Rheumatology Fellowship Training Program

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Fellowship Curriculum

I. Medical Knowledge

Medical knowledge refers to the understanding of established and evolving biomedical, clinical, and cognate sciences, and to the application of this knowledge to patience care. A working knowledge of the basic and clinical sciences that relate to musculoskeletal and rheumatic disease [as outlined below] is fundamental to the practice of rheumatology. By completion of the rheumatology fellowship, trainees should have an understanding of normal and pathogenic processes of the immune system that forms the basis of reliable diagnosis and the development and use of an increasingly sophisticated range of treatments. Rheumatology trainees should also have practical understanding of the modalities and approaches used by other specialists and allied health professionals in order to manage the care of their patients effectively.

- **Basic Sciences**

A. Anatomy and biology of musculoskeletal tissues: for each tissue, understand the embryology, development, biochemistry and metabolism, structure, function, and classification

1. Joints and ligaments: diarthrodial joints, intervertebral discs, synovium, cartilage
2. Connective tissue cells and components: fibroblasts, collagens, proteoglycans, elastin, matrix glycoproteins
3. Bone: development, structure, cellular basis of turnover and remodeling, hormonal and cytokine regulation
4. Muscle and tendons
5. Blood vessels

B. Immunology

1. Anatomy and cellular elements of the immune system

a. Lymphoid organs: gross and microscopic anatomy and function
b. Organization of the immune system: innate and adaptive immune systems
c. Specific cells: for each cell type, understand the ontogeny, structure, phenotype, function, and activation markers/receptors

(1) Lymphocytes: T cells and B cells (naïve, memory, activated)
(2) Antigen presenting cells: monocytes, macrophages and dendritic cells
(3) Natural killer cells
(4) Neutrophils and eosinophils
(5) Other cells: mast cells, endothelial cells, platelets, fibroblasts

2. Immune and inflammatory mechanisms

a. Receptor/ligand interactions: adhesion molecules, complement receptors, Fc receptors, toll receptors, activating and inhibiting receptors, signal transduction
b. T cell receptors: structure, function, antigen binding, signaling, genetic basis
c. B cell receptors/immunoglobulins: structure, function, antigen binding, signaling, genetic basis, effector function
d. Antigens: types, structure, processing, presentation, and elimination
e. Superantigens: types, site of binding, and effect on immune system
f. Major histocompatibility complex: structure, function, nomenclature, and immunogenetics
g. Complement/Kinin systems: structure, function, and regulation
h. Acute phase reactants and enzymatic defenses

3. Cellular interactions and immunomodulation

a. Cellular activation and regulation: for each cell type, understand mechanisms of activation and suppression of function function (eg. T cell:B cell interactions via CD28:CD80/86)
b. Cytokines: for each cytokine, understand the origin, structure, effect, site of action, metabolism, regulation, and gene activation.
c. Inflammatory mediators: for each mediator, understand the origin, structure, effect, site of action, metabolism, and regulation.

4. Immune responses

a.. Antibody-mediated: opsonization, complement fixation, and antibody dependent cellular cytotoxicity
b. Cell-mediated: cells and effector mechanisms in cellular cytotoxicity and granuloma formation
d. IgE - mediated: acute and late - phase reactions
e. Mucosal immunity: interactions between gut and bronchus-associated lymphoid tissue and secretory IgA
f. Innate immune responses: natural killer cells, pattern recognition
g. Pathologic immune responses: Immune complex-mediated (physiochemical properties and clearance of immune complexes), graft versus host response, abnormal apoptosis.

5. Immunoregulation

a. Tolerance: clonal selection, deletion, and anergy
b. Cell-cell interactions: help and suppression. Understand the collaboration among cells for control of the immune response
c. Idiotype networks: inhibition and stimulation

C. Purine and uric acid metabolism

1. Purine: biochemistry, synthesis, and regulation
2. Uric acid: origin, elimination, and physicochemical properties
3. Crystals: factors affecting formation, induction of inflammation
4. Purine pathway enzyme deficiencies and immunodeficiency: ADA, PNP

D. Biomechanics of bones, joints, and muscles: understand the principles of kinesiology of peripheral/axial joints and gait and how alterations in biomechanics contribute to musculoskeletal disorders

E. Neurobiology of Pain

1. Peripheral afferent nociceptive pathways
2. Central processing of nociceptive pathways
3. Mechanisms of action of drugs used for the treatment of neuropathic pain
4. Biopsychosocial model of pain

• Clinical Sciences

A. Rheumatic Diseases

1. Systemic connective tissue diseases: rheumatoid arthritis, lupus erythematosus (systemic, discoid, and drug-related), scleroderma (localized syndromes, systemic sclerosis, CREST variant, chemical/drug-related), eosinophilic fasciitis, eosinophilic myalgic syndrome, Sjögren's syndrome, polymyositis and dermatomyositis, overlap syndromes including mixed connective tissue disease, polymyalgia rheumatica, relapsing polychondritis, relapsing panniculitis, erythema nodosum, adult-onset Still's disease, primary antiphospholipid antibody syndrome, undifferentiated connective tissue disease
2. Seronegative spondyloarthropathies: ankylosing spondylitis, reactive arthritis, psoriatic arthritis, inflammatory bowel disease-associated arthritis, arthritis associated with acne and other skin diseases, SAPHO syndrome, and undifferentiated spondyloarthropathies
3. Vasculitides: temporal arteritis, Takayasu's arteritis, polyarteritis nodosa and systemic necrotizing vasculitis overlaps, allergic granulomatosis of Churg-Strauss, Granulomatous polyangiitis, and other ANCA-associated diseases, Behcet's disease, hypersensitivity and small vessel angiitis, cryoglobulinemia, Cogan's syndrome
4. Infectious and reactive arthritides

   a. Infectious arthritides: bacterial (nongonococcal and gonococcal), mycobacterial, spirochetal (syphilis, Lyme), viral (HIV, hepatitis B, parvovirus, other), fungal, parasitic
   b. Whipple's disease
   c. Reactive arthritides: acute rheumatic fever, arthritis associated with subacute bacterial endocarditis, intestinal bypass arthritis, post-dysenteric arthritides, postimmunization arthritis, other colitic-associated arthropathies

5. Metabolic, endocrine, and hematologic disease associated rheumatic disorders

   a. Crystal - associated diseases: monosodium urate monohydrate (gout), calcium pyrophosphate dihydrate deposition disease, basic calcium phosphate (hydroxyapatite), calcium oxalate
   b. Endocrine - associated diseases: rheumatic syndromes associated with diabetes mellitus, acromegaly, hyperparathyroidism, hypoparathyroidism, hyperthyroidism, hypothyroidism, Cushing's disease
   c. Hematologic - associated diseases: rheumatic syndromes associated with hemophilia, hemoglobinopathies, angioimmunoblastic lymphadenopathy

6. Bone and cartilage disorders

   a. Osteoarthritis - primary and secondary osteoarthritis, chondromalacia patellae
   b. Metabolic bone disease: osteoporosis, osteomalacia, bone disease related to renal disease
   c. Paget's disease of bone
   d. Avascular necrosis of bone: idiopathic, secondary causes, osteochondritis dissecans
   e. Others: transient osteoporosis, hypertrophic osteoarthropathy, diffuse idiopathic skeletal hyperostosis, insufficiency fractures

7. Hereditary, congenital, and inborn errors of metabolism associated with rheumatic syndromes

   a. Disorders of connective tissue: Marfan's syndrome, osteogenesis imperfecta, Ehlers-Danlos syndromes, pseudoxanthoma elasticum, hypermobility syndrome, others
   b. Mucopolysaccharidoses
   c. Osteochondrodysplasias: multiple epiphyseal dysplasia, spondylepiphyseal dysplasia
   d. Inborn errors of metabolism affecting connective tissue: homocystinuria, ochronosis
   e. Storage disorders: Gaucher's disease, Fabry's disease, Farber's lipogranulomatosis
   f. Immunodeficiency: IgA deficiency, complement component deficiency, SCID and ADA deficiency, PNP deficiency, others
   g. Periodic fever syndromes, including familial Mediterranean fever
   h. Others: hemachromatosis, hyperlipidemic arthropathy, myositis ossificans progressiva, Wilson's disease, others

8. Nonarticular and regional musculoskeletal disorders

   a. Fibromyalgia
   b. Psychogenic rheumatism
   c. Axial syndromes: low back pain, spinal stenosis, intervertebral disc disease and radiculopathies, cervical pain syndromes, coccydynia, osteitis condensans ilii, osteitis pubis, spondylolisthesis/spondyolysis, discitis
   d. Regional musculoskeletal illnesses: in addition to bursitis, tendinitis, or enthesitis occurring around each joint, the fellow should be familiar with other disorders occurring at each specific joint site (e.g., shoulder-rotator cuff tear, adhesive capsulitis, impingement syndrome; wrist ganglions; trigger fingers and Dupuytren's contractures;

knee synovial plicaes, internal derangements, cysts; hallux rigidus, heel pain, and metatarsalgia; TMJ syndromes; costochondritis
e. Biomechanical/anatomic abnormalities associated with regional pain syndromes: scoliosis and kyphosis, leg length discrepancy, foot deformities
f. Overuse rheumatic syndromes: occupational, sports, recreational, performing artists
g. Sports medicine: injuries, strains, sprains, nutrition, female athlete, medication issues
h. Entrapment neuropathies: thoracic outlet syndrome, upper extremity entrapments, lower extremity entrapments
i. Other: reflex sympathetic dystrophy, erythromelalgia

9. Neoplasms and tumor-like lesions

    a. Benign

        (1) Joints: loose bodies, fatty and vascular lesions, synovial osteochondromatosis, pigmented villonodular synovitis
        (2) Tendon sheaths: fibroma, giant cell tumor, nodular tenosynovitis
        (3) Bone: osteoid osteoma, others

    b. Malignant

        (1) Primary: synovial sarcoma, others
        (2) Secondary: leukemia, myeloma, metastatic malignant tumors
        (3) Malignancy-associated rheumatic syndromes: carcinomatous polyarthritis, palmoplantar fasciitis, Sweet's syndrome

10. Muscle diseases

    a. Inflammatory: polymyositis, dermatomyositis, inclusion body myositis
    b. Metabolic

        (1) Primary: glycogen storage diseases, lipid metabolic disorders, myoadenylate deaminase deficiency, mitochondrial myopathies
        (2) Secondary: nutritional, toxic, endocrine disorders, electrolyte disorders, drug-induced

    c. Muscular dystrophies
    d. Myasthenia gravis

11. Miscellaneous rheumatic disorders

    a. Amyloidosis: primary, secondary, hereditary
    b. Raynaud's disease
    c. Charcot joint
    d. Remitting seronegative symmetrical synovitis with pitting edema
    e. Multicentric reticulohistiocytosis
    f. Plant thorn synovitis
    g. Intermittent arthritides: palindromic rheumatism, intermittent hydrarthrosis

h. Arthritic and rheumatic syndromes associated with: sarcoidosis, scurvy, pancreatic disease, chronic active hepatitis, primary biliary cirrhosis, drugs, and environmental agents
i. Rheumatic disease in the geriatric population
j. Rheumatic disease in the pregnant patient
k. Rheumatic syndromes in dialysis patients

12. Pediatric rheumatic diseases: Many rheumatic diseases are similar in pathogenesis, presentation, clinical course, and treatment in adults and children. These diseases (such as systemic lupus, scleroderma syndromes, the systemic vasculitides, and enteropathic arthritides) are not specifically addressed in this section. Other diseases, or specific aspects of management, that are unique or more prevalent in children are included in this outline of knowledge content. A supplementary section, providing more detailed information and a reading list, will be provided as an appendix.

    a. Rheumatic diseases that occur primarily in children. Know how to diagnose and how they differ from the same, or similar, disease in adults.

        (1) Systemic juvenile rheumatoid arthritis (Still's Disease)
        (2) Pauciarticular juvenile rheumatoid arthritis
        (3) Polyarticular juvenile rheumatoid arthritis
        (4) Juvenile spondyloarthropathy
        (5) Juvenile dermatomyositis
        (6) Kawasaki Disease
        (7) Henoch-Schonlein Purpura
        (8) Acute rheumatic fever
        (9) Neonatal lupus syndrome
        (10) Familial Autoinflammatory/Periodic fever syndromes

    b. Know the major sequelae or life-threatening complications of rheumatic diseases that occur primarily in children:

        (1) Systemic onset JRA
            Macrophage activation syndrome
            Cardiac tamponade

        (2) Pauciarticular JRA
            Chronic uveitis

        (3) Juvenile dermatomyositis
            GI vasculitis
            Calcinosis

        (4) Kawasaki Disease
            Aneurisms of coronary and other arteries

        (5) Henoch-Schonlein Purpura
            GI- intussusception, intestinal infarction
            Renal - chronic nephritis

(5) Neonatal lupus syndrome

Heart block
Thrombocytopenia

c. Know the appropriate treatments of the above childhood rheumatic disorders and complications.
d. Recognize non-rheumatic disorders in children that can mimic rheumatic diseases:

(1) Bone dysplasias

(2). Neoplasms: Leukemia, lymphoma, and solid tumors

(3) Post-infectious syndromes
Transient tenosynovitis of the hip
Other post-infectious arthritis and arthralgia
Post-viral myositis

(4) Orthopedic conditions
Legg-Calve-Perthes Disease and other avascular necrosis syndromes
Slipped capital femoral epiphyses
Spondylolysis and spondylolisthesis
Patellofemoral syndrome

(5) Non-rheumatic pain
Benign limb pains of childhood ("growing pains")
Benign hypermobility syndrome
Pain amplification syndromes including reflex sympathetic dystrophy

e. Know aspects of rheumatic disease and treatments specific to children:

(1) Disease effects on growth
Accelerated or decelerated growth of affected limbs
Short stature and failure to thrive

(2) Child-specific side effects of chronic corticosteroid treatment
Growth retardation
Delay of puberty

(3) Drugs
FDA approved drugs for childhood rheumatic diseases
Drug metabolism and dosing different from adults

(4) Physical and occupational therapy
Exercises
Splinting

(6) Psychosocial and developmental issues
Peer and sibling interaction
Family adjustment
School accommodations for disability
School and recreational activities
Transition to adulthood

B. Therapeutic modalities and strategies

1. Pharmacology: for each medication, understand the dosing, pharmacokinetics, metabolism, mechanisms of action, side effects, drug interactions, compliance issues, costs, and use in patients including fertile, lactating, and pregnant women.

a. Nonsteroidal anti-inflammatory drugs
b. Glucocorticoids: topical, intraarticular, systemic
c. Systemic antirheumatic drugs: antimalarials, sulfasalazine, gold compounds, methotrexate, D-penicillamine
d. Cytotoxic drugs: azathioprine, cyclophosphamide, chlorambucil
e. Immunomodulators: cyclosporine, biologic agents
f. Hypouricemic drugs: allopurinol, sulfinpyrazone, probenecid
g. Antibiotic therapy for septic joints
h. Narcotic and non-narcotic analgesics
i. Others: apheresis, ionizing radiation

2. Rehabilitation and disability issues

a. Methods of rehabilitation: for each method, understand principles, mechanism of action, indications, precautions and contraindications, potential side effects, and costs.

(1) Exercise: range of motion, strengthening, conditioning, and stretching
(2) Rest and splinting
(3) Modalities and hydrotherapy: ultrasound, iontophoresis, spa therapy
(4) Joint protection and energy conservation techniques
(5) Adaptive equipment and assistive devices
(6) Job site/home evaluation and adaptation
(7) Footwear and orthotics
(8) Others: acupuncture, TENS unit, pain clinics, traction
(9) Nutritional issues

b. Demonstrate understanding of specific rehabilitative techniques/modalities and what modification of these techniques are needed depending on the patient's disease (e.g. osteoarthritis, myositis, etc.), location of symptoms (e.g. back, shoulder, etc) and other related issues.

c. Psychosocial aspects of disability: understand the impact that the following factors have on the overall therapy of a patient with rheumatic disease and demonstrate knowledge of what can be done to assist a patient in these areas.

(1) Psychologic and emotional factors including sexuality
(2) Economic and vocational issues: vocational rehabilitation, costs of therapy and monitoring
(3) Disability determination: impairment vs disability, evaluation and measurement, social security disability, workmen's compensation, other
(4) Compliance issues

3. Surgical management

a. For each procedure, the fellow should possess a working knowledge of indications, preoperative evaluation and medication adjustments, contraindications, complications, postoperative management, and expected outcome.

(1) Bone biopsy
(2) Arthroscopy
(3) Synovectomy of tendons and joints
(4) Entrapment neuropathy release
(5) Osteotomies: hip, knee
(6) Arthrodesis: wrist, other
(7) Spine surgery: radiculopathy, stenosis, and instability
(8) Reconstructive surgery of hand and foot
(9) Total joint replacement: hip, knee, shoulder, other
(10) Specific surgical management problems:

(A) Rheumatoid arthritis patient
(B) Infected joint: arthrosopy vs. arthrotomy
(C) Infected prosthetic joint
(D) Ankylosing spondylitis patient
(E) Pediatric rheumatic disease patient
(F) Prevention and treatment of deep venous thrombosis

4. Complementary and alternative medical practices: diet, nutritional supplements, antimicrobials, acupuncture, topicals, homeopathic remedies, venoms, others

• Diagnostic Testing

A. Laboratory tests: for each test, understand the biologic rationale, methods for performing, and utility/limitations of specific laboratory tests including but limited to:

1. Erythrocyte sedimentation rate, C-reactive protein, and acute phase reactants
2. Rheumatoid factors, cryoglobulins, and circulating immune complexes
3. Anti-cyclic citrullinated peptide antibodies;Antinuclear antibodies and subtype specificities including anti dsDNA, anti-Smith, anti U1 RNP, anti-centromere antibodies, and anti-histone antibodies; and LE cell preparation
4. Antiribosomal P, anti-topoisomerase 1, and anti-synthase antibodies including anti-Jo-1
5. Anti-neutrophil cytoplasmic antibodies including specificities for neutrophil granule constituents [anti-PR3, anti-myeloperoxidase]
6. Antiphospholipid antibodies including RPR, lupus anticoagulant, anticardiolipin and _2-glycoprotein I antibodies
7. Antibodies to formed blood elements including direct and indirect Coombs testing, anti-platelet antibodies, anti-granulocyte antibodies
8. Assays for complement activity [CH50] and components of the complement cascade
9. Serum immunoglobulin levels, Serum protein electropheresis and immunofixation electropheresis
10. HLA typing
11. ASO and other streptococcal antibody tests
12. Serologic and PCR tests for Lyme disease, HIV, Hepatitis B, Hepatitis C, and Parvovirus
13. Serum and urine measurements for uric acid
14. Iron studies including ferritin
15. Flow cytometry studies for analysis of lymphocyte subsets and function

B. Diagnostic imaging techniques: understand the basic underlying principles and technical considerations in the use of plain radiographs, computed tomography, magnetic resonance imaging, ultrasonography and radionuclide scanning of bones, joints, and periarticular and vascular structures.

C. Synovial fluid analysis: cell count and differential, crystal identification, viscosity, protein, glucose, and other special stains/analyses

D. Test-performance characteristics: principles of sensitivity, specificity, and predictive value

- ## Research Principles

A. Principles of epidemiology and health services research

B. Design of experimental protocols, clinical trials, and outcomes research

C. Laboratory techniques

1. Serologic: ELISA, RIA, RID, nephelometry, immunoblots, protein electrophoresis, circulating immune complex assays.
2. Cellular: lymphocyte proliferation, flow cytometry.
3. Histochemistry and immunofluorescence of biopsied tissues.
4. Molecular: Northern, Southern, Western, polymerase chain reaction, genetic mapping techniques, gene sequencing
5. Hybridoma and monoclonal antibody production
6. Transgenic and gene knock-out animals
7. Principles of gene therapy
8. Data analysis, biostatistics, meta-analysis and medical informatics
9. Health status, disease activity, accumulated damage, functional, and quality of life measurements/assessments
10. Methods of cost effectiveness analysis
11. Bioethics of basic research and clinical trials
12. Critical literature review

Methods for Acquisition

The methods and resources for acquiring the body of medical knowledge include the following:

• Attendance and participation in structured tutorials facilitated by faculty

• Recommended textbook and journal article reading

• Review of topics in peer-reviewed on-line information sources

• Attendance and participation in weekly Journal Club review of peer-reviewed articles

• Attendance at weekly Divisional Grand Rounds/Clinical Conference

• Mentored research experience

• Attendance at regional and national meetings and seminars

Performance Markers

Basic Science: Demonstrate adequate understanding of anatomy, basic immunology, cell biology and metabolism pertaining to the rheumatic diseases in both didactic and clinical settings.

Clinical Science: Demonstrate adequate understanding of pathogenesis, epidemiology, clinical expression, treatments and prognosis of the full range of rheumatic and musculoskeletal disease in both didactic and clinical settings.

Diagnostic Testing: Display an understanding of the physical and biologic basis of the range of diagnostic testing in rheumatology and the clinical test characteristics of these procedures.

Research Principles: Demonstrate an understanding of the essential components of quality experimental design, data analysis, interpretation of results, and the importance of adherence to ethical standards of experimentation. Exhibit familiarity with the common experimental approaches used in laboratory and epidemiology research and with the standard methods of clinical trial design.

Evaluation Tools

- Periodic global evaluations by faculty
- Faculty and peer evaluations of presentations in conferences and journal clubs
- Cognitive testing [yearly in-training examination]
- Mentor evaluation of trainee's research performance

II. Patient Care

The ability to provide quality patient care that is compassionate, appropriate, and effective for the treatment of disease and the promotion of health is the ultimate goal of the clinical training program in rheumatology.
Upon completion of the Rheumatology training program, trainees should be proficient in:

- **Information Gathering**

A. Obtaining the history
B. Performing a careful physical examination
C. Obtaining further testing: laboratory, imaging, other

- **Synthesizing a Treatment Plan**

Medical decision making accounting for patient preferences and circumstances

- **Implementation of treatment**

A. Prescribing medications and rehabilitation
B. Patient education and counseling
C. Preventive medicine and proactive care
D. Therapeutic aspiration and injection

- **Reassessment and patient follow up.**

Methods for Acquisition

- Evaluation of patients during one-on-one faculty mentored consultation and continuity clinics
- Evaluation and treatment of patients during faculty mentored trainee continuity clinics
- Faculty supervised evaluation of children with rheumatic disease in the monthly Children's Arthritis Clinic
- Faculty-supervised evaluations of inpatients for whom rheumatology consultations have been requested
- Didactic lectures/tutorials on clinical topics
- Participation in faculty-facilitated case discussion during weekly Clinical Conference
- Maintenance of and presentations from a Clinical Portfolio

Performance Markers

The trainee should be able to:

A. Understand principles and demonstrate competency in obtaining a clinical history, relevant review of systems, and assessing functional status of patients with rheumatic disease symptoms
B. Understand principles and demonstrate competency in performing and interpreting the examination of the structure and function of all axial and peripheral joints, periarticular structures, peripheral nerves and muscles. Additionally, the fellow should be able to identify extraarticular findings that are associated with specific rheumatic diseases
C. Demonstrate understanding and competency in the assessment and interpretation of:

1. Radiographs of normal and diseased joints, bones, periarticular structures and prosthetic joints
2. Bone densitometry

D. Using the basic principles of decision analysis, demonstrate understanding and competency in the indications for and the interpretation of results from laboratory tests and procedures [outlined in section I] to establish a diagnosis of a rheumatologic disease, including:

1. Arthrography, ultrasonography, computed tomography, magnetic resonance imaging of joints, bones and periarticular structures
2. Radionuclide scans of bones and joints
3. Arteriograms (conventional and MRI/MRA*)* for patients with suspected or confirmed vasculitis
4. Computed tomography of lungs and paranasal sinuses
5. Magnetic resonance imaging of the central nervous system (brain and spinal cord)
6. Electromyograms and nerve conduction studies
7. Biopsy specimens including histochemistry and immunofluorescence of tissues relevant to the diagnosis of rheumatic diseases: skin, synovium, muscle, nerve, bone (e.g.metabolic bone disease), minor salivary gland, artery, kidney and lung
8. Specific laboratory tests [outlined in section I].
9. Arthroscopy
10. Schirmer's and rose Bengal tests; parotid scans and salivary flow studies

E. Understand the indications for and demonstrate competence in arthrocentesis and periarticular/soft tissue injections. The fellow should understand the anatomy, precautions (including OSHA requirements) and potential sequelae of arthrocentesis and demonstrate competency in obtaining synovial fluid from diarthrodial joints, bursae and tenosynovial structures with adequate informed consent.
F. Understand the principles and interpretation of results of synovial fluid analysis and become proficient in the examination and interpretation of synovial fluid under conventional and polarized light microscopy from patients with a variety of rheumatic diseases.

G. Demonstrate the ability to construct a differential diagnosis in patients presenting with signs and symptoms related to rheumatologic diseases and to outline further testing necessary to establish the correct diagnosis.

H. Demonstrate the ability to identify physical impairment; relate the impairment to the observed functional deficits; prescribe appropriate rehabilitation (physical therapy, occupational therapy) to achieve goals to improve the defined impairment

I. Understand indications for surgical and orthopedic consultation in acute and chronic rheumatic diseases

J. Demonstrate a working knowledge of clinical pharmacology: for each medication, understand the dosing, pharmacokinetics, metabolism, mechanisms of action, side effects, drug interactions, compliance issues, costs, and use in patients including fertile, lactating, and pregnant women.

1. Nonsteroidal anti-inflammatory drugs and adequate gastroprotection
2. Glucocorticoids: topical, intraarticular, systemic
3. Disease modifying antirheumatic drugs:

a) historical agents such as gold compounds and penicillamine
b) oral agents: methotrexate, antimalarials, sulfasalazine, leflunomide, tetracyclines, auranofin
c) parenteral biological response modifiers including inhibitors of TNF, IL 1, Il-6 and other cytokines and immune based therapies such as CTLA4Ig, anti-CD 20, JAK inhibitors.

4. Cytotoxic drugs: azathioprine, cyclophosphamide, chlorambucil,mycophenolate mofetil
5. Immunomodulators: cyclosporine, FK-506
6. Hypouricemic drugs: allopurinol, sulfinpyrazone, probenecid
7. Antibiotic therapy for septic arthritis, Lyme disease
8. Experimental therapies: plasmapheresis, intravenous immunoglobulin, myeloablative therapy and immune reconstitution including stem cell transplantation

K. Pre- and Post-operative Management of the Surgical Patient:

1. Understand indications for surgical and orthopedic consultation in acute and chronic rheumatic diseases
2. Understand perioperative evaluation, appropriate referral and medication adjustments.
3. Rehabilitation of the rheumatic disease patient after a surgical or orthopedic procedure, as well as aspects of postoperative medical management pertaining to the rheumatologic condition.

L. Understand changes required in patient management should the rheumatology patient become pregnant; this should include pre-pregnancy counseling about ramifications of becoming pregnant on the disease process, the use of medications before and during pregnancy and in the postpartum period.

M. Understand pain assessment and pain management:

1. Methods of pain assessment including visual analog scale scores, pain questionnaires

2. Non-pharmacological modalities of pain management including exercise, cognitive behavioral therapy
3. Pharmacological therapy including

a) Immunosuppressive and anti-inflammatory management of underlying rheumatic disorder.
b) Analgesic agents including acetaminophen, nonsteroidal anti-inflammatory agents and narcotic analgesics.
c) Antidepressants
d) Investigational uses of approved drugs such as gabapentin

N. Understand complementary and unconventional medical practices: diet, nutritional supplements, antimicrobials, acupuncture, topical therapeutic agents, homeopathic remedies, venoms, and others
O. Understand the indications for and costs of ordering laboratory tests, procedures to establish a diagnosis of rheumatologic disease and of different therapies used in the management of these diseases.
P. Demonstrate the ability to construct and implement an appropriate treatment plan for the care of a patient with a rheumatologic problem integrating the prescribing of medications (oral, injectable or infused), counseling, rehabilitative medicine, and, when necessary, surgical or other consultation. The fellow should be able to explain the rationale and the risks/benefits for the treatment plan.
Q. Demonstrate the ability to reassess the patient over time and alter the treatment plan accordingly.

Evaluation Tools

Periodic global evaluations by faculty
Structured faculty-observed patient encounters
Cognitive tests [yearly in-training examination]
Maintenance of and presentations from a Clinical Portfolio

III. Practice-based Learning and Improvement

Practice-based learning and improvement involves the assessment of care provided to both individual patients as well as to groups of patients in a given practice, the assimilation and appraisal of scientific evidence relevant to clinical problems encountered, an evaluation of care provided in the context of this evidence, and effecting improvements in patient care based upon these evaluations. In addition to structured learning of the basic components of medical knowledge and patient care, rheumatology trainees must evaluate their knowledge base and care delivery on an ongoing basis with the goal of continually improving that care.
Upon completion of the training program, trainees should be proficient in:

- **Accessing information to effect independent learning and practice improvement**. Accessing appropriate information systems and sources to improve understanding of underlying pathology, assess the accuracy of diagnoses, and gauge the appropriateness of therapeutic interventions for patients they encounter, and to assess practice behaviors.

- **Self-evaluation of performance.** Engagement in ongoing self-assessment activities, including continuous self-evaluation of learning needs and to monitor practice behaviors and outcomes to ascertain whether clinical decisions and therapeutic interventions are effective and adhere to accepted standards of care.

- **Incorporation of self-assessment data and feedback into improvement of clinical practice.** Appropriate interpretation of clinical outcome studies, individual and group practice data, and faculty/peer feedback and evaluations and applying the acquired information to patient care and practice behavior.

Methods for Acquisition

- Evaluation and treatment of patients in faculty-mentored trainee continuity clinics

- Accessing and reading textbooks, journal articles and internet based resources

- Faculty-facilitated/interactive case discussions at weekly Clinical Conference

- Preparation of patient care clinical portfolios linking care experiences with information subsequently acquired in response to perceived learning needs and deficiencies in care.

- Systematic record review of [own] practice patients with participation in individual and/or group quality improvement projects.

Performance Markers

- **Accessing information to effect independent learning and practice improvement.** The rheumatology trainee should be able to:

  A. Search, retrieve and interpret medical information relevant to the care of patients with rheumatic disease from sources including:

    1. peer-reviewed journal articles
    2. clinical case reports
    3. peer-reviewed or edited internet-based resources
    4. published clinical performance guidelines
    5. CME presentations
    6. Consultations with peers/colleagues.

  B. Systematically acquire and review their own clinical practice data

- **Self-evaluation of performance.** The rheumatology trainee should be able to:

  A. Use information acquired from medical information sources and clinical practice data to identify learning needs, ascertain adherence to accepted standards of care and identify practice improvement needs.

- **Incorporation of self-assessment data and feedback into improvement of clinical practice.** The rheumatology trainee should be able to:

  A. Demonstrate the ability to improve practice based upon learned concepts and obtained feedback.

  B. Implement quality improvement measures in his/her own practice

  C. Assess the impact of practice improvements on patient care

Evaluation Tools

- Global Faculty performance rating with regard to demonstration of reflective learning in mentored clinical venues
- Faculty/peer review of case presentations from clinical portfolios

• Faculty/peer review of Journal Club presentations

• Assessment of Practice Quality Improvement initiatives

• Periodic faculty review of clinical portfolio

IV. Systems-based Practice

Systems-based practice reflects an understanding of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Knowledge of the nature and variety of the external and internal systems that can impact clinical practice and the effective utilization of that knowledge to positively impact patient care is an essential skill. Upon completion of the training program, trainees should have the skills needed to positively influence patient care by:

• Utilizing **partners in health care delivery;** i.e., the various providers and resources available to deliver optimal care. [Principal partners in delivering health care to rheumatic patients include providers such as nurses, physiatrists, orthopedists and allied health professionals available within the local healthcare system. Partners also include outside volunteer agencies, both locally and nationally, such as the American College of Rheumatology, the Arthritis Foundation, the disease-specific foundations (Lupus, Scleroderma, Ankylosing Spondylitis, etc), the National Institute of Arthritis, Musculoskeletal and Skin Diseases (NIAMS) and pharmaceutical companies that have specific patient-related initiatives. Other agencies that impact on the practice of rheumatology include the American Medical Association (AMA), the Food and Drug Administration (FDA) and the Center for Medicare and Medicaid Services (CMS)].

• Providing **advocacy for patients.** This advocacy might consist of assisting patients with applications for disability status, completing preauthorization documents for the use of certain medications and appealing to HMOs with respect to denial of certain treatments, benefits and claims.

• Providing **cost-effective health care** through knowledge of the principles of cost allocation and resource management within the external (state, national) and local health systems. This includes a knowledge of the availability of certain drugs (and unavailability of others) on the trainee's hospital formulary, the mechanisms by which compensation (by CMS and other carriers) is dependent upon the delivery of various levels of service to patients and the methods in place for Quality Review of inpatient and outpatient practice patterns. The utilization of evidence-based cost-conscious strategies for the diagnosis and treatment of patients with rheumatic diseases is paramount.

• Engaging **systems** in health care delivery. This includes an understanding of the limitations and opportunities of various types of rheumatology practices and delivery systems, practice management strategies, managed care and health insurance issues. It also comprises an ongoing analysis of the strengths and weaknesses of the local academic system, in both the inpatient and

outpatient settings, and its impact on the health care delivery to rheumatic patients. In particular, efforts should be made to identify potentially correctible systematic weaknesses and medical errors due to systems failure and to develop strategies to rectify the problems (i.e. Quality Improvement projects).

Methods for Acquisition

- Evaluation of patients during one-on-one faculty mentored consultation and continuity clinics
- Evaluation and treatment of patients during faculty mentored trainee continuity clinics
- Faculty supervised evaluation of children with rheumatic disease in the monthly Children's Arthritis Clinic
- Faculty-supervised evaluations of inpatients for whom rheumatology consultations have been requested

Within these venues, the utilization of partners, the importance of patient advocacy, cost-effective approaches to patient care, and the strengths and limitations of the local and external systems impacting the delivery care are evaluated and critiqued.

- Faculty facilitated review of journal articles that address cost-effective rheumatologic practices.
- Participation in Quality Improvement initiatives.

Performance Markers

- **Partners** – Rheuamtology trainees are expected to demonstrate the ability to utilize multiple providers and resources as needed for optimal patient care.

A. Understand the rheumatologist's role as well as when to consult other health professionals (physiatrist, nurse practitioner, visiting nurse, physical therapist, occupational therapist, podiatrist, social worker, vocational rehabilitation counselor, psychologist, others) in the outpatient and inpatient rehabilitation of patients with rheumatic diseases.
B. Demonstrate the ability to educate patients about outside resources which might be of assistance to their physical, emotional and financial well being. Examples of these external resources include the Arthritis Foundation self help groups, Lupus Foundation support groups and pharmaceutical company-initiated financial aid programs.

- **Advocacy**: - Rheumatology trainees are expected to demonstrate the ability to act as effective advocates for their patients in a variety of needs, such as dealing with insurance companies for preauthorizations for medications, filing disability claims, etc.
- **Cost effective care**

  A. The trainees are expected to know the local costs of medications they prescribe, rheumatologic lab tests they order and commonly used diagnostic tests and procedures.
  B. Trainees must demonstrate a commitment to the practice of appropriate evidence-based cost-conscious patient care.

- **Systems**: Trainees are expected to:

  A. Demonstrate knowledge about how different health care delivery systems affect the management of patients with rheumatic diseases.
  B. Practice management: be familiar with types of practice, equipment, insurance, economics, personnel, ethical aspects, quality assurance, and managed care issues relating to the practice of rheumatology.
  C. Identify the strengths and weaknesses of the system in which they are training and practicing. They should also demonstrate the ability to develop strategies to overcome systematic problems they have identified, and/or QI projects to improve it.
  D. Be familiar with the history of rheumatology, American College of Rheumatology, Arthritis Foundation, and Association of Rheumatology Health Professionals.
  E. Understand the influence on rheumatology of the American Medical Association, Food and Drug Administration, HCFA and other governmental agencies involved in health care legislation, peer review organizations.

Evaluation Tools

- Global evaluation by faculty with regard to demonstration of effective systems-based performance markers.

- 360^{o} evaluations that specifically address advocacy

- Review of maintained portfolio documenting systems-based practice performance markers, including QI projects.

- Cognitive test for knowledge about Systems-based practice issues [in-training examination]

V. Interpersonal and Communications Skills

The complexity of most of the rheumatic diseases, as well as increasingly complicated treatment regimens require a working partnership between patient and physician, and often between physician and the patient's family. In addition to improved patient satisfaction and confidence and understanding, such working partnerships promote medical compliance. Effective physician-colleagues-relationships are also dependent upon these skills.

Upon completion of the training program, rheumatology trainees should possess interpersonal and communication skills that result in the effective exchange of and collaboration with patients, their families, and other health professionals. Specifically trainees should have the capacity to:

- Effectively gather information from patients, families, and other health professionals

- Understand and incorporate the patient's perspective in disease assessment and management

- Effectively explain to patients and referring health professionals disease processes and the recommended management

- Establish trust and effective patient relationships

Methods of Acquisition

- Evaluation and management of patients in faculty-supervised outpatient clinics
- Faculty-supervised consultations of hospitalized inpatients
- Faculty/Peer-critiqued presentation of cases from Clinical Portfolio
- Participation in case discussions at weekly Clinical Conference
- Presentations of clinical topics to other health professionals and lay audiences

Performance Markers

- Obtains informed consent
- Writes effective consultation notes and/or letters to referring and primary care physicians
- Clearly explains benefits and risks of treatment
- Effectively interacts and communicates with colleagues and peers
- Displays effective teaching skills to colleagues and patients

Evaluation Tools

- Faculty global assessments
- Structured faculty-observed patient encounter exercise
- Patient feedback [Patient component of Clinical Evaluation Exercise]
- 360 degree evaluation
- Summative critique of Clinical Portfolio presentations

VI. Professionalism

Professionalism is manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to patients of diverse backgrounds. It is one of the foundations of the practice of medicine and is frequently an inherent character trait in a well-rounded physician. Rheumatologists are expected to interact with patients from a wide range cultural, and socioeconomic backgrounds. In addition, trainees and as well as practicing rheumatologists are increasingly targeted by the pharmaceutical industry in an attempt to influence prescribing habits at an early phase of their careers. A substantial level of professionalism is thus required to maintain the balance required be an effective rheumatologist.

Upon completion of the training program, trainees should exhibit:

- **Primacy of patient interest** in the evaluation and management of patients

- **Physician autonomy [free of commercial interests] in making decisions for patients medical care**

- **Physician accountability and responsibility** to patients, colleagues, society, and self

- **Humanistic qualities and altruism** in order to serve patients with respect to their cultural, emotional and social needs

- **Ethical behavior** including being trustworthy and cognizant of conflicts of interest..

Methods for Acquisition

- Evaluation and management of patients in faculty-supervised outpatient clinics

- Faculty-supervised consultations on hospitalized inpatients

- Participation in professional activities, including community service, professional organizations, and institutional committee activities.

- Participation in discussions of professionalism issues in weekly clinical conference

- Completion of yearly Institutional Review Board and Conflict of Interest Review Board training/certification.

- Self Directed Learning including reading assignments and/or journal club discussions of peer reviewed publications and specialty organization publications from the AMA, ABIM, ACP and ACGME and web-based discussions on professionalism.

Performance Markers
By the end of their training fellows should be able to demonstrate competency in the following areas:

- **Patient Primacy**. Trainees are expected to demonstrate understanding of the importance of patient primacy by:

  A. Placing the interest of the patient above their own interest
  B. Providing autonomy to their patients to decide upon treatment once all treatment options and risks have been outlined for them.
  C. Providing and obtaining key elements of informed consent in an understandable manner or therapeutic interventions and clinical research endeavors.
  D. Giving equitable care to all patients
  E. Treating all patients with respect regardless of race, gender and socioeconomic background

- **Physician accountability and responsibility** including;

A. Following through on duties and clinical tasks
B. Demonstrating timeliness in required activities, in completing medical records and in responding to patient and colleague calls
C. Exhibiting regular attendance and active participation in divisional and departmental training activities and scholarly endeavors
D. Striving for excellence in care and/or scholarly activities as a rheumatologist.
E. Working to maintain personal physical and emotional health and demonstrates an understanding of and ability to recognize physician impairment in self and colleagues.

• **Humanistic qualities and altruism**

A. Exhibiting empathy and compassion in patient/physician interactions
B. Demonstrating sensitivity to patient needs for comfort and encouragement
C. Is courteous and respectful in interactions with patients, staff and colleagues
D. Maintaining the welfare of their patients as their primary professional concern

• **Ethical behavior** including being trustworthy and cognizant of conflicts of interest. Integrity as a physician and consultant rheumatologist pervades all of the components of professionalism.

A. Demonstrating integrity in reporting back key clinical findings to supervising physicians
B. Is trustworthy in following through on clinical questions, laboratory results, and other patient care responsibilities.
C. Recognizing and addressing actual and potential conflicts of interest including pharmaceutical industry involvement in their medical education and program funding and guarding against this influencing their current and future prescribing habits

Evaluation Tools

• Anonymous 360^0 global assessment by patients, peers, faculty, allied health professional and clinical support staff. Trainees should also fill out self-evaluations in the sphere of professionalism and compare it to responses from others for self-reflection and self-improvement.

• Reflective entries in Clinical Portfolios on issues of professionalism such as difficult patient and peer encounters, conflicts of interest, and barriers to providing equitable care

• Global evaluation by faculty with regard to demonstration of professional behavior.

VII. Documentation and Presentations Expected of Rheumatology Fellows

To enhance the educational experience of rheumatology fellows, prepare fellows for ABIM certification, and maintain the training program's ACGME certification, fellows are expected to take an active role in the following endeavors:

- An entry should be made in evalue when fellows perform an arthrocentesis, joint injection, or peri-articular/soft tissue injection, with sign-off by relevant faculty attending to the patient encounter. Once three entries with appropriate sign-off has been made for a given procedure, it is no longer necessary for the fellow to log that procedure. A summative report of procedures logged will be provided each fellow at the time of each six-month summative evaluation with the program director.

- Fellows are expected to maintain a Clinical Portfolio containing copies of new patient evaluations and consultations performed by fellows in the outpatient or inpatient venues. Notes relevant to particularly instructive follow-up visits in which the fellow has participated might also be included. In addition to the consultation/clinic note, the portfolio should also contain:

  1] a summary of findings from relevant lab/imaging/biopsy tests ordered

  2] a summary of the final assessment and management plans

  3] a reflective summary of the relevant teaching points--what was learned from participating in the patient's evaluation and care; this would include concepts gleaned from review of relevant literature and a brief bibliography.

- On a rotating basis during the scheduled Thursday morning Clinical Conferences, fellows are expected to provide a brief 10-15 minute presentation on a patient and related clinical topic drawn from their Clinical Portfolio. The presentation is best performed using Power Point, including a brief summary of the case, the outcome, a brief literature review, closing with the identified teaching points. Ideally, the case upon which the presentation is based would be drawn from a patient previously presented during the clinical conference.

- Fellows are expected to provide feedback to the program director in the form of an anonymous yearly program evaluation form provided to the fellows as well as during the formative evaluations conducted every six months with the program director.

VIII. Training in Musculoskeletal Ultrasound

To enhance the educational experience of those rheumatology fellows interested in learning musculoskeletal ultrasound use in the rheumatology clinic. Fellows are expected to enroll in the 8 month USSONAR course for rheumatology trainees. Under the supervision of the clinical faculty fellows are to perform, interpret and submit scans for review. Fellows enrolled in the USSONAR course shall be able attend all courses and exams. The fellows enrolled in the course will have a two ½ day sessions per week for the teaching and performance of MS ultrasound.