

CURRICULUM REDESIGN DESIGN TEAM SUMMARY REPORTS

PHASE 1 – FEBRUARY 2014

Practice of Medicine (POM) Summary Report

Overview of Content

This course will integrate and expand on the current way we teach our students communication, physical exam, and clinical reasoning skills. The goal is to create a four-year longitudinal clinical course that will teach foundational skills during the first 15 months (Foundations), core skills during the Principal Clinical Experience (PCE, Year II), and advanced skills during the remainder of time (Advanced, Years III/IV). The course will focus on ten fundamental skills (see below) that are further divided into specific competencies and clinical milestones that should be achieved by all students prior to graduation. Students will be assigned to an education-medical “home” where they will be integrated into a primary care/ambulatory practice and become part of the medical team. In addition, the inpatient setting and the Clinical Skills Center in the Tosteson Medical Education Center will be used to complement clinical education and enrich the ambulatory experience.

Relationship to other new courses

This course will be integrated in a bidirectional fashion with all basic, social, and clinical science courses. It will serve as the laboratory in which the knowledge and skills acquired in other courses will be practiced. It will begin with an intensive period at the beginning of Year I through Introduction to the Profession, which will introduce students to the profession of a physician and to Harvard Medical School. Throughout the school year the course will meet at least weekly in addition to the other courses. Finally there will be a period of consolidation of knowledge and preparation for the wards prior to the PCE when the POM will be the only course in session.

10 fundamental skills

1. Demonstrate professional behavior
2. Communicate with patients and families
3. Perform a physical exam
4. Ability to Utilize and Interpret clinical tests and imaging
5. Ability to perform medical, diagnostic and surgical procedures
6. Ability to work in interprofessional teams
7. Ability to diagnose clinical problems
8. Ability to intervene in the natural history of disease
9. Ability to provide clinical care within the context of the patient’s determinants of health
10. Solve clinical problems using medical knowledge and scientific evidence

Possible Years III/IV Advanced Courses

- 1) The physiology of the physical diagnosis
- 2) Simulation experience: Advanced clinical reasoning and team dynamics
- 3) Ultrasound as a clinical tool
- 4) Approach to vulnerable populations: Health Care For the Homeless/Community Health Centers
- 5) Bedside Diagnostic techniques
- 6) Advanced clinical procedures
- 7) Interprofessional clinical education

***Foundations* Summary Report**

Overview of Content

The set of courses comprising *Foundations* will be organized into three discipline-specific themes: *Molecular and Cellular Basis of Medicine* (cell biology, biochemistry, genetics, and pharmacology); *Structure and Function of the Human Body* (anatomy, histology, developmental biology); and *Mechanisms of Disease* (pathology, immunology, microbiology). The content will be selected to emphasize the key principles of each field, yet most topics will be taught in an integrated fashion to help students identify conceptual links between fields. For example, cell signaling will be taught in the context of how signaling pathways are perturbed by mutation or disease and how drugs are used to intervene in signaling pathways.

To complement discipline-oriented teaching, *Foundations* will introduce several disease-specific themes that will be used to teach content in a longitudinal and integrated fashion. These themes will include Cancer, Treating Infection, and Atherosclerosis.

Relationship to other new courses

As implied by the name, *Foundations* will provide a molecular, cellular and anatomic framework upon which subsequent courses build. For the *Human Body*, emphasis during *Foundations* will be placed on the musculoskeletal system, with other organ-system based anatomy integrated into subsequent organ system courses. We anticipate that the teaching of the disease-specific themes will continue during the organ system courses. For example, in the *Cancer* theme, *Foundations* will teach general principles of cancer biology and therapeutics, while the organ systems will teach specific manifestations of cancer in the relevant organ systems.

Major topics to be covered: (abbreviated)

Molecular and Cellular Basis of Medicine: Molecular building blocks of cells; principles of cell organization, communication and metabolism; structure of genes, regulation of gene expression and consequences of genetic variation; mapping disease genes; population genetics; genetics of disease; drug-receptor interactions; enzyme kinetics and inhibition; pharmacokinetics and pharmacodynamics; drug-drug interactions; drug resistance; drug discovery; pharmacogenetics

Structure and Function of the Human Body: Cell and tissue types; histology of normal tissues; overview of body organization; dissection of the musculoskeletal system (dissection of other systems to occur during organ system blocks); embryology and developmental biology will focus on early events in embryogenesis and organization of the body plan (details of specific organ systems will occur in organ system blocks)

Mechanisms of Disease: Structure and function of microorganisms; pathogenesis and pharmacology of infectious disease; mechanisms of innate and adaptive immunity; mechanisms of inflammation and its treatment

Disease Themes: Cancer, Atherosclerosis, Treating Infection: Will emphasize molecular and cellular pathogenesis with description of treatment strategies.

Possible Years III/IV Advanced Courses

- Advanced Clinical Pharmacology
- Clinical Anatomy for Surgical Specialties
- Discovering New Drugs
- Frontiers in Genetics
- Diseases of Protein Folding

Immunology in Defense and Disease (IDD) Summary Report

Overview of content

This course will focus on commonly encountered and/or highly instructive diseases of the skin, joints, muscles, and blood vessels, and systemic diseases that involve these tissues. These are topics currently included in FOM II Dermatology and Rheumatology courses, as well as in the Immunology component of Immunology, Microbiology and Pathology in FOM I. The integrating theme of *IDD* will be immune/inflammatory mechanisms of disease, with a focus on dysregulated or inappropriately targeted immune responses. Causes and manifestations of acquired immunodeficiency (both iatrogenic and infectious) will also be covered. Other clinically important aspects of Dermatology, and Rheumatology that do not readily associate with the immune/inflammatory theme, such as skin cancer, will be included.

Relationship to other new courses

IDD will build on several topics that should be covered in detail in Foundations, including anatomy and histology of the skin and musculoskeletal system, inflammation, the normal functions of the immune system, and basic microbiology. *IDD* will also lay the foundations for coverage of the way systemic diseases affect organ systems covered in *Homeostasis I and II*. For example, the pathophysiological basis of SLE, and the manifestations of this disorder in skin, joints, and blood vessels, will be introduced in this course, but the manifestations of SLE in other organs systems will be covered in Renal, Cardiovascular, and Pulmonary blocks in the *Homeostasis* courses later.

Major topics to be covered (abbreviated)

Dermatology: function of the skin; clinical description of skin lesions; skin cancer; the response of skin to infection (appropriate inflammation); inflammatory diseases of the skin (inappropriate inflammation).

Rheumatology: SLE-immunological abnormalities (clinical presentation, differential diagnosis); clinical assessment of aches and pains of joints and muscles; RA and other polyarthritis (pathophysiology, clinical manifestations, treatment); laboratory medicine of inflammatory/autoimmune diseases; monoarthritis (crystalopathies, osteoarthritis); septic arthritis.

Immunology/immunopathology: How and when innate and adaptive immune responses cause disease; mechanism of self-tolerance and how they fail in autoimmunity; causes and manifestations of immunodeficiency

Diseases covered that will integrate Dermatology and Rheumatology, and Immunopathology
SLE, psoriasis, vasculitis, drug hypersensitivity reactions

Possible Years III/IV Advanced courses, or topics within courses, related to *IDD*

Integrated: Common mechanisms and therapeutic targets in autoimmune diseases

Dermatology: Cutaneous manifestations of internal disease; Disorders of hair and nails

Rheumatology: Lupus-related disorders (Sjogren's, mixed connective tissue diseases. others); Vasculitis Revisited (Serum Sickness, Cryoglobulinemia, ANCA+, ANCA-); Fibrosing disorders (Scleroderma); Autoinflammatory diseases and the inflammasome; Pediatric rheumatology

Social and Population Sciences (SPS) Summary Report

Overview of content

The *SPS* courses, taught together in Year I during the January block, will cover topics of clinical epidemiology and population health, health care policy, social medicine and global health, and medical ethics and professionalism.

Relationship to other new courses

Relevant *SPS* topics will be introduced throughout the four-year curriculum as needed, including in *Introduction to the Profession*, transition to the clerkships week, the four PCE intersessions, the *PCEs* themselves, a post-PCE month-long course, and the *Capstone Course*.

Major topics to be covered during the Year I *SPS* course include

Clinical Epidemiology and Population Health: continuum of individual patient care and population health approaches; study design; critical reading; introduction to inference and biostatistics; diagnostic testing and clinical decisions (sensitivity, specificity, etc.); summarizing and integrating evidence; introduction to paradigmatic population health issues/interventions; and introduction to tools and resources for practicing evidence-based medicine.

Health Policy: key characteristics of U.S. health care system and recent reforms; private insurance; Medicare and Medicaid; payment of health care providers; measurement of quality of care; improving quality and patient safety; innovations in delivery and financing; health care politics; how other countries organize and finance their health care systems; and health care spending and efforts to constrain it.

Introduction to Social Medicine and Global Health: applying the perspectives of social science to understand the role of medicine, the challenges that medicine faces, and possible solutions; introduction to the social, economic, and political forces that affect both the burden of disease and the ability of health care to improve patients' lives; health care disparities and social determinants of disease; how and why the burden of disease changes over time; the meaning of efficacy, how doctors assess it, and an introduction to the limits of "evidence based medicine"; and introduction to the social factors influencing health care

Medical Ethics and Professionalism: role of the physician and the moral framework of modern health care practice; informed consent, confidentiality, and truth-telling; deciding for others (e.g., advanced directives); introduction to ethical issues at the beginning and end of life; overview of futility; introduction to research ethics; special topics that come up on the wards; and introduction to ethics of bedside rationing.

Possible topics for the post-PCE course in Year III or IV

CEPH: interpreting medical evidence; physicians and public health emergencies; data to support patient safety and quality; and interface of clinical practice and public health

Health Policy: malpractice policy, long-term care policy, mental health policy, pharmaceutical and device policy and regulation, and end of life care policy

Social Medicine: caring for high utilizers of medicine, delivering high value care, and reverse innovation (learning from global perspectives about addressing disparities in U.S.)

Ethics: ethics of conflict of interest and commercialization; ethics of research; reproductive ethics; and ethical issues in disclosure and apology after errors and adverse events

Homeostasis I: Maintaining Aerobic Metabolism (Respiratory, Cardiovascular, Hematology)

Summary Report

Overview of Content

This course will focus on key concepts that are common to patients presenting with respiratory, cardiovascular and hematologic problems, and that are illustrative of principles that form the basis for the understanding of related conditions that are less prevalent. The common theme will be the support of aerobic metabolism via gas exchange, oxygen delivery and utilization. To support a pedagogical approach that emphasizes inductive reasoning, analytical thinking, and problem solving, the course content is presented as a series of questions the answers to which will require students to have not only factual knowledge but deeper understanding that will enable them to apply the information in a range of clinical contexts.

Relationship to other new courses

This course will extend many of the basic principles elaborated in the *Foundations* course with particular attention to functional anatomy, histology, and pathology of the three organ systems. In addition, we will build on the themes of vascular biology, tumor biology, and core immunology/microbiology as we explore coronary disease, infections (e.g., pneumonias in immunocompetent and compromised hosts) and neoplasms (e.g., lung cancer, leukemia) present in these organ systems. To support the development of skills in diagnostic reasoning for the *Practice of Medicine* course, content questions have also been formulated to provide the anatomic, physiologic, and pathophysiologic basis for findings ascertained on the physical exam.

Major topics to be covered (abbreviated)

Note: topics will integrate anatomy, histology, physiology, pathophysiology, pharmacology, pathology, radiology

Respiratory: principles of gas exchange and flow through tubes, pulmonary function testing, obstructive lung diseases, restrictive lung disease, common pulmonary vascular problems, pulmonary infections

Cardiovascular: muscle contraction, hemodynamics and heart failure, determinants of stroke volume, core electrophysiology of rhythm generation and conduction, Fick Principle, coronary artery disease, valvular dysfunction

Hematology: function of blood cells, anemias, clotting mechanisms and anticoagulation, white blood cells and immune function

Diseases that will integrate organ systems (examples)

Pulmonary embolism, pulmonary vascular disease, heart failure

Possible Years III/IV advanced courses

Cardiology: Advanced Hemodynamics – to include didactic time as well as time in catheterization lab

Respiratory: Advanced Clinical Physiology – to include didactics, pulmonary function interpretation, chest radiology, and medical ICU (mechanical ventilation)

Homeostasis II: Food, Water, Mineral Metabolism, Maintenance of Internal Balance (GI; Renal; Endocrine/Reproductive) Summary Report

Overview of Content

This course will focus on how the body can maintain the steady state despite the wide range of challenges from the external environment.

Relationship to other new courses

Homeostasis II will build explicitly on material from preceding courses. Lessons in anatomy, histology and embryology will show how form dictates function. Transporters and cell barriers described in *Foundations* will become critical players in the nephron and the GI tract. The interplay between cardiac function, the vasculature and the kidney's calibrated response will be considered as will the essential role of hormones in the maintenance of homeostasis. Similarly, earlier study of the role of respiration in the maintenance of pH will be complimented by contributions from the kidney. Perturbations created by the GI tract that cause fluid and electrolyte losses will help demonstrate renal adaptive response. *Homeostasis II* will also consider reproductive endocrinology and dovetail exploration considered earlier in embryology within the *Foundations* course. Absorption and neuroendocrine signaling by the GI tract will also be addressed in the context of the regulation of normal serum glucose levels.

Major topics to be covered (abbreviated)

Note: topics will integrate anatomy, histology, physiology, pathophysiology, pharmacology, pathology, radiology

Gastroenterology: Function of the esophagus, stomach, small intestine, colon, exocrine pancreas, liver; intraluminal digestion, brush border absorption, colonic fluid reclamation, response to infection in the small intestine; study of celiac disease to reinforce the immune mechanisms of disease

Renal: The essential role of the kidney in the maintenance of homeostasis. Disorders of volume, osmoregulation, acid-base, potassium and divalent cations will be considered. In addition, renal pathology with study of glomerular diseases will serve an opportunity to reinforce the immune mechanisms of disease

Endocrinology and Reproductive Endocrinology: Hormones orchestrate much of physiology, including growth, development, energy regulation, metabolism, and homeostasis. The endocrine program will examine dysregulation of these hormonal systems and how they lead to problems as varied as diabetes mellitus, adrenal insufficiency, osteoporosis, hypothyroidism, Graves' disease, infertility, preeclampsia, hypogonadism, while exploring common neoplasia including thyroid, breast, uterus, and prostate.

Disorders covered that will integrate Gastroenterology, Nephrology and Endocrinology

Vomiting, diarrhea, cirrhosis, diabetes mellitus, Conn's syndrome, primary hyperparathyroidism

Possible Years III/IV advanced courses, or topics within courses, related to *Homeostasis II*

Integrated: Common mechanisms and therapeutic targets in autoimmune diseases (with *IDD*) or advanced clinical physiology (with *Homeostasis I*)

Nephrology: History and Hot Topics in Nephrology. This course would showcase the remarkable contributions of HMS in the understanding of nephrology past and present.

Endocrinology: Diabetes pathobiology and therapeutics; fertility and reproduction; endocrine neoplasia; integrated chronic care; sexual identity and its resolution; bench to bedside with thyroid diseases

Gastroenterology: The microbiome in wellness and disease (with Crohn's and ulcerative colitis as a model of disease); advanced pharmacology, biological treatments and pharmacogenetics; GI disease in children: influence of malnutrition and inflammation on growth; the liver in repair and disrepair: drug-induced liver injury and sclerosing cholangitis as model illnesses of acute and chronic injury.

Neuroscience and Behavioral Development - Summary Report

Overview of Content

This will be a core integrated preclerkship course on the nervous system, behavior, and development. In proposing this course we have integrated content currently being covered in three separate courses that run contemporaneously in the curriculum (Human Systems: Nervous System and Behavior, Psychopathology and Introduction to Clinical Psychiatry, and Human Development) and have identified core content that we feel needs to be learned prior to the core clinical year. We have organized this proposed course into a sequence of seven units, and we have identified the topics that we feel need to be covered in each unit, the settings in which we feel this content would be learned most effectively, and the key questions that would frame this material for both students and faculty, including evaluators. A sample of topics in each unit is provided below:

Major topics to be covered (abbreviated)

Unit 1 topics: Neurons, axons, synapses; gross brain and spinal cord anatomy; peripheral nervous system; introduction to human development; overview of nervous system disorders; mental status exam

Unit 2 topics: Somatosensory systems, pain, visual and auditory systems; infant development; schizophrenia

Unit 3 topics: Motor systems, motor neuron disease, basal ganglia and cerebellum; toddler development; Parkinson's, Huntington's

Unit 4 topics: Diffuse neurotransmitter systems, hypothalamus, brainstem, cranial nerves, autonomic system; preschool development; autism; mood and anxiety disorders, addictions, eating disorders, sleep

Unit 5 topics: Cerebral cortex, frontal lobes, language/aphasia, limbic system, stroke; school age and adolescent development; ADHD, learning disabilities, personality disorders, PTSD

Unit 6 topics: Brain imaging in health and disease; aging/senescence; delirium and dementias; epilepsy

Unit 7 topics: Principles of neuropathology; multiple sclerosis, brain tumors, infections; principles of therapeutics (pharmacology, neuromodulation, surgery, behavioral and psychotherapies)

Relationship to other new courses

This course will require prior mastery of many of the fundamentals in the *Foundations* course, including cell and molecular biology, principles of musculoskeletal anatomy, and principles of peripheral nervous system anatomy. In addition, it will build on the *Introduction to the Profession* course in that we will emphasize the range of human behavioral responses across the lifespan that inform patient-doctor interactions. With regard to the other organ system courses, we plan to highlight normal and abnormal aspects of nervous system functioning that are unique and distinct from other systems. In conjunction with the *Practice of Medicine* course, we will teach the anatomical and physiological underpinnings of the neurological examination and will specifically address specialized aspects of the pediatric physical exam and psychiatric mental status exam.

Possible Years III/IV Advanced Courses

An exciting array of advanced science courses in our fields, which would follow the principal clinical experience, is now anticipated, and we welcome suggestions for these courses from throughout the community. Topics suggested to date include such diverse titles as the molecular basis of neurologic and psychiatric disease, fundamentals of developmental and behavioral pediatrics, principles of neurophysiology and neuropharmacology, and the interview and examination of challenging patients.