prevalence of CSOM, number of deaths and DALYs, with Africa ranking second.

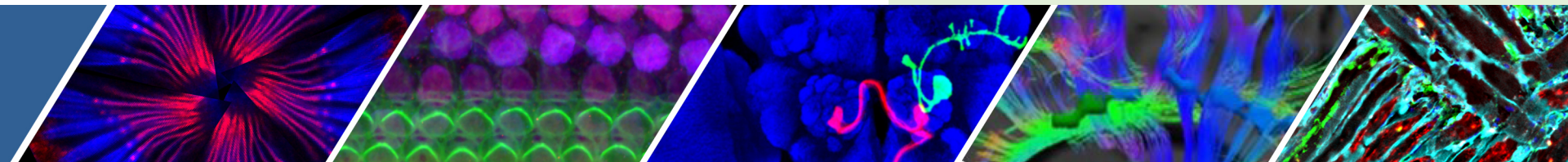
Early diagnosis and treatment: Prompt care-seeking and improved clinical guidelines for the first years of life.

Societal burden: The costs from OM and related hearing loss on health systems and households, the impact of learning and work performance

NIDCD Workshop
Otitis Media in Early Childhood

1. Understand immune responses in the middle ear,
2. Increase the translation of basic research to clinical utility,
3. Use cutting-edge and novel methods to advance the field of OM research,
4. Enable clinical trials for vaccines for *Nontypeable Haemophilus influenzae* and *Moraxella catarrhalis*
5. Increase omics and genetic studies

1 PMID: 22558393
2 WHO: https://www.who.int/pbd/publications/Chronicsuppurativeotitis_media.pdf



Multifactorial Determinants of Childhood Hearing Loss in Rural Alaska

Susan Emmett, R21DC018399

Leverage a NICHD-funded prospective cohort study in northern and western Alaska - *Diet and the CPT1A arctic variant: Impact on the Health of Alaska Native Children*

- Define the link between the **CPT1A arctic variant** and **childhood hearing loss**
- Evaluate the impact of prenatal and postnatal exposure to traditional subsistence foods and environmental risk factors on the risk of hearing loss in Alaska Native children

Rural AN children have a disproportionately high prevalence of childhood hearing loss **31%** compared to 1.7 - 5% in the general U.S. population.

Outpatient visits related to ear infections (otitis media) for AI/AN children under 1 year of age were almost **3x greater** than for other U.S. infants.

1 Curns AT. Pediatrics. 2002 Mar;109(3):E41-1. doi: 10.1542/peds.109.3.e41.

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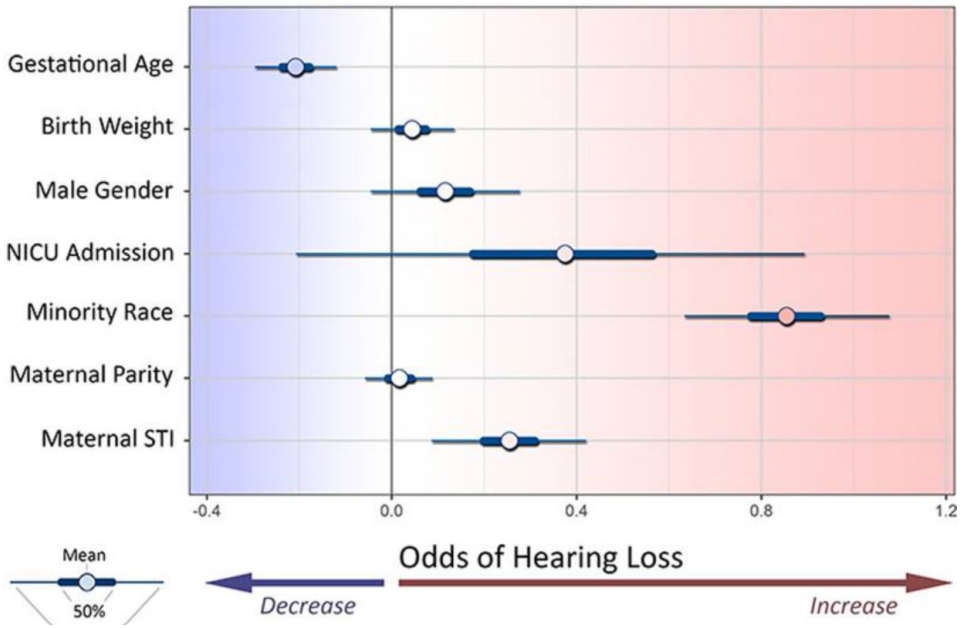
Helping the Hearing of Infants by Reaching Parents: The CHHIRP Navigator Trial

Matthew Bush, R01DC017770

Effect of individual and maternal predictors of infant hearing loss[1]



69.1% of infants who **do not pass** a hearing screening test are diagnosed with hearing loss before 3 months of age.[2]

36% of infants who do not pass a newborn hearing screening are **considered Lost to Follow-up**/Documentation.[2]

A community-engaged, effectiveness-implementation trial of a Patient Navigator (PN) intervention aimed at **decreasing infant hearing diagnosis non-adherence** after **failed newborn hearing screening**.

1. Test the effectiveness of PN to decrease non-adherence to receipt of infant hearing diagnosis within 3 months after birth.
2. Investigate implementation outcomes and factors.
3. Determine the cost-effectiveness.

Reduce non-adherence to timely infant diagnostic hearing testing to **prevent life-long negative consequences**.

1 PMID: 30296906
2 https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/pehdic/pages/early-hearing-detection-and-intervention.aspx

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Taste and Smell

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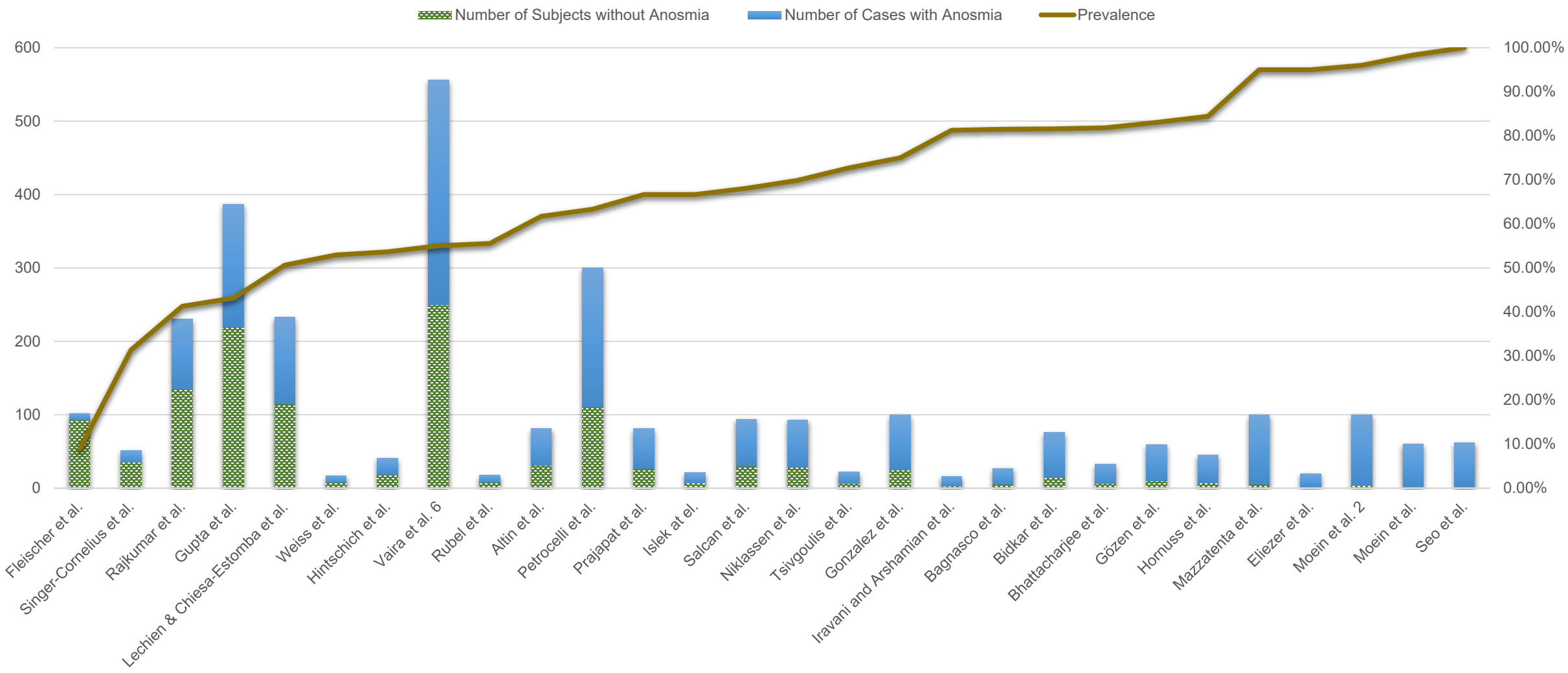
Loss of Smell is a Strong Predictor of COVID-19



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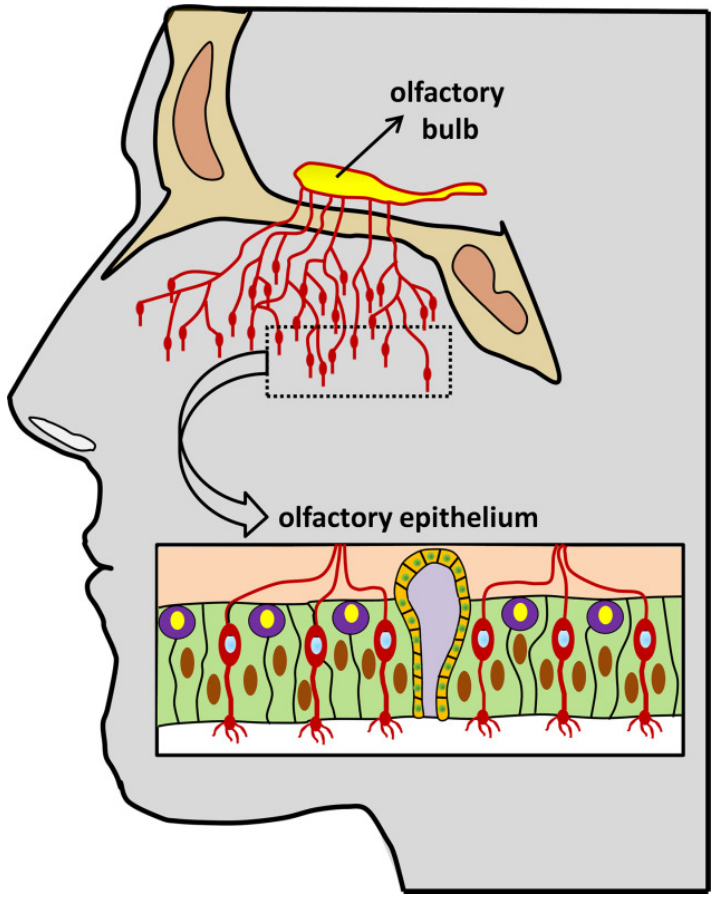
Regeneration and the Peripheral Olfactory System

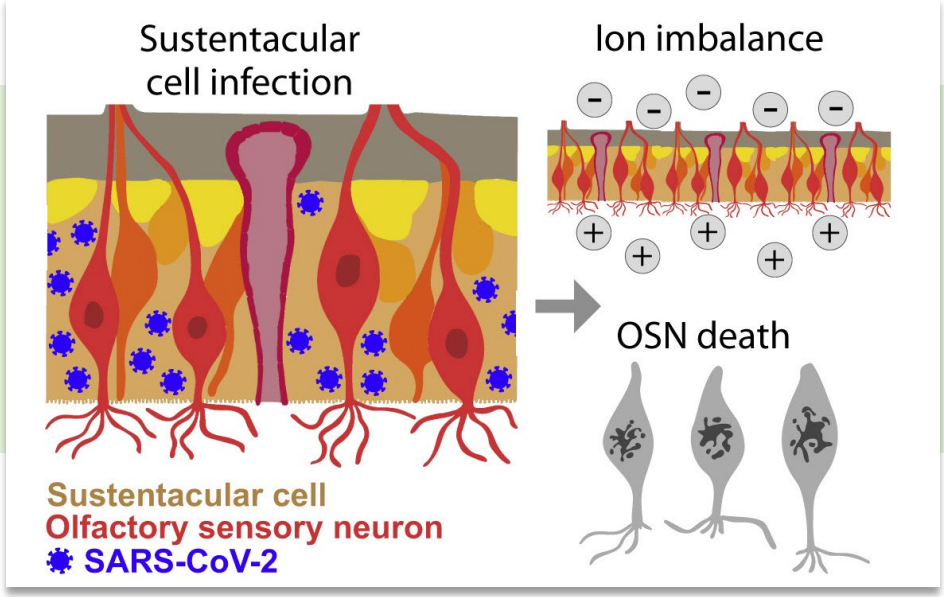


- The olfactory epithelium can support life-long neurogenesis and to recover after injury and restore its projection into the central nervous system.

- The olfactory epithelium is composed of three distinct cell types: basal cells, olfactory sensory neurons, and sustentacular (or supporting) cells.

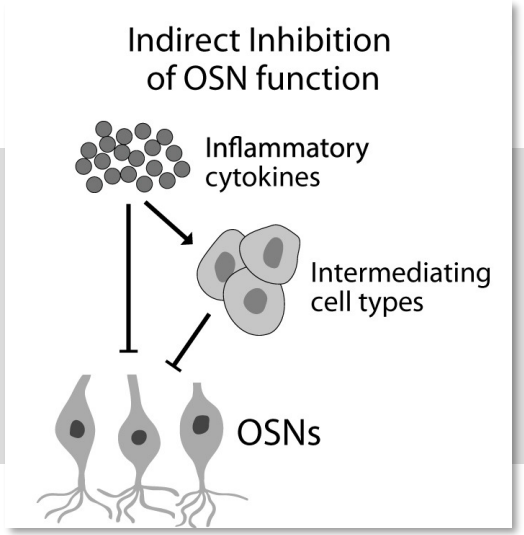
The Anatomical Record, Volume: 302, Issue: 3, Pages: 405-427, First published: 16 April 2018, DOI: (10.1002/ar.23816)

Likely Olfactory System Entry Points for SARS-CoV-2



Sustentacular cells, Bowman's gland cells, and microvillar cells in the **olfactory epithelium** may be direct entry points for the virus.

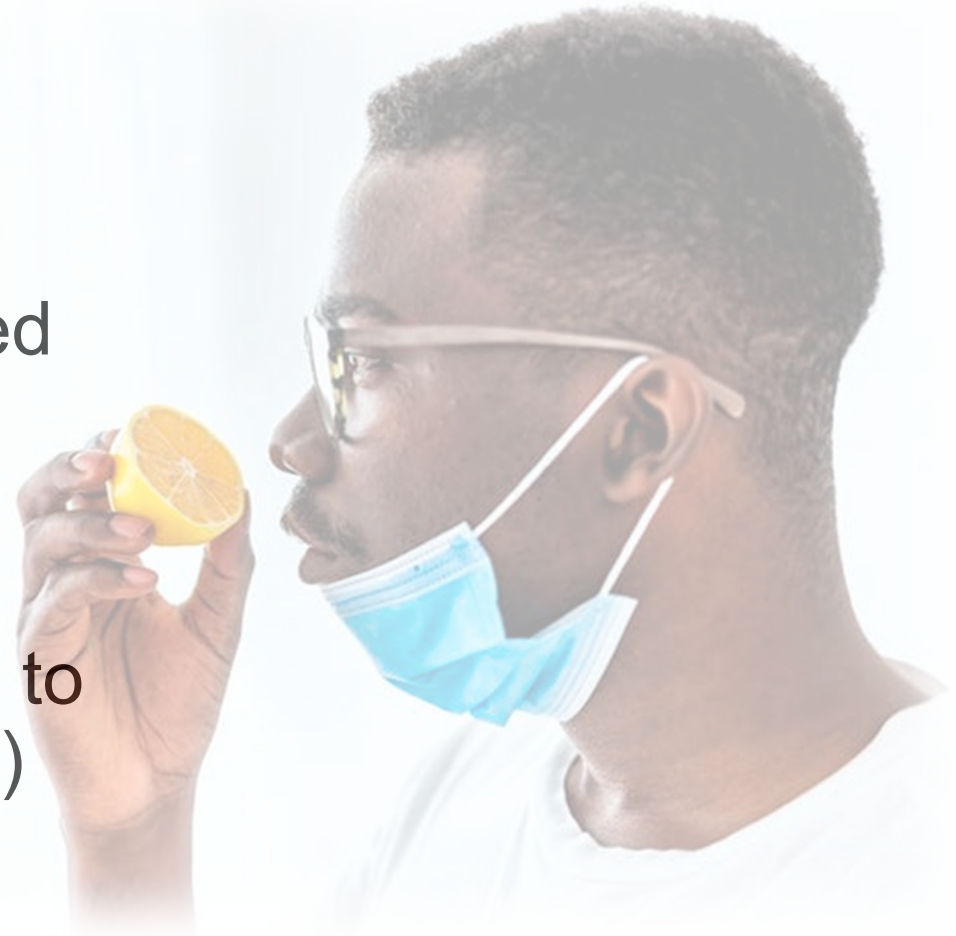
Inflammatory cytokines may also directly or indirectly inhibit olfactory sensory neuron function.



Cooper et al, 2020

COVID-19 and Chemosensory Research (Administrative Supplements)

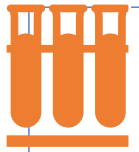
- Determine if anosmia (loss of smell) is an **early indicator** of COVID-19
- Identification of **genetic variation** associated with anosmia in individuals with COVID-19
- Examine **mechanisms underlying persistent smell loss** in COVID 'long-haulers' (5-10% of patients still have severe to complete smell loss 6 months post infection)



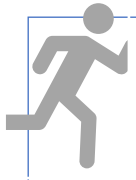
RADx-radical (rad) Initiative: Chemosensory Testing as a COVID-19 Screening Tool

Radx-rad supports new non-traditional approaches to address gaps in COVID-19 testing.

- Determine if chemosensory loss is an early indicator of COVID-19 and predictive of disease severity, disease persistence, or other neurological manifestations.
- NIDCD funded 4 awards at a total cost of $3.7 million



Develop objective chemosensory tests to screen for COVID-19



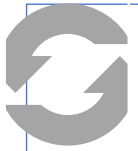
Fast, instantaneous results

Disposable, self-administered

Highly scalable

Validated using diverse populations and across the lifespan

Stable and suitable for global deployment



Multiple versions to allow for repeat testing with the same person over time

Taste of medicines for children: genetic variation and medical adherence

Julie Mennella, R01DC011287

Test hypotheses that individual and genetic variations in taste predict side effects and medication adherence, and that the adult palate can be used to identify medicines likely to present taste issues for some patients.

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Downshifting Sweet Preference and Added Sugar Intake During Snacking Among Young Children: A Randomized Controlled Trial

Julie Mennella, R01DC016616

A trial of 3- to 6-year-old children and their mothers will evaluate the extent to which repeated exposure to lower sugar foods will result in decreased preferences for sweet and increased liking and intake of lower sweetness foods.

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Voice, Speech, and Language

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Complementary Portfolios

Eunice Kennedy Shriver National Institute of Child Health and Human Development

versus

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Normal Language

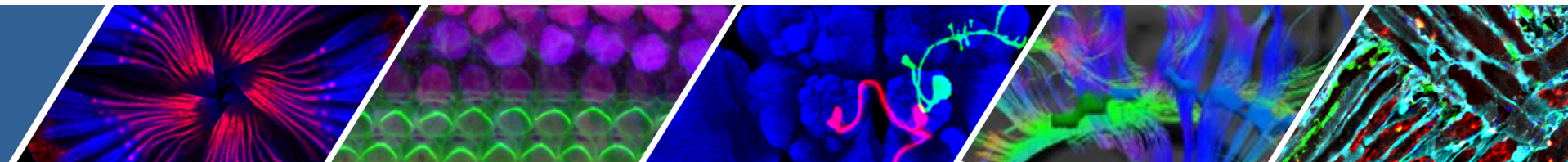
Examples of NICHD-supported research:

- The Power of Language: Does the Quality of Preschool Teacher Language Translate to Children's Executive Functions? (R03HD099419)
- The Role of Cognitive Skills and Language Experience in Grammatical Processing (R01HD098652)
- Navigating two languages: Effects of everyday language switching on bilingual infants and toddlers (R01HD095912)
- Speech rhythm acquisition (R01HD087452)

Disordered Language

Examples of NIDCD-supported research:

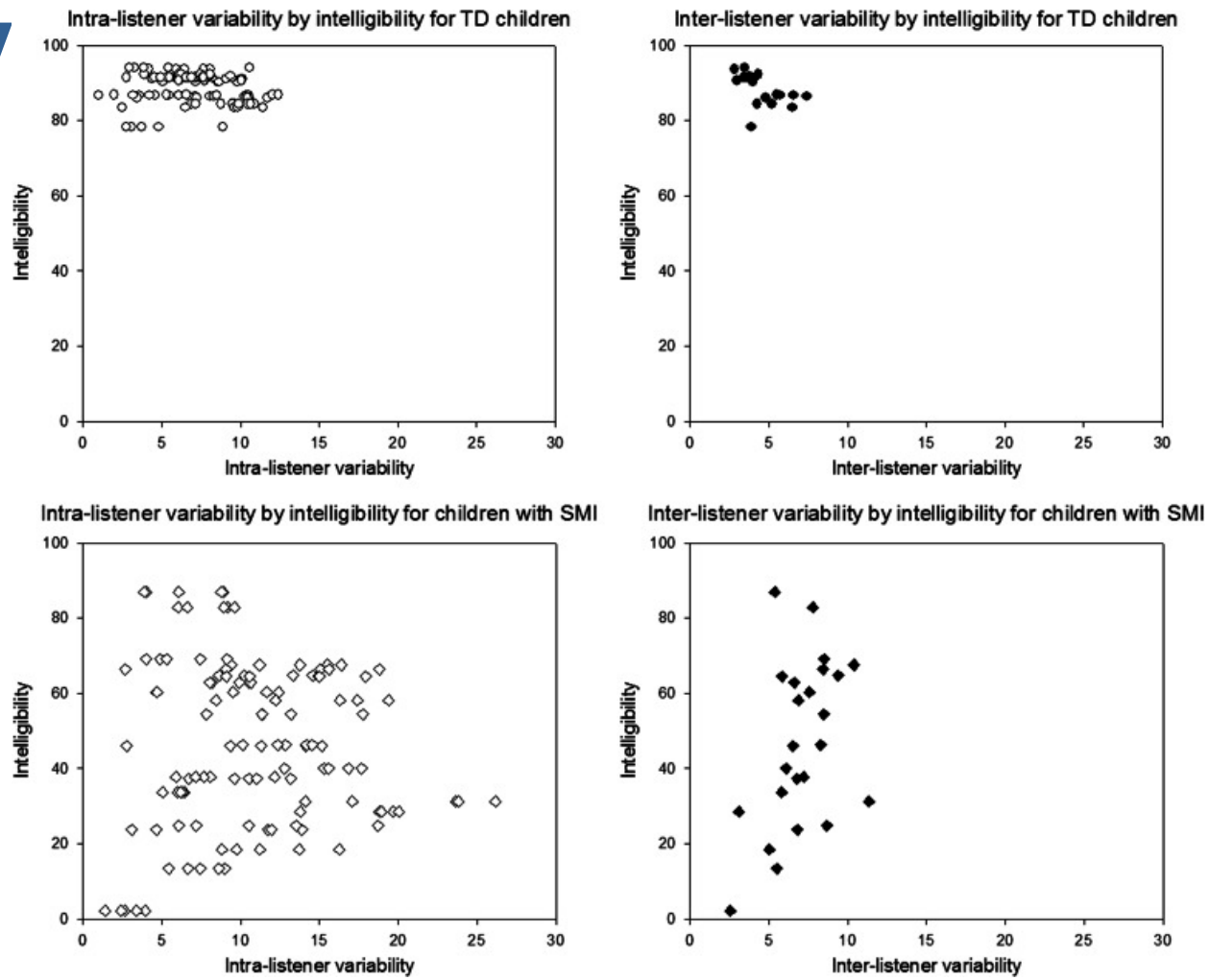
- How children with cochlear implants learn speech from their environments (F32DC019539)
- Language in Primary Progressive Aphasia (R01DC008552)
- Automated measurement of language outcomes for neurodevelopmental disorders (R01DC012033)
- Sequential Pattern Learning in Children with Developmental Language Disorder (R01DC016813)
- Differentiating First Language Loss from Language Impairment in Bilingual Children (K23DC015835)



Communication Development in Children with Cerebral Palsy

Katherine Hustad, R01DC009411

- Generate theoretically driven, empirically validated longitudinal models of speech and language development in CP that can be used to predict outcomes, test interventions, and guide treatment decisions.

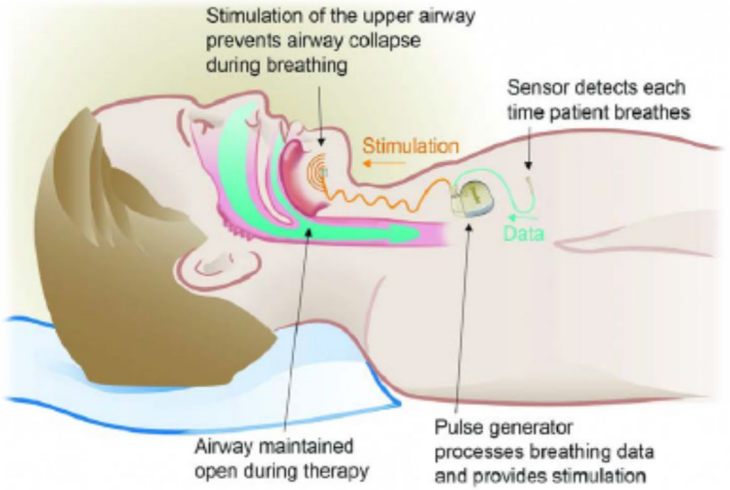


Intra- and interlistener variability by intelligibility score for children in typically developing (TD) and speech motor impairment (SMI) groups. Hustad, et al., 2015

Effects of Hypoglossal Nerve Stimulation on Cognition and Language in Down Syndrome

Christopher Hartnick U01DC019279

- Participants, age 10-21, with Down Syndrome and severe, untreated obstructive sleep apnea.
- Preceded by a Phase I trial with unexpected observations:
  - Parental report of children being more attentive and doing better in school
  - Pilot data in 5 children showed improvement in IQ, diversity of vocabulary
- Phase II/III multicenter trial, primary outcomes:
  - Neurocognitive measures
  - Expressive language



INCLUDE

(**IN**vestigation of **C**o-occurring conditions across the **L**ifespan to **U**nderstand **D**own syndrom**E**) Project

- Improving understanding of the natural history of communication disorders (hearing, balance/vestibular, voice, speech, language, taste and smell) throughout the lifespan in Down syndrome.
- Early identification and clinical management of communication disorders throughout the lifespan in individuals with Down syndrome.

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Tools to Improve Outcomes of Toddlers with Communication Delays

Amy Wetherby, R21DC018128

Baby NAVIGATOR™

What every parent needs to know

- Interactive, web-based tool for diagnosing children with communication impairments.
- Provides information on early childhood development.
- Provides information about early signs of Autism Spectrum Disorder.

Autism NAVIGATOR®

- About 1 in 54 children has been identified with autism spectrum
- A unique collection of web-based tools and courses using extensive video footage to bring science to communities.

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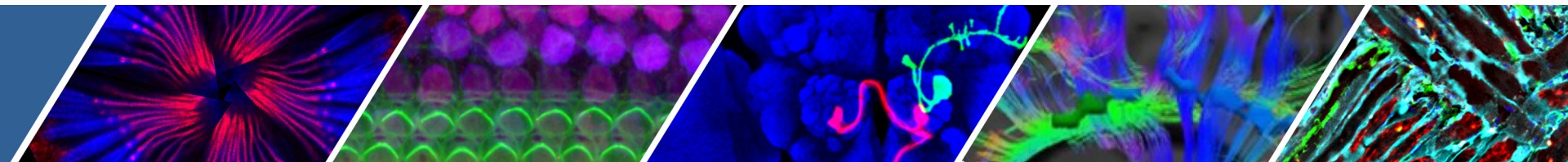

Digitizing Human Vocal Interaction to Understand and Diagnose Autism

Julia Parish-Morris, R01DC018289

Identify sensitive and specific language-based markers of autism spectrum disorder that can be detected during social interaction. Using machine learning and natural language processing, this study will lay the foundation for personalized approaches to social communication intervention and support.

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National Center of Neuromodulation for Rehabilitation (NC NM4R)

P2CHD086844

https://chp.musc.edu/research/nc-nm4r

Goal: To coordinate the development and high impact functioning of a national center at the Medical University of South Carolina (MUSC) to support researchers in the field of neuromodulation for rehabilitation.

https://ncmrr.org/

Learning opportunities

- Taught by leading experts in the field and accomplished senior researchers in NM or rehabilitation (e.g., *Speech and Language Rehab for NM4R*)

Funding opportunities

- Pilot projects in populations, such as, pediatrics and neonates, post-stroke, SCI, TBI, Parkinson's Disease, Progressive Supranuclear Palsy, autism, orthopedics, and aging; and in the conditions of locomotor dysfunction, aphasia, apathy, cognition, swallowing, trunk control and gait.

Advances

- Transcranial direct current stimulation (tDCS) based NM4R intervention for aphasia (anodal tDCS during speech therapy)

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Questions?

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https://www.nidcd.nih.gov

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