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Core curriculum outline

David P. Huston, Chairman

The Training Program Directors (TPD) Core Curriculum Outline is updated every 2 years by the Core Curriculum Subcommittee of the TPD and is consistent with the requirements of the Residency Review Committee for training in allergy and immunology. The TPD Core Curriculum Outline serves as a guide for (1) TPD and trainees in meeting the requirements of the Residency Review Committee, (2) the Reading List Subcommittee, and (3) the in-training Examination Subcommittee.

Abbreviations used

TPD: Training program directors'
C: Complement
GVHR: Graft versus host reaction

TRAINING PROGRAM DIRECTORS' CORE CURRICULUM OUTLINE

Basic sciences

Strategies and resources for acquiring the body of knowledge within the Basic Science Core Curriculum will vary between institutions but should include structured didactic programs (courses, lectures, and seminars), TPD recommended textbooks, TPD reading list, and regional and national seminars. The fund of [redacted] latory disorders, immunodiagnostics, and therapy of immunologic and allergic disorders.

A. Immune mechanisms
   1. Antigens: types, structures, processing, and presentation
   2. Major histocompatibility complex: structure, function, and regulation
   3. Immunogenetics: polymorphisms, generation of diversity, and rearranging gene families
   4. Immunoglobulins: structure, function, and antigen binding
   5. T-cell receptors: structure, function, and antigen binding
   6. Receptor-ligand interactions: adhesion molecules, C receptors, Fc receptors, and signal transduction
   7. Complement/kinin: structure and function
   8. Nonspecific: acute phase reactants and enzymatic defense

B. Anatomy and cellular elements of the immune system
   1. Lymphoid organs: gross and microscopic anatomy and functions
   2. [redacted]

C. Immunomodulation
   1. Cytokines: for each cytokine, understand the origin, structure, effect, site(s) of action (receptor), metabolism, regulation, and gene activation
   2. Inflammatory mediators (e.g., leukotrienes, prostaglandins, and platelet-activating factor): for each mediator, understand the origin, structure, effect, site(s) of action (receptor), metabolism, and regulation
   3. Immunomodulatory agents: for each agent, understand the mechanism of action
      a. Drugs
      b. Antibodies
      c. Recombinant molecules

D. Immune responses
   1. IgE-mediated: acute and late-phase reactions
   2. IgG-, IgA-, and IgM-mediated: opsonization, C fixation, antibody-dependent, cell-mediated cytotoxicity, stimulation, and blocking

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3. Immune complex-mediated: physicochemical properties and clearance
4. Cell-mediated: participating cells and effector mechanisms and granuloma formation
5. Other: natural killers, lymphokine-activated killers, and cutaneous basophil hypersensitivity

E. Mucosal immunity
1. Specific: mechanism of interaction between gut-associated lymphoid tissue, bronchus-associated lymphoid tissue, and secretory IgA and IgE
2. Nonspecific: mechanisms of interaction between lysozyme, mucus, and cilia

F. Transplantation immunology
1. Histocompatibility: major and minor antigens and principles of cross-matching
2. Allograft rejection: mechanisms
3. GVHR: mechanisms

G. Tumor immunology
1. Tumor markers: leukemias and lymphomas
2. Immunosurveillance: mechanisms
3. Oncogenes: translocation and breakpoints

H. Immunoregulation
1. Tolerance: clonal selection, suppression, and antigen paralysis
2. Cell-cell interactions: help and suppression
3. Idiotype networks: inhibition and simulation

I. Laboratory measurements
1. Techniques: understand the principles and methodology of these techniques, particularly as they relate to measurement of immunoglobulin levels, immunoglobulin classes and subclasses, specific antibodies, T lymphocytes and their subsets, B lymphocytes, natural killer cells, null cells, cellular response to mitogens, cellular response to antigens, cytokines, immune complexes, cryoprecipitable proteins, total serum complement activity, complement components, and histocompatibility markers:
   a. Serologic: ELISA, RIA, RID, nephelometry, immunoblots, high-performance liquid chromatography, isoelectric focusing, immunoelectrophoresis, electroimmunodiffusion, and protein electrophoresis
   b. Cellular: flow cytometry, chemotaxis, phagocytosis, cytolysis, lymphocyte proliferation, Ig production
   c. Histochemistry and immunofluorescence
   d. Molecular: Northern, Southern, Western, polymerase chain reactions, crossover breakpoint analysis, ligase chain reactions
   e. Hybridomas and monoclonal antibodies
2. Test-performance characteristics: principles of sensitivity, specificity, and predictive value
3. Unproven tests (for example)
   a. Provocation-neutralization testing
   b. Cytotoxic food tests
   c. Applied kinesiology
   d. Electrodiagnosis
4. Inappropriate tests (for example)
   a. IgG antibodies and circulating immune complexes to foods in diagnosis of food allergy
   b. Measurement of lymphocyte subsets, immunoglobulins, and interleukins in patients with alleged "environmental or ecologic disease" who have no symptoms of immunologic disease
   c. Serum, urine, hair, fat analysis for chemicals in diagnosis of "environmental illness"

J. Research principles
1. Experimental design
2. Data analysis and biostatistics
3. Epidemiology

Clinical sciences

The subspecialty of immunology and allergy encompasses three major clinical areas: allergic diseases, immunoregulatory disorders, and immunodeficiency diseases. It is the intention of allergy and immunology training programs to train residents as expert consultants and accomplished practitioners in these areas. Moreover, the scholastic approaches to maintaining the understanding of the current concepts of the specialty must be instilled during the training program. It is required that each trainee be accomplished in the basic knowledge and clinical and laboratory skills required to diagnose and effectively treat allergic, immunoregulatory, and immunodeficiency diseases.

The following is an outline of the diseases of which allergy and immunology fellows must be knowledgeable. Training programs may vary their emphasis based on their expertise and resources. Each resident must have sufficient exposure to all the allergic disease entities to eventually serve as an expert consultant in the diagnosis and treatment of these disorders. It is expected that all residents be trained in the physiology, pathology, diagnosis, differential diagnosis, and treatment of each disease. Explicit recognition should also be given to the importance of behavioral studies and bioethics with relationship to clinical trials and appropriate use of diagnostic and therapeutic techniques.

A. Allergic disorders
1. Upper airway diseases
   a. Diseases: rhinitis, sinusitis, nasal polypo-

sis, otitis (bacterial and serous), and laryngeal disorders
   b. Clinical skills (only listed once through this document): skin testing, (epicutaneous and intracutaneous), nasal challenges, assessment of nasal secretions, assessment of ciliary function, rhinoscopy (highly recommended skill, but not absolutely required), nasal and ear examination, assessment of radiographic examination, environmental assessment, and tympanometry
2. Eye diseases
   a. Diseases: conjunctivitis
   b. Clinical skills: eye examination
3. Dermatologic diseases
   a. Diseases: urticaria, angioedema, atopic dermatitis, contact dermatitis, urticaria pigmentosa, bullous disease, drug rashes, erythema multiform, erythema nodosum, and other immunologic skin diseases
   b. Clinical skills: proper cutaneous examination, skin biopsy, patch testing, drug skin testing (immediate hypersensitivity skin tests), and an understanding of dermatopathology and immunofluorescent tests
4. Lower respiratory tract disease
   a. Diseases: asthma (exercise, allergic bronchopulmonary aspergillosis, sulfite-related, aspirin-induced, occupational, vasculitis, infection-related, and intrinsic), hypersensitivity pneumonitis, chronic obstructive pulmonary disease, chronic and acute bronchitis, and diagnosis of patients with cystic fibrosis, immotile cilia syndrome, sarcoid, and cough syndromes
   b. Specific skills to be acquired: chest examination, pulmonary function testing, bronchial challenges, sputum analysis, and interpretation of bronchoscopy and bronchial lavage and of radiographs
5. Adverse reactions to ingestants
   a. Diseases: food allergies, food intolerance, gluten sensitivity, and food-additive reactions
   b. Clinical skills: oral challenge for foods and additives
6. Anaphylaxis
   a. Diseases: anaphylaxis (allergens, blood products, exercise, menstrually related, idiopathic, drug related, and radiocontrast media induced)
   b. Clinical skills: emergency treatment
7. Insect hypersensitivity
   a. Diseases: stinging-, biting-, and inhaled-insect reactions
   b. Clinical skills: venom skin testing
8. Therapeutic modalities (for example)
   a. Modalities: environmental control of allergens, hyposensitization immunotherapy, antihistamines, theophylline, β-agonists, sympathomimetics, calcium channel blockers, cromolyn, anticholinergics, corticosteroids, troleandomycin, mucolytics, and antibodies
   b. Clinical skills: maintenance of therapeutic levels of plasma theophylline
   c. Unproven therapy: neutralization therapy, rotation diets, acupuncture, orthomolecular diagnosis, homeopathic remedies
   d. Inappropriate forms of therapy: multiple food elimination diets, multiple chemical avoidance, anti-*Candida* drugs, vitamin, mineral, or amino acid supplements, in vitro allergy tests, and allergen vaccine preparation by third party not knowing the patient ("remote allergy practice")

B. Immunodeficiency diseases are an essential component of allergy-immunology programs, and allergy-immunology fellows should be exposed to and familiar with the following diseases and their treatments.
1. Complement deficiencies
   a. Diseases: hereditary angioedema and complement-component deficiencies
   b. Clinical skills: interpretation of complement tests
2. Primary immunodeficiencies:
   a. Diseases: severe combined immunodeficiency, DiGeorge syndrome, adenosine deaminase deficiency, nucleotide phosphorylase deficiency, ataxia telangiectasia, Wiskott-Aldrich syndrome, congenital X-linked agammaglobulinemia, selective IgA deficiency, IgG subclass deficiencies, hyper-IgE syndrome, and common variable immunodeficiencies
   b. Clinical skills: Assessment for thymic shadow, assessment of recurrent serious infections, immunoglobulin-level interpretation, functional antibody interpretation, lymphocyte-subset interpretation, lymphocyte-function interpretation, and delayed skin test placement and interpretation
3. Acquired immunodeficiencies
   a. Diseases: acquired immunodeficiency syndrome, chromosomal defects, metabolic defects, immunosuppression, viral infections, parasitism, malnutrition, malignancies, autoimmune diseases, burns, splenectomy, and radiation

b. Clinical skills: human immunodeficiency virus tests (ELISA and Western blot)

4. White blood cell disorders
   a. Diseases: chronic granulomatous disease of childhood, myeloperoxidase deficiency, leukocyte-adhesion disorder (Mac-1 deficiency), Chédiak-Higashi syndrome, eosinophilia syndromes, and mastocytosis
   b. Clinical: assessment of leukocyte function, chemiluminescence test interpretation, surface glycoprotein test (LFA-1, Mac-1, P95, 150) phenotype interpretation, chemotaxis interpretation, and absolute neutrophil count interpretation

C. Immunoregulatory disorders
1. Autoimmunity
   a. Diseases: systemic lupus erythematosus, other collagen-vascular diseases (connective tissue disease), immune endocrinopathies, inflammatory gastrointestinal diseases, immunologic neuropathies and neuromuscular diseases, immunohematologic diseases, and immunologic eye diseases
   b. Clinical skills: interpretation of physical findings, interpretation of autoantibody tests (including but not limited to) ANA, anti-DNA, anti-Rho, anti-La, anti-intrinsic factor, antiparietal cell antibody, antireceptor antibodies, antimyelin antibody, anti-idiotypes, antiplatelet antibody, and anti-neutrophil antibody
2. Vasculitis
   a. Diseases: small vessel disease, medium vessel disease, large vessel disease, pulmonary and renal immune disease, and cryoproteins
   b. Clinical skills: interpretation of biopsy specimens of skin, kidney, and lung (immunofluorescence), interpretation of physical findings, interpretation of circulating immune complex levels, and interpretation of cryoglobulins
3. Transplantation and GVHR
   a. Diseases: GVHR and knowledge of transplantation immunity
   b. Clinical skills: clinical assessment of GVHR and working knowledge of immunologic mechanisms and their pharmacologic modulation
4. Immune-related malignancies
   a. Diseases: leukemia, lymphoma, plasma cell dyscrasia, multiple myeloma, gammopathies, and amyloidosis
   b. Clinical skills: interpretation of serum protein electrophoresis, interpretation of immunoelectrophoresis, interpretation of serum immunoglobulin levels, and interpretation of lymphocyte subset data
5. Immune reproductive defects
   a. Diseases: infertility (male and female), abortion (chronic), Rh incompatibility, ABO incompatibility, secondary reproductive defects, and semen sensitivity
   b. Clinical skills: interpretation of Rh/AB antibody levels and interpretation of appropriate autoantibodies
6. Immunomodulation
   a. Immunosuppressants
   b. Immune reconstitution
   c. Gammaglobulin and monoclonal antibodies
   d. Cytokines
   e. Vaccines
   f. Plasmapheresis and cytopheresis

Workshop A: Educational strategies*

Howard J. Zeitz, Moderator, **Bruce Bochner** and **Michael Kaliner**
Comoderators

*Participants, workshop A: N. Franklin Adkinson, Gildon N. Beall, Malcolm N. Blumenthal, Robert Bush, Lawrence T. Chiaramonte, Deborah Danoff, William J. Davis, Lawrence N. DuBuske, Theodore M. Freeman, Bann C. Kang, Gerald B. Kolski, J. Li, David R. McCourtie, Nicholas A. Pawlowski, Stephen I. Rosenfeld, R. Michael Sly, Laurie J. Smith, Harry S. Spaulding, Chester T. Stafford, Doris Stoll, Paul Van Arsdel, and Paul Williams.

The workshop met first in plenary session to discuss educational strategies concerning use of the Training Program Directors (TPD) Core Curriculum and Reading List. Then, workshop participants divided into three breakout groups to discuss (1) strategies for the use of conferences and courses, (2) strategies for the use of educational aids, and (3) the comparative value