Courses for SLHS PhD students

SLHS

SAR SH680 Neural Control of Speech (F17)
The course will focus on speech motor control, i.e. the production of phoneme strings with minimal regard for linguistic content. More specifically, brain mechanisms responsible for commanding the musculature of the vocal tract to produce articulations that lead to an acoustic signal that conveys a desired string of syllables with a desired prosodic contour will be covered. This treatment will include neuroanatomical and neurophysiological descriptions of the primary brain structures involved in speech production, with particular emphasis on the cerebral cortex and its interactions with the cerebellum and basal ganglia using basic control theory concepts to explore the computations performed by these brain regions.

SAR SH708 Models of Language (F17)
This course is a comprehensive overview of structure and process in language use and development and includes a review on the structure of language in each of the traditional areas of linguistic analysis. In addition, the course will provide an overview of normal language processing in children by reviewing the stages of typical language acquisition. Finally, experimental methods and analysis tools commonly used in language research will be covered.

SAR SH 721 Motor Speech Disorders (F17)
In this course, students will review the neuroanatomy underlying motor speech disorders and will then learn about each type of motor speech disorder in detail. Most of the classes will cover specific types of dysarthria, but two sessions will focus on apraxia of speech. Clinical assessment protocols will be learned and treatment interventions will be covered. Each class will devote some time to listening and scoring audiotapes of patients with a dysarthria or apraxia of speech. (2cr)

SAR SH 733 Voice Disorders (S18)
Anatomical and physiological bases of voice production. Diagnosis and therapy for phonatory disorders in children and adults. Function of the team philosophy for speech pathologists in vocal rehabilitation.

SAR SH 736 Aphasia (S18)
This course will cover current theories of language processing and of language breakdown subsequent to neuropathology. Course topics cover neuroanatomy, neuroimaging and psycholinguistic models of language processing. Evaluation, diagnosis, and treatment of adults with aphasia will be covered. Students will learn how to analyze language disorders in relation to current theories using a variety of diagnostic instruments and how to use the results of this analysis to plan for therapy.

SAR SH 755 Applied Speech Science
The purpose of this course is to introduce students to those aspects of speech science that bear on clinical issues in speech-language pathology. Classes are structured to include the presentation of new material followed by an in-class lab session that applies the new concepts. Topics include acoustic phonetics, basic signal processing, speech analysis software, disordered speech analysis, and speech perception.

SAR SH 756 Cognition and Neural Bases (F17)
The purpose of this course is to provide students with a thorough understanding of the brain and its neuroanatomy; students will also learn about common models of language processing and the latest advances in neuroimaging studies on language processing in the brain. When students have completed this course, they should be able to (a) be able to identify various structures in the brain and their significance, (b) relate specific communicative disorders to their etiology in the brain, (c) relate models of language processing with specific

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regions in the brain, and (d) critically evaluate existing neuroimaging studies based on models of language processing and neuroanatomy.

**SAR SH 739 Advanced Dysphagia**
This course will delve more deeply into topics of importance to clinical practice in dysphagia. Topics include evaluation procedures, analysis of FEES and MBS studies, efficacy of novel and established treatments, difficult decision making, dysphagia in head and neck cancer, neurologic disorders, dementia. Lab dissection and hands-on scoping sessions. Case studies to highlight each topic. The size of the class will be limited to encourage class discussion.

**SAR SH770 Advanced AAC**
Case based clinical application of AAC assessment and intervention. This course offers a detailed investigation of varied populations, implementation of high-tech, low-tech and no-tech solutions, partner training and development of measurable goals. A selection of hardware and software solutions that represent appropriate options for emerging, context dependent and independent communicators will be explored with a focus on language support, integration and partner training. As available, students may be paired with consumers of AAC to support implementation and appropriate design of communication options. Format includes lecture and hands on training both at BU and during select Saturday sessions at Boston Children's Hospital-Waltham.

**SAR SH 810 Doctoral Seminar (S18)**
The course covers areas of scholarly and professional development that are relevant to PhD students. Seminar themes will include research funding and grant-proposal writing strategies, ethical conduct in science, academic career issues and other strategic professional topics.

**Advanced Statistics**

**CAS MA 578 - Bayesian Statistics**

**CAS MA 588 Non Parametric Statistics (S18)**
The theory and logic in the development of nonparametric techniques including order statistics, tests based on runs, goodness of fit, rank-order (for location and scale), measures of association, analysis of variance, asymptotic relative efficiency.

**GRS MA614 Statistical Methods 2 (F17)**
Second course in statistics, embodying basic statistical methods used in educational and social science research. Reviews all basic concepts covered in a first statistics course and presents, in detail, more advanced topics such as analysis of variance, covariance, experimental design, correlation, regression, and selected nonparametric techniques. A problem-solving course; students carry out analysis of data taken from educational and other social science sources.

**GRS MA681 Accelerated Introduction to Statistical Methods for Quantitative Research (F17)**
Introduction to statistical methods relevant to research in the computational sciences. Core topics include probability theory, estimation theory, hypothesis testing, linear models, GLMs, and experimental design. Emphasis on developing a firm conceptual understanding of the statistical paradigm through data analyses.

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GRS MA684 Applied Multiple Regression and Multivariable Methods (F17, S18)
Application of multivariate data analytic techniques. Multiple regression and correlation, confounding and interaction, variable selection, categorical predictors and outcomes, logistic regression, factor analysis, MANOVA, discriminant analysis, regression with longitudinal data, repeated measures, ANOVA.

GRS MA685 Advanced Topics in Applied Statistical Analysis (F17, S18)

GRS PS 711 Statistics in Psychology I (F17)
General linear models including multiple regression and logistic regression; multilevel models; survival analysis; interaction effects.

GRS PS 712 Statistics in Psychology II (TBD)
Statistical analysis with latent variables including exploratory factor analysis, confirmatory factor analysis, structural equation models, latent growth models, psychometrics.

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GRS PS716 Psychological Research Methods (F17)
The methodological foundations of psychological research, including issues in general scientific practice, research design, measurement, methods of data collection, and practical and ethical problems arising in the conduct of psychological research.

SPH BS704 Introduction to Biostatistics (F17/S18)
This course meets the biostatistics core course requirement for all degrees and concentrations at SPH. The course replaces BS701 and BS703. Topics include the collection, classification, and presentation of descriptive data; the rationale of estimation and hypothesis testing; analysis of variance; analysis of contingency tables; correlation and regression analysis; multiple regression, logistic regression, and the statistical control of confounding; sample size and power considerations; survival analysis. Special attention is directed to the ability to recognize and interpret statistical procedures in articles from the current literature. This course gives students the skills to perform, present, and interpret basic statistical analyses using the R statistical package.

SPH BS722 Design and Conduct of Clinical Trials (F17)
This course covers the development, conduct, and interpretation of clinical trials. It is suitable for concentrators in any department. Topics include principles and practical features such as choice of experimental design, choice of controls, sample size determination, methods of randomization, adverse event monitoring, research ethics, informed consent, data management, and statistical analysis issues. Students write a clinical trial protocol during the semester.

SPH BS730 Introduction to R: software for statistical computing (F17)
Students will learn how to conduct statistical analysis using the public domain and free statistical software, R. Many public, private, and international organizations use R to conduct analysis, thus experience with R is a great skill to add to one's credentials. R offers flexibility, ranging from ease of writing code for simple tasks (e.g. using R as a calculator) to implementing complex analyses using cutting-edge statistical methods and models. Additionally, the R language provides a rich environment for working with data, especially for statistical modeling, graphics, and data visualization. This course will emphasize data manipulation and basic statistical analysis including exploratory data analysis, classical statistical tests, categorical data analysis, and regression. Students will be able to identify appropriate statistical methods for the data or problems and conduct their own analysis using the R environment. This hands-on and project-based course will enable students to develop skills to solve statistical problems using R. R can be used as an alternative or in addition to SAS (BS723). R is compatible with Apple OS, Windows, and Unix environments.

SPH BS845 Applied Statistical Modeling and Programming in R (F17)
This course covers applications of modern statistical methods using R, a free and open source statistical computing package with powerful yet intuitive graphic tools. R is under more active development for new methods than other packages. We will first review data manipulation and programming in R, then cover theory and applications in R for topics such as linear and smooth regressions, survival analysis, mixed effects model, tree based methods, multivariate analysis, boot strapping and permutation.

SPH BS851 Applied Statistics in Clinical Trials I (F17)
This is an intermediate statistics course, focused on statistical issues applicable to analyzing efficacy data for clinical trials. Topics include design and analysis considerations for clinical trials, such as randomization and sample size determination, and the application of statistical methods such as analysis of variance, logistic regression and survival analysis to superiority and non-inferiority clinical trials. This course includes lectures and computer instructions. Upon completion of the course, the student will be able to have a working

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knowledge of how to collect and manage clinical trial data; will be to analyze continuous, dichotomous, and
time-to-event clinical trial data; and will be able to contribute to the statistical portions of a clinical trial study
design. The student will also gain the overall knowledge required to interpret clinical trial statistical results.

Neuroscience/CNS

CAS NE 360/ SAR HS 361 Introduction to Computational Neuroscience of Speech, Language, and Hearing
Introduces the foundations of auditory perception including the mammalian auditory pathway, speech and
language perception, links with speech production, auditory scene analysis, and music perception from a
computational perspective. Laboratory computer assignments elucidate functional properties of these
systems.

CAS CN 510 Principles and Methods of Cognitive and Neural Modeling I (F17)
Explores psychological, biological, mathematical, and computational foundations of behavioral and brain
modeling. Topics include organizational principles, mechanisms, local circuits, network architectures,
cooperative and competitive non-linear feedback systems, associative learning systems, and self-organizing
code-compression systems. The adaptive resonance theory model unifies many course themes.

CAS NE528 Human Brain Mapping (F17)
Localization in the brain of human mental functions and the study of their neural mechanisms. Topics include
methods (fMRI, PET, TMS, ERP), memory, perception, recognition, attention, and executive processes. Also
offered as CAS PS 528.

CAS NE 560 Perception and Quantitative Physiology of the Auditory System (TBD)
Introduction to the mammalian auditory system from a systems prospective. The class follows how sound
propagates into the ear, how mechanical energy is transformed into a neural code, how that code is
transformed through the mammalian auditory pathway from the cochlea to the cortex, and how auditory
sensation and perception are related to this chain of neural processing. Anatomy and physiology cover the
structure and function of the middle ear, cochlea, brainstem, midbrain, thalamus, and cortex. Perceptual
topics include basic sensitivity, spatial hearing, pitch perception, auditory scene analysis, attention, and
speech perception. Implications for hearing impairment and prosthetic hearing devices are covered.
Associated discussion sessions cover recent research findings from general-interest, high-impact publications.

GRS NE742 Neural Systems: Cognition and Behavior (TBD)
Surveys current neuroscience research. The goal is to develop an understanding of nervous system function in
animals and humans, linking cellular and systems level neural circuitry to cognition and behavior.

GRS MA665 Introduction to Modeling and Data Analysis in Neuroscience (TBD)
An introduction to the basic techniques of quantifying neural data and developing mathematical models of
neural activity. Major focus on computational methods using computer software and graphical methods for
model analysis.

GRS MA666 Advanced Modeling and Data Analysis in Neuroscience (TBD)
Advanced techniques to characterize neural voltage data and analyze mathematical models of neural activity.
Major focus on computational methods using computer software and graphical methods for model analysis.

CAS CN 780 Topics in Computational Neuroscience (F17)

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In this seminar, recent research papers and applications in computational neuroscience are reviewed. Topics covered include cortical modeling, analog VLSI, active perception, robotic control, stereo vision, and computer-aided neuroanatomy.
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**GRS PS 750 - Mind and Language**
Seminar examines how language influences cognition. Surveys cognitive, developmental, psycholinguistic, and primate psychology literatures to explore whether cross-linguistic differences cause cross-cultural differences in cognition, and whether possession of a language faculty influences the nature of thought.

**GRS PS829 Principles of Neuropsychology** (F17)
Central nervous system processes underlying memory, language, cognition, emotion, sensory functioning, and motor function in normal and pathological conditions. Theory, experimental findings, and reference to clinical cases.

**Graduate Medical Sciences Courses in the Anatomy and Neurobiology or the Behavioral Neuroscience and Bioimaging Programs**

**GMS BN 775 Human Neuropsychology I** (F17)
This course focuses on the relationship of the field of neuropsychology to other medical and scientific disciplines. Includes neuropsychological assessment, electrical activity of the brain, the study of consciousness and emotions, cerebral dominance, pathologies of language, and traumatic brain injuries. 4 cr, Fall sem.

**GMS BN 776 Human Neuropsychology II** (TBD)
This course focuses on the relationship of the field of neuropsychology to other medical and scientific disciplines. Includes psychiatric aspects of neurological disease and the pathologies of memory, intelligence, perception, motor function, and PTSD. 4 cr, Spring sem.

**GMS BN 777 Basic Neurosciences** (TBD)
Overview includes neurophysiology, neurochemistry, neuroanatomy, neurobehavior, and neuropsychopharmacology. Processes occurring at the cellular and physiological levels are related to known central nervous system dysfunction. Spring Semester: Review of brain function and selected topics such as Parkinson's disease, schizophrenia, neurotoxicology, aphasia, electrophysiology, and neuroimaging. This course is the same as GMS BN 778 (4 cr) and GMS BN 779 (2 cr), providing students with 32.5 hours of required course time. May not be taken concurrently with GMS BN 778 or 779. 3 cr, Fall or Spring sem.

**GMS BN 779 Beginning Basic Neurosciences** (F17)
Overview includes neurophysiology, neurochemistry, neuroanatomy, neurobehavior, and neuropsychopharmacology. Processes occurring at the cellular and physiological levels are related to known central nervous system dysfunction. Spring Semester: Review of brain function and selected topics such as Parkinson's disease, schizophrenia, neurotoxicology, aphasia, electrophysiology, and neuroimaging. This course is the same as GMS BN 777 (3 cr) and GMS BN 778 (4 cr), providing students with 25 hours of required course time. May not be taken concurrently with GMS BN 777 or 778.

**GMS BN795 Cognitive Neuroscience of Memory and Perception** (TBD)
The study of normal and abnormal perception and memory is related to brain structure and function. This seminar covers theoretical and clinical issues about how abilities change in normal and abnormal (e.g., Alzheimer's disease) conditions, using a variety of methods. 4 cr, Fall or Spring sem. on demand.

**GMS BN 796 Neuropsychological Assessment I** (F17)
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Overview of structure and function of the central nervous system. Emphasis on quantitative and qualitative analysis of standardized and experimental tests of cognitive functions useful in differential diagnosis of neurological syndromes with an emphasis on the Boston Process Approach to neuropsychological evaluation.

**GMS BN798 Functional Neuroanatomy in Neuropsychology (F17)**
Overview of central nervous system, structure and function; basic understanding of neurobehavioral symptoms and their relationship to neuropathology, neuroepidemiology, including vascular infections, and congenital, degenerative, and toxic insults to the central nervous system, and will include laboratory examination of a specimen of a human brain. Appropriate for psychologists, speech pathologists, or other students in the behavioral sciences. 4 cr, Fall sem.

**GMS BN821 Seminar in Neuroimaging (TBD)**
Overview of neuroimaging techniques available as adjuncts to neuropsychological measures of human brain damage. Intended for students with limited background in the application of neuroimaging techniques for the study of neuropsychiatric illnesses. Techniques, including MRI, fMRI, DTI, MRS, PET and SPECT will be covered with relevance to selected neurobehavioral disorders. 2 cr, Spring sem.

**GMS AN 707 Neurobiology of Aging (TBD)**
Prereq: consent of instructor. With growing awareness of an accelerating increase in the size of the elderly population, there has been increasing interest in the neuropsychology of normal aging. Similarly, since aging is a major risk factor for many dementia states, interest has also focused on the neuropsychology of age-related disorders such as Alzheimer's disease, Parkinson's disease and the Dementias of the frontal lobe type. This course summarizes what is known about cognitive and related changes associated with normal aging and age-related disease. Topics are divided into two major sections. The first considers the cognitive and neurobiological changes associated with normal aging; the second deals with several of the most common age related diseases. 2 cr, Spring sem.

**GMS IM600 Bioimaging Foundations (F17)**
The physical, mathematical, and experimental foundations of bioimaging are studied with historical context and are presented in the following sequence: bioimaging, principles, bioimaging mathematics, and bioimaging physics, leading to the study of the different bioimage generation techniques (modalities). 4 cr

**GMS IM610 Magnetic Resonance: Principles, Methods, and Applications in Biomedical Research (F17)**
This course will provide an overview of the underlying principles of nuclear magnetic resonance (NMR) and the various methodologies used in magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) with emphasis on methods applied in biomedical research. The course will emphasize the connection between the basic manipulation of the spin system via the sequence of RF and gradient pulses (the pulse sequence) and the information that can be retrieved from the observed object, be it a solution of an isolated protein of the human brain. 4 cr

**GMS IM620 Bioimaging Theory & Imaging Processing (TBD)**
The main theoretical aspects of bioimaging are studied, including image meaning, image generation, image quality (analysis, improvement, and limits), image information content (generation and extraction), and image assisted modeling of biologic systems. Mathematical foundations and basic techniques for digital image processing are studied theoretically as well as in a hands-on approach in the Image Processing Laboratory. 4 cr

**GMS IM630 Methods of Functional Imaging of the Brain (TBD)**

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This course will provide an overview of the various existing methods for detecting and mapping brain function in vivo. A brief introduction will provide the necessary background to brain physiology: electrical activity, synaptic transmission, cell metabolism and haemodynamic response associated with neuronal activity. 2 cr

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GMS IM 651 Statistical Analysis of Neuroimaging Data (F17)
This course is designed to give the student a working knowledge of the parametric and non-parametric statistical procedures that are commonly used to analyze data generated from in vivo imaging techniques such as CT, MRI, PET and SPECT. 2 cr

Sargent College Rehabilitation Sciences

SAR RS650 Foundations of Rehabilitation Sciences (F17)
This course provides an overview of the field of rehabilitation science and an introduction to the social constructs of disability with an emphasis on bio-psycho-social-environmental models of the enabling-disabling process across the life course. The historical, philosophical and theoretical foundations of Rehabilitation Science and the evolution of laws and policies related to rehabilitation that inform the ethical, funding, and social implications of rehabilitation research are analyzed. The course will also provide an in-depth understanding of person-environment interactions and the link between biomedical factors and community participation.

SAR RS750 Research Design (S18)
This course serves as an introduction into research designs relevant to rehabilitation science. The first set of sessions provides the background and framework for understanding the reasoning behind different research designs. The remaining sessions focus on various categories of research designs, the types of research questions these designs address, and the types of data analyses that are appropriate to the designs. The course content is integrated with the content students received in Philosophy of Rehabilitation Science. Format of sessions are lecture, discussion, and experiential. Student assignments are individualized to student areas of mentored research. Student presentations are integrated into the topics presented according to the class schedule.

SAR RS809 Advanced Topic in SLHS
This 2-credit seminar is designed to keep graduate students up-to-date on the latest experimental findings, technologies, and statistical analysis techniques in the speech, language, and hearing sciences, while also providing them with experience in presenting scientific research to a multi-disciplinary audience. Students will be encouraged to consult with their advisors to choose recent articles relevant to their current research projects. Students may also present their own research (if approved to do so by their advisors), including practicing upcoming conference presentations.

SAR RS 8XX Grant Writing
Seminar on grant preparation, submission and review. An overview of the grant-writing process focusing on the preparation of individual NRSA awards (F31/2) from NIH. Topics include types of funding mechanisms, preparation and submission of applications, peer review and summary statements, interactions with agency staff and preparation of revision applications. Students are expected to prepare and present to the class draft specific aims and/or outlines for prospective proposals as well as provide constructive critical review of the work of classmates in a discussion-style format. Intended for doctoral and postdoctoral students. Meets Fridays 2:30-4:15. Permission of instructor required. 2 credits.

SAR RS 8XX Manuscript Writing
In this seminar, students will obtain experience regarding the process of manuscript writing and reviewing first from a reviewer's perspective and then from an author's perspective. First, students will be asked to review an original paper within their broad area of expertise (generously shared by faculty in the SLHS department) and then submit their own research to a multi-disciplinary audience. Students will be encouraged to consult with their advisors to choose recent articles relevant to their current research projects. Students may also present their own research (if approved to do so by their advisors), including practicing upcoming conference presentations.

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Learn to provide written critiques of the paper and view author responses to reviewer's comments. In the second half of the semester, students will obtain experience preparing a manuscript for review, following author guidelines and best practices for reporting methods and statistics in experimental and clinical research. Twice in the semester, students will be asked to present their ongoing work or research from their laboratory in short conference style presentations.

**SAR RS8XX Doctoral Seminar**

The course covers areas of scholarly and professional development that are relevant to PhD students. Seminar themes will include research funding and grant-proposal writing strategies, ethical conduct in science, academic career issues and other strategic professional topics. Enrollment in the seminar is limited to doctoral students in speech, language and hearing sciences and associated fields of study.

**SAR RS870 Emerging Topics (F17/S18)**

A seminar for doctoral students that focuses on a different topic each semester.

**Additional resources**

The Department of Biomedical Engineering and the Hearing Research Center [http://www.bu.edu/hrc/](http://www.bu.edu/hrc/) are excellent resources for seminars, colleagues and courses in the area of auditory physiology and behavioral measures of hearing status. The BU School of Public Health [www.bu.edu/sph](http://www.bu.edu/sph) also offers a wide variety of coursework in addition to their biostatistics options that were included above.

Cross-registration is allowed with Boston College, Brandeis University and Tufts University. [https://www.bu.edu/reg/registration/consortia/](https://www.bu.edu/reg/registration/consortia/). Also, faculty from these and other area schools such as MIT, Harvard and U. Mass Amherst have served on doctoral committees for BU SLHS students.