

AUTONOMIC DISORDERS FELLOWSHIP CORE CURRICULUM

I. Traditional Curriculum Components

A. Program Content

The program for subspecialty training in Autonomic Disorders is aimed to provide neurologists with basic and advanced knowledge of the anatomy, physiology and pharmacology of the autonomic nervous system (ANS); the nosology and diagnosis of central and peripheral autonomic disorders; the indications, techniques, and pitfalls of noninvasive clinical autonomic function testing; and the basis of nonpharmacological and pharmacological treatment of autonomic dysfunction. Appendix A provides the detailed program content.

B. Goals

The goals of the program are to provide (1) the scientific rationale for evaluation and treatment of disease of the ANS, through didactic lectures or discussions based on assigned readings relevant to the anatomy, physiology, and pharmacology of the ANS; (2) hands-on experience in performance of autonomic testing, including the indications, interpretation, and pitfalls of tests of sudomotor, cardiovagal, and adrenergic function; (3) opportunity for clinical evaluation and management of patients with autonomic symptoms, by participating in Autonomic Clinics or consulting services.

The aims are to prepare the trainee (1) to provide local expertise at the level of his or her neurologic practice in regard to clinical evaluation and management of autonomic disorders; (2) to serve as a resource for, and be actively involved in, teaching and research efforts related to the ANS; and (3) to interact successfully with non-neurologists involved in evaluation and management of patients with autonomic disorders, including cardiologists, endocrinologists, gastroenterologists, other internists, family practitioners, and urologists.

C. Objectives

Upon completion of the training program, the participant should have acquired the following fund of knowledge and skills:

1. Anatomical organization of the central autonomic control centers, the parasympathetic, sympathetic and enteric nervous systems, and visceral afferents
2. Basis of cardiovascular, respiratory, gastrointestinal, pupillary, sudomotor, and other autonomic reflexes
3. Basis of autonomic neurotransmission, including neurotransmitter synthesis, distribution, and release mechanisms, receptor subtypes, effects on their target organs

4. Autonomic pharmacology, including pharmacokinetics and pharmacodynamics of drugs affecting the ANS
5. Clinical and laboratory diagnosis of central and peripheral disorders of autonomic function, including neurodegenerative disorders associated with generalized autonomic failure, peripheral autonomic neuropathies, focal or target-specific autonomic syndromes, and effects of drugs
6. Indications, techniques, and limitations of noninvasive recordings of arterial pressure, heart rate and sudomotor output, including theoretical and practical knowledge of the equipment used to obtain those recordings
7. Performance, supervision, and interpretation of tests of orthostatic tolerance (heart rate and blood pressure responses to standing or passive head-up tilt); cardiovagal function (including heart rate response to deep breathing); Valsalva maneuver; and sudomotor function
8. Interpretation of the results of humoral, microneurography, and power spectral analysis evaluation of autonomic function
9. Interpretation of tests of pupillary function, gastrointestinal motility, urodynamics, penile erection, and thermography
10. Expertise in nonpharmacologic and pharmacological management of orthostatic intolerance syndromes (including orthostatic hypotension, syncope, and postural tachycardia), gastrointestinal dysmotility, neurogenic bladder, and sudomotor disorders
11. Knowledge of the complex pathophysiological mechanisms involved in neuropathic pain syndromes (including complex regional pain syndromes), and application and limitations of autonomic testing to help determine the contribution of sympathetic outflow to pain and to vasomotor and sudomotor components of the syndrome

D. Methods of Evaluation

1. Evaluation of Individual Programs

Program success will be measured through assessments at programmatic, institutional, regional, national and organizational levels. These should include, but not be limited to:

- A. Board certification of trainees in their primary specialty.
- B. Pass rate on subspecialty examination.
- C. Contributions to general knowledge in the disease management area, as measured by publications in both the specialty and general medical journals
- D. Recognition by the ruling bodies of the UCNS, AAS and specialty associations of origin for non-neurologists.
- E. National recognition of mentors.

Fulfillment of dynamically defined, competency based evaluations using on-site and off-site evaluation teams including regular review by UCNS and UCNS Accreditation Council where appropriate

2. Evaluation of Fellows and Faculty

- A. There must be regular written evaluation after each rotation or at least quarterly of the trainee(s) by faculty and results must be discussed with the trainee(s). Evaluation of performance has to include each clinical component and should follow the standard format approved by the institution or in compliance with ACGME recommendations for postdoctoral medical training. The evaluation must be reviewed by both the faculty member and trainee. Permanent record of evaluation must be maintained and be accessible to trainee(s) and other authorized personnel(s).
- B. A final written evaluation of performance should be provided by the Program Director at the conclusion of the training program, signed by both the trainee and program Director. The Program Director should discuss the written performance evaluation with each trainee(s).
- C. The educational experience must be documented in the trainee's file, including curriculum present during the training the time of training, and a certificate or letter signed by the program Director indicating successful completion of the course and competency regarding its content, which may be ascertained as desired by the Program Director (e.g., interview, examination).
- D. The program Director should meet on a regular basis (at least quarterly) with the trainee(s) to discuss the performance, clinical practice and quality assurance issues as applicable to the actual training experience and clinical practice of the trainee(s), and produce written minutes reflecting the proceedings of such meetings that will be kept confidential and protected.
- E. The trainee will provide feedback, preferably in form of a written evaluation, of the faculty supervisors following each major rotation or equivalent training unit.
- F. Trainees should submit written evaluations of the program at least once a year.
- G. All evaluations described here should remain confidential and will not be disclosed except in accordance with institutional and state policies. The program Director is responsible for making reasonable efforts to ensure confidentiality and protected security of these records.

Appendix A: Core Content

I. BASIC SCIENCE

A. ANATOMY

1. Central organization of autonomic control
2. Sympathetic system
3. Parasympathetic system
4. Visceral afferents
5. Enteric nervous system

B. PHYSIOLOGY

1. Patterns of activity of central autonomic neurons
2. Synaptic transmission in autonomic ganglia
3. Autonomic neuroeffector junctions
4. Cardiovascular reflexes (with emphasis on baroreflex)
5. Cardiorespiratory interactions
6. Thermoregulation
7. Autonomic control of the bladder
8. Control of gastrointestinal motility
9. Control of sexual function
10. Control of the eye
11. Control of immune function
12. Neuro-endocrinology
13. Sleep and autonomic function

C. NEUROCHEMISTRY

1. Basic neurochemistry of the central autonomic circuits
2. Preganglionic neurotransmission and receptors: acetylcholine and co-transmitters
3. Post-ganglionic transmission with emphasis on catecholamines
4. Chemical coding in the sympathetic ganglia: norepinephrine, neuropeptides, and ATP
5. Chemical coding in the parasympathetic system
6. Humoral and local modulation of autonomic neurotransmission
7. Neuropeptides in primary visceral afferents
8. Chemical coding in the enteric nervous system

D. PHARMACOLOGY

1. Pharmacology of the central autonomic network.
2. Nicotinic receptors: distribution, agonists, and antagonists
3. Muscarinic receptors: subtypes, distribution, agonists, and antagonists
4. Alpha adrenergic receptors: subtypes, distribution, agonists, and antagonists
5. Beta adrenergic receptors: subtypes, distribution, agonists, and antagonists

6. Autonomic neuropeptide receptors

II. LABORATORY EVALUATION OF AUTONOMIC FUNCTION

A. SUDOMOTOR FUNCTION

1. Thermoregulatory sweat test (physiology, method, pitfalls, interpretation)
2. Sudomotor axon reflex test (physiology, method, pitfalls, interpretation)
3. Sweat imprint method
4. Skin potentials

B. CARDIOVASCULAR REFLEXES

1. Spontaneous
2. Deep Breathing
3. Head-up tilt/standing
4. Valsalva maneuver Drugs
5. Cold pressor test
6. Handgrip maneuver
7. Venoarteriolar reflex
8. Flare response

C. OTHER METHODS TO INVESTIGATE CARDIOVASCULAR REGULATION

1. Microneurography
2. Neck suction
3. Lower body negative pressure
4. Pharmacological assessment of postganglionic sympathetic outflow.
5. Doppler Ultrasound techniques
6. Positron emission tomography and Single Photon Emission Computed Tomography

D. PUPILLARY

E. LACRIMAL/SALIVARY FUNCTION

F. GASTROINTESTINAL MOTILITY

G. BLADDER FUNCTION

H. SEXUAL FUNCTION

I. HUMORAL MARKERS

1. Plasma catecholamines (indications, methods, pitfalls)
2. Peptides
3. Endocrine markers

J. STATISCAL METHODS AND EXPERIMENTAL DESIGN

K. MOLECULAR, BIOLOGIC, GENETIC and IMMUNOLOGIC APPROACHES

III. CLINICAL AUTONOMIC DISORDERS

- A. Degenerative central nervous system disorders such as multiple system atrophy
- B. Other central nervous system disorders
- C. Peripheral autonomic disorders (neuropathy, ganglionopathy, neuro-effector)
 - Acute
 - Chronic
- D. Disorders of orthostatic tolerance –
- E. Paroxysmal dysautonomias including dysreflexia and Raynaud's
- F. Focal autonomic disorders
- G. Iatrogenic (Drugs, surgery and toxin- induced autonomic neuropathies)
- H. Neoplastic and paraneoplastic disorders
- I. Pain and the autonomic nervous system
- J. Autonomic co-morbidities of psychiatric and medical illnesses
- K. Genetic and Developmental Disorders

IV. CLINICAL MANAGEMENT

- A. Orthostatic and postprandial hypotension
- B. Orthostatic intolerance
- C. Syncope
- D. Labile hypertension (Baroreflex Failure, pheochromocytoma, etc....)
- E. Inappropriate sinus tachycardia
- F. Autonomic abnormalities in spinal cord and other CNS disorders
- G. Thermoregulatory and Sweating Disorders
- H. Gastrointestinal dysmotility
- I. Neurogenic bladder
- J. Sexual dysfunction
- K. Secretomotor function: excessive salivation and lacrimation, reduced/absent salivation and lacrimation