Program Handbook for Residents Enrolled In the Rheumatology Residency Training Program At McMaster University

Nader A. Khalidi MD, FRCPC
Residency Training Program Director

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Resident Handbook, Rheumatology Program
McMaster University
Revision date: July 2007
Preamble to the Rheumatology Resident Handbook

Welcome to the world of Rheumatology. Your next two years will take you to places I hope you will find as intriguing as I did from the first day that I started in my Rheumatology Residency.

The two year program will include a variety of sites which will include hospitals throughout Hamilton in the McMaster University system. This will include St. Joseph’s Health Care and the Hamilton Health Sciences. The core inpatient service is located at St. Joseph’s hospital where the resident will take a key role in treating and diagnosing complex Rheumatologic patients as well as common Rheumatologic conditions occurring in all patients admitted to hospital on other services. Other rotations will include working at the Hamilton General Hospital and Henderson, MUMC, Radiology, Metabolic Bone Disease and Community Rheumatology in St. Catharine’s and Cambridge. There will be time for Research and Electives.

The resident will also be assigned a continuity clinic for which they attend weekly to follow their own patients along with an assigned attending for the 2 years. This will allow them a smooth transition into their own practice, as they will be following their own patients and will help run a clinic.

This handbook presents the objectives and an outline of each of the rotations in the core Rheumatology Training Program.

Nader Khalidi, MD FRCPC
Program Director
PROGRAM OBJECTIVES FOR RESIDENTS
ENROLLED IN THE ADULT RHEUMATOLOGY
TRAINING PROGRAM AT MCMASTER UNIVERSITY

At the completion of training the resident will have acquired the following competencies and will function effectively as:

Medical Expert/Clinical Decision-Maker

General Requirements

- Demonstrate diagnostic and therapeutic skills for ethical and cost effective patient care.
- Access and apply relevant information to clinical practice.
- Demonstrate effective consultation services with respect to patient care, medical education and legal opinions.

Specific Requirements

At the completion of training the resident must exhibit the following specific knowledge, clinical competences and skills.

KNOWLEDGE REQUIREMENTS

Upon completion of training, the resident must have acquired knowledge pertaining to the following areas of rheumatology.

1. General Knowledge
   1.1 History of rheumatic disease
   1.2 Classification and diagnosis of rheumatic diseases
   1.3 Epidemiology and demographics of rheumatic disease
   1.4 Epidemiological methods in the study of rheumatic disease
   1.5 Economic and social consequences of rheumatic disease
   1.6 Evaluation of disability
   1.7 Functional status and disease activity indicators
   1.8 Laboratory tests, and diagnostic imaging techniques in diagnosis and assessment of rheumatic diseases
   1.9 Ability to undertake a critical appraisal of the literature
2. Basic Science

2.1 Structure and function of bone joints, connective tissue and muscle in health and disease
2.2 Genetics of rheumatic disease
2.3 Mechanism of joint deformities and structural abnormalities in rheumatic disease
2.4 Immune and inflammatory responses
2.5 Coagulation pathways in rheumatic disease
2.6 Metabolic pathways and physiology of uric acid and other crystals in rheumatic disease
2.7 Infectious agents and their role in rheumatic disease
2.8 Pharmacology of therapeutic agents in rheumatic disease

3. Clinical Diagnoses — Adult Rheumatology

3.1 Rheumatoid Arthritis
3.2 Juvenile Chronic Arthritis (JCA), Juvenile Rheumatoid Arthritis (JRA), Juvenile Idiopathic Arthropathy (JIA)
3.3 Osteoarthritis
3.4 Osteoporosis and metabolic bone disease
3.5 Systemic Lupus Erythematosus (SLE) and related syndromes
3.6 Sjogren's Syndrome
3.7 Systemic Sclerosis and related syndrome(s)
3.8 HLA-B27 related arthropathies
3.9 Fibromyalgia
3.10 Chronic Fatigue Syndrome
3.11 Crystal Arthritis
3.12 Infectious Arthritis
3.13 Infection-related arthropathies
3.14 Myositis, myopathy
3.15 Fasciitis
3.16 Vasculitidies
3.17 Antiphospholipid Antibody Syndromes
3.18 Intermittent Arthritis Syndromes
3.19 Extra-articular Manifestations of Rheumatic Disease
3.20 Systemic Disorders with Rheumatological Manifestations
3.21 Other bone disorders — Paget's, Diffuse Idiopathic Skeletal Hyperostosis (DISH), hypertrophic osteopathy, renal bone disease, reflex sympathetic dystrophy, dysplasia
3.22 Physical musculoskeletal syndromes
3.23 Tumors of bone, synovium
3.24 Pregnancy and rheumatic disease
3.25 Occupational and environment related disease-silicosis, breast implants, and allergies
3.26 Inherited Collagen Diseases-Marfan's, Ehlers-Danlos, hypermobility

4. Clinical Diagnoses — Pediatric Rheumatology
4.1 Juvenile Arthritis (JRA, JCA, JIA)
4.2 Juvenile Spondyloarthropathies and enthesitis related arthritis
4.3 Juvenile Psoriatic Arthritis
4.4 Systemic Lupus Erythematosus and related syndromes including neonatal LE
4.5 Myositis/Myopathies
4.6 Mixed Connective Tissue Disease (MCTD)/Undifferentiated Connective Tissue Disease/Overlap Syndrome
4.7 Scleroderma syndromes including morphea syndromes
4.8 Raynaud's Phenomenon
4.9 Sjogren's Syndrome
4.10 Antiphospholipid antibody syndromes (primary and secondary)
4.11 Vasculitides including Kawasaki disease
4.12 Non-inflammatory pain syndromes
4.13 Infectious/Post-infectious arthritides
4.14 Periodic Fever Syndromes
4.15 Osteoporosis/Metabolic Bone Disease
4.16 Orthopedic/Mechanical/Developmental abnormalities
4.17 Immune Deficiency Syndromes
4.18 Tumors / Malignancies
4.19 Disorders of Collagen
4.20 Primary and Secondary Osteoarthritis
4.21 Rheumatic manifestations of systemic diseases
4.22 Miscellaneous conditions:
   a. Sarcoid — classic, juvenile
   b. Amyloidosis — primary and secondary
   c. Retroperitoneal Fibrosis
   d. Polychondritis
   e. Autoimmune lymphoproliferative syndrome (ALPs)

5. Therapeutics
   5.1 Non pharmacological Therapy
   5.2 Surgical Intervention
   5.3 Therapeutic agents and techniques: indications/contraindications, administration, monitoring and complications
   5.4 Complementary Medicine

CLINICAL COMPETENCIES AND SKILL REQUIREMENTS

Upon completion of training the resident will be able to:

1. Elicit a history that is relevant, concise, and accurate and appropriate to the patient's problem(s).
2. Perform a physical examination (with special attention to the musculoskeletal system) that is relevant and appropriate to the patient's problems. These skills should include the following:
   2.1 Measures of arthritic disease activity
   2.2 Measures of arthritic damage and deformity
   2.3 Detection of Extra-articular Complications
   2.4 Functional Assessment
2.5 Pain Amplification
2.6 Assessment of Spinal Disease
2.7 Assessment of Regional Pain Syndrome

3. Demonstrate knowledge of, indications for, and interpretation of:
   3.1 Specialized immunological and serologic investigations
   3.2 Joint aspiration and synovial fluid analysis.
   3.3 Tissue biopsies
   3.4 Electromyography and nerve conduction studies
   3.5 Diagnostic imaging of joint and skeletal diseases.

4. Synthesize data derived by the above processes to derive the most likely diagnosis (es) and differential diagnosis (es).

5. Apply knowledge and expertise to performance of technical skills relevant to Rheumatology including joint and soft tissue aspiration and injections and synovial fluid analysis.

6. Develop an appropriate management and therapeutic plan.

7. Demonstrate effective consultation skills in the provision of timely well-documented assessments and recommendations in written and/or verbal forms.

8. Demonstrate the attitudes and skills necessary to collaborate with other health care professionals necessary to the care of the patient.

9. Access, retrieve, critically evaluate, and apply information from all sources in maintaining the highest standard of patient evaluation, care, and management.

10. Demonstrate medical expertise in situations other than those involving direct patient care (e.g. medical presentations, patient and referring physician education, and medico-legal opinions).

11. Demonstrate insight into his/her own limitations of expertise by self-assessment.

**Communicator**

**General Requirements**

- Establish therapeutic relationships with patients/families.
- Obtain and synthesize relevant history from patients/families/communities.
- Listen effectively.
Discuss appropriate information with patients/families and the health care team.

**Specific Requirements**

1. Establish therapeutic relationships with patients and their families and other caregivers that are characterized by understanding, trust, respect, empathy, and confidentiality.
2. Listen effectively to patients, families, and members of the health care team.
3. Present clinical problems clearly, concisely, and correctly in verbal reports or written letters.
4. Demonstrate ability to provide appropriate support and counsel to a patient and family with chronic rheumatologic, connective tissue or musculoskeletal disorders.
5. Demonstrate an appreciation of the patients' perception of health, concerns, and expectations and the impact of the rheumatologic disease on the patient and the family while considering factors such as the patient's age, gender, cultural, and socioeconomic background and spiritual values.
7. Demonstrate an understanding of the importance of communication among health care professionals involved in the care of individual patients such that the roles of these professionals are delineated and consistent messages are delivered to patients and their families.

**Collaborator**

**General Requirements**

- Effective and timely consultation with other physicians and health care professionals.
- Contribute effectively to other interdisciplinary team activities.

**Specific Requirements**

1. Consult and contribute effectively with other physicians, particularly those working in a discipline most often associated with Rheumatology such as: orthopedics, plastic surgery, physiatry, general internal medicine, general pediatrics, medical imaging, neurology and neurosurgery, dermatology, and pain management.
2. Consult and contribute effectively with physicians working in neonatology and obstetrics.
3. Contribute effectively to other inter-disciplinary activities with the allied health professions most often associated with rheumatology including: physical therapy, occupational therapy, exercise training and chiropractic.

**Manager**

**General Requirements**

- Utilize resources effectively to balance patient care, learning needs, and outside activities.
- Allocate finite health care resources wisely.
- Work effectively and efficiently in a health care organization.
- Utilize information technology to optimize patient care, life long learning and other activities.

**Specific Requirements**

1. Allocate finite health care resources wisely in the context of the health care system for individual patient care, and institution, and the community.
2. Work effectively and efficiently in health care organizations such as inpatient wards, outpatient clinics, day treatment centers, acute and chronic care institutions and regional or provincial health systems.
3. Recognize the role of audits, budget reviews, quality improvement, risk management, incident reporting, and complaint management in various settings including day treatment centers, clinical investigation units, and the ambulatory care setting.
4. Demonstrate the use of cost/benefit ratios of diagnostic and therapeutic interventions for rheumatologic disorders as well as cost containment, efficacy, and efficiency as they relate to decision-making and quality assurance.

**Health Advocate**

**General Requirements**

- Identify the important determinants of health affecting patients.
- Contribute effectively to improved health of patients and communities.
- Recognize and respond to those issues where advocacy is appropriate.

**Specific Requirements**

1. Identify the important determinants of health affecting patients particularly those contributing to the burden of illness and disability from chronic
arthritic and connective tissue disorders, chronic muculoskeletal pain disorders and chronic metabolic bone disorders such as osteoporosis.

2. Advocate on behalf of patients and parents for improved and timely access to specialist, and allied health care, necessary surgery, beneficial medications and therapies, and community based support services.

Scholar

General Requirements

- Develop, implement and monitor a personal continuing education strategy.
- Critically appraise sources of medical information.
- Utilize information technology to optimize patient care, life-long learning and other activities.
- Facilitate learning of patients, house staff/students and other health professionals.
- Contribute to development of new knowledge.

Specific Requirements

1. Critically appraise sources of medical information particularly as it pertains to the rheumatologic and connective tissue disorder(s).
2. Educate patients, housestaff, students, and other health professionals in formal and informal educational settings regarding rheumatology, connective tissue disease, and the burden of chronic musculoskeletal disorders.
3. Demonstrate knowledge of preferred learning methods in dealing with students, residents and colleagues.
4. Contribute to development of new knowledge in rheumatology and the connective tissue disorders.

Professional

General Requirements

- Deliver highest quality care with integrity, honesty and compassion.
- Exhibit appropriate personal and interpersonal professional behaviours.
- Practice medicine ethically consistent with obligations of a physician.

Specific Requirements

a) Discipline-Based Objectives:
   i) Demonstrate a willingness to accept peer and supervisor reviews of professional competence.

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ii) Demonstrate recognition of personal limitations of professional competence and demonstrate a willingness to call upon others with special expertise.

iii) Demonstrate flexibility and willingness to adjust to changing circumstances, for example political decisions such as hospital closures and cutbacks in human and physical resources.

b) Personal/Professional Boundary Objectives:
   i) Strive for a balance between personal and professional roles and responsibilities.

c) Objectives Related to Ethics and Professional Bodies:
   i) Demonstrate knowledge of the principles of medical ethics as they relate to patient care and clinical research including autonomy, beneficence/nonmalificence, confidentiality, truth-telling, justice, respect for persons, conflict of interest and resource allocation.
Rheumatology In Training Evaluation Form

To be completed by ___________________________
On this form, you will be evaluating ______________________________________
For dates: ______________ to _________________

**OBJECTIVE: THE RESIDENT WILL DISPLAY EFFECTIVE CANMEDS COMPETENCIES**

**Please rate the resident’s performance in the objectives listed below**

**The resident will display effective doctor-patient communication skills (communicator)**

<table>
<thead>
<tr>
<th>Objective</th>
<th>n/a</th>
<th>1 Unsatisfactory: Many major deficiencies</th>
<th>2 Needs to Improve: Several important deficiencies</th>
<th>3 Good: Satisfactory performance (at appropriate level)</th>
<th>4 Very Good: Often exceeds level of training</th>
<th>5 Outstanding: Consistently exceeds level of training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishes a trusting and professional rapport with the patient and family</td>
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<td>Encourages full participation of the patient/family in decision-making and management</td>
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<td>Can obtain an informed consent</td>
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<td>Provides clear instructions and checks whether the patient/family understands</td>
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<td>Verbally presents the patient’s problems clearly, concisely and correctly in the clinical setting</td>
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<td>Clear, concise and legible problem-oriented medical records</td>
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**The resident will display good collaborative team skills (collaborator)**

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<th>5 Outstanding: Consistently exceeds level of training</th>
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<tbody>
<tr>
<td>Able to request and provide consultations with clear understanding of question being asked</td>
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<td>Able to work effectively in an interdisciplinary team to optimize patient care</td>
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<td>Has a straightforward and respectful approach with all health care professionals and peers</td>
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<td>Takes on appropriate share of team assignments and assists others as required</td>
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### The resident is an effective manager (manager)

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<th>n/a</th>
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<tr>
<td>Displays organisational skills with effective time-management</td>
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<tr>
<td>Effectively uses information technology to optimize patient care and continued self-learning</td>
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<tr>
<td>Identifies and addresses issues related to discharge planning</td>
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### The resident will carry out his/her duties in a professional manner (professional)

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<th>n/a</th>
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<tr>
<td>Recognizes limitations and seeks advice and consultation when needed</td>
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<td>Exercises initiative within limits of knowledge and training</td>
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<td>Discharges duties and assignments dependably and in a timely and ethical manner</td>
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<td>Reports facts accurately, including own errors</td>
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<td>Maintains appropriate boundaries in work and learning situations</td>
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<tr>
<td>Respects diversity of race, age, gender, disability intelligence and socio-economic status</td>
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### The resident will develop a plan for self-improvement (scholar)

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<tbody>
<tr>
<td>Attends and contributes to rounds and other learning events</td>
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<td>Accepts and acts on constructive feedback</td>
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<td>Critically appraises sources of medical information and takes an evidence-based approach to diagnosis and management</td>
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<td>Effectively uses opportunities to teach and supervise juniors</td>
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</table>
The resident is a **health advocate**

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<tr>
<td>Identifies situations where patient advocacy is required</td>
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<tr>
<td>Acts as a patient advocate</td>
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**OBJECTIVE 1: THE RESIDENT WILL DISPLAY EFFECTIVE CLINICAL SKILLS.**

**History and Physical**

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<tbody>
<tr>
<td>Performs a focused, accurate and complete history</td>
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<tr>
<td>Performs a focused, accurate and complete physical exam</td>
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<td>Knows test characteristics of common physical exam signs</td>
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**Utilization of Laboratory and Other Investigations**

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<td>Can justify investigations ordered</td>
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<td>Can interpret clinical information and integrate it appropriately</td>
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<tr>
<td>Able to retrieve and use information regarding test characteristics of common tests</td>
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### Problem Solving and Clinical Judgement

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<td>Good knowledge base</td>
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<tr>
<td>Able to synthesise clinical information and formulate patient problem list</td>
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<td>Able to incorporate newly learned information in subsequent assessment of patients</td>
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<td>Shows good judgement when setting management priorities</td>
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<td>Demonstrates a systematic and organised approach to clinical problem solving</td>
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### Implementing a Management Plan

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<tbody>
<tr>
<td>Able to assess and start initial management in acute emergency</td>
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<td>Writes orders that are clear, comprehensive and correct</td>
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<td>Is fully aware of the side-effects of therapies ordered</td>
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<td>Monitors therapy appropriately</td>
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### OBJECTIVE 2: THE RESIDENT WILL DISPLAY EFFECTIVE TECHNICAL SKILLS:

Displayed proficiency in the following technical skills:

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<thead>
<tr>
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<th>Not Assessed</th>
<th>Needs Improvement</th>
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<tbody>
<tr>
<td>Knee joint aspiration</td>
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**Strengths and Areas Needing Improvement:**

**Strengths:**

**Weaknesses:**

**Individual Evaluations from Attendings:**

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<th>Exceeds Expectations</th>
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15

Resident Handbook, Rheumatology Program
McMaster University
Revision date: July 2007
Please indicate number of days of absence during rotation:

________________________________________________________________________

Written Comments:

________________________________________________________________________

The following will be displayed on forms where feedback is enabled...

(for the evaluator to answer...)

* Did you have an opportunity to meet with this trainee to discuss their performance?
  ☐ Yes
  ☐ No

(for the evaluee to answer...)

* Did you have an opportunity to discuss your performance with your preceptor/supervisor?
  ☐ Yes
  ☐ No
To be completed by __________________________
On this form, you will be evaluating __________________________
For dates: ______________ to _________________

**CLINICAL EVALUATION CARD**

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<th>meets expectations</th>
<th>Above Expectations</th>
<th>Outstanding</th>
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Comments:

The following will be displayed on forms where feedback is enabled...

*(for the evaluator to answer...)*

* Did you have an opportunity to meet with this trainee to discuss their performance?
  ○ Yes
  ○ No

*(for the evaluee to answer...)*

* Did you have an opportunity to discuss your performance with your preceptor/supervisor?
  ○ Yes
  ○ No
Location sites and Site Supervisor/Coordinator

St. Joseph’s Hospital Site.........................Dr. Nader Khalidi

McMaster Site..................................Dr. Sam Pillersdorf

Hamilton General/ Henderson General/
West Haldimand General Hospital Site……Dr. A. Cividino

Metabolic Bone Disease Rotation.........Dr. J.D. Adachi

St. Catherine’s Rotation.......................Dr. S. Shaikh

Radiology Rotation............................Dr. J. O’Neill

Electives Rotation.............................Dr. T. Scocchia

Research Rotation and
Other Scholarly work.......................Dr. J.D. Adachi

Lab Medicine and
Quality Assurance and Rotation..........Dr. Denis Snider

Career Mentoring............................Dr. P. Boulos
Site Specific Objectives for Rheumatology Residents

St. Joseph’s Hospital Site
Dr. Khalidi Site Director
McMaster University

OVERVIEW

The Rheumatology rotation will consist of both inpatient and outpatient care. Rheumatology rotation will be split into outpatients and inpatient care. Evaluation and care of the patient and interpretation of laboratory procedures appropriate to Rheumatologists will be emphasized.

A schedule will be given to the resident at the beginning of the rotation. Any changes in the schedule must be approved of and communicated to both the Site Director, Dr. Khalidi (905 719 2791 or naderkhalidi@sympatico.ca) and the Administrative Assistant for Rheumatology, Rennee Tremblay (905 521 1863 or renneetremblay@gmail.com).

Resident Responsibilities

Outpatient care

The Resident will be assigned clinics that will include a variety of attendings in a variety of outpatient settings in Rheumatology. This variety will help the Resident appreciate the various practices and involve them with a wide variety of types of patients seen in a General Rheumatology as well as a Subspecialty Rheumatology clinic.

The objectives and responsibilities include:

1) Obtain an appropriate rheumatologic history and physical exam for new consults
2) Obtain an appropriate focused rheumatologic history and physical for followup patients
3) Develop an appropriate differential diagnosis based on critical analysis of clinical data and its integration with basic fund of medical knowledge
4) Understand the rational for ordering and a basic understanding of the principals of serology, imaging studies including computerized tomography and magnetic resonance imaging
5) Learn synovial aspiration of, and injections of peripheral joints amenable to bedside procedures.
6) Generate a differential diagnosis based on analysis of synovial fluid and rational for aspiration
7) Understand basic anatomy, pharmacology, epidemiology and pathophysiology and clinical manifestations
8) Develop skills in those of communication and in providing consultation services
9) Display professionalism and humanism, including respect and compassion for patients and peer

Inpatient Care

An important aspect of care in the Rheumatology patient. There is a Rheumatology inpatient service that will include patients admitted to the Rheumatology service with beds located primarily on the 7th floor MSK unit but also on other floors as well as patients that have been consulted by other services who will be the primary service.

The objectives and responsibilities are as follows:

1) Obtain an appropriate rheumatologic history and physical exam for new consults for the various services at St. Joseph’s Hospital
2) See followup patients and communicate findings to appropriate Rheumatology attending
3) Communicate findings to the appropriate service after discussing case with Rheumatology attending
4) Admit patients and see followup patients on the Rheumatology ward
5) Be involved in the teaching and rounds with students and residents from other services who are rotating through Rheumatology as well as to residents from other services

The resident will be responsible for running the Inpatient Rheumatology service, for which there will be an attending assigned on a weekly basis. There will, in most cases, be at least one resident from Internal Medicine or Physical Medicine who will be also on the team. The Rheumatology Resident will have increasing responsibility and begin to act as a Junior Attending. The junior resident on the team will report to the Rheumatology resident and ultimately they will report to the Attending physician. If the Rheumatology resident is unable to contact this attending, then they will be expected to call the Site Director (Dr. Khalidi) to help sort out the situation. It is expected that emergent cases will be discussed to the Attending physician within hours and nonurgent cases discussed within the day that is has been received. It will be the responsibility of the Rheumatology resident to insure the Attending Physician is kept appraised of all consults. It will be also expected of the resident that they will keep the Attending physician appraised of all ward issues and review all patients with the Attending Physician at least once daily or more if needed.

The list of patients can be found on the internet as follows:
1) Go to www.yahoo.ca
2) Click on My Mail
3) The yahoo ID is sjh_rheum and password is 25Charlton25 (The account is sjh_rheum@yahoo.ca)
4) The latest list will be found under messages

The PGY 1-3 resident on inpatients will be contacted from a variety of sources about all new consults. They will then see the patient that day and call the Rheumatology resident and/or the attending to discuss the timing of review for the case.

The responsibilities of the Rheumatology resident will increase with increasing independence as time goes on during first year and second year so that by the time training is complete, the resident will be able to function as independent Consultant in Rheumatology.

The first day of the rotation the resident will be assigned no clinics and will be given time to become familiar with all the inpatients with the assigned PGY 1-3 resident. After that, the resident will typically have a clinic assigned to them in the morning and then be available to supervise the wards in the afternoon. Thursday mornings Residents will typically be assigned to the Vasculitis clinic in the Fontbonne building.

**RHEUMATOLOGY INPATIENT LOG**

All new inpatient consults and admissions are recorded in the "Rheumatology Inpatient Log". This is the responsibility of the clerk, resident or fellow who actually does the initial consult. The Log is an Excel file and is found on the email account, along with the inpatient list. The idea is that when new entries are made, the file is resaved with a new name, indicating the date, and emailed back to the email account. It is the responsibility of the fellows to download the most recent file at the end of the month, and save the file with a file name including the month and year, onto the network in the resident’s room located on the second floor of 240 James St. South. All columns, with the exception of the "Xrays", "Pathology" and "Comments" need to be completed for each case, and "n/a" should be entered when appropriate. The "Final Rheum Dx" column should be completed at the time of signoff or discharge if it is not immediately apparent at the time of the initial consultation. If there is no definitive diagnosis at the point of last inpatient encounter, an appropriate syndromic entity should be entered (eg "polyarthritis NYD"). The last three columns are optional; the intention is to allow banks of interesting cases to be created with respect to interesting imaging and pathology, to facilitate their review at the relevant rounds or otherwise, with other interesting aspects recorded in the "Comments" column, so please note these details when appropriate.
After exposure to the various aspects of the core rotation, the Rheumatology resident will have a basic understanding of the following (non-exhaustive) set of problems in rheumatology.

1) The evaluation and treatment of Osteoarthritis and Crystalline Associated Synovitis
2) The evaluation and treatment of Osteoporosis
3) The evaluation and differential diagnosis of monoarticular arthritis. The focus will be on urgent evaluation and appropriate therapeutic intervention
4) The evaluation and differential diagnosis of polyarticular arthritis.
5) A basic understanding in the evaluation and treatment of Rheumatoid Arthritis, Seronegative Spondyloarthropathy, Systemic Lupus Erythematosus, Antiphospholipid Syndrome, Scleroderma, Inflammatory Myopathies, Vasculitides, and Infectious arthritis.
6) The understanding of arthritides in the realm of systemic disease such as Amyloidosis, Hemophilia, Myeloproliferative Disorders, Hemochromatosis, Hypertrophic Osteoarthritis, Neoplastic diseases and Endocrine Disorders
7) A basic understanding of Soft tissue Rheumatism and its appropriate anatomy
8) The evaluation and examination of crystalline arthropathies and the use of the polarizing microscope utilizing the 4th floor lab and resources

Rounds

Rheumatology Residents will be expected to attend certain rounds including:

1) Xray rounds which are held in the Radiology Conference Room at St. Joseph’s Hospital every Wednesday from 7-8am. The residents are expected to ask the Site Director before each session if there is a cancellation.

2) Academic Half Days, which will be usually, be on Wednesday afternoon from 3-6. These Half Days may also include Friday mornings combined with Allergy and Immunology.

The Rheumatology resident will be expected to do a case presentation on a monthly basis as determined by the supervisor of the Academic Half Day, which is currently Dr. Bobba.

Schedule

Residents are expected to start their day doing inpatient consults from 7am. There will be a few clinics with which they will be expected to attend as well. Generally speaking, there will be a junior resident on inpatient service, so when the Rheumatology resident is in clinic, the junior will handle all first calls and will subsequently call the Rheumatology resident with their findings.
Evaluation

The resident will be evaluated by all Rheumatology attendings who will submit their evaluations to the Site Director who will then compile a summary to be sent to the Program Director. A Clinical Evaluation Card will be used for assessments in the clinics. Residents will be able to evaluate the rotation both formally and informally. Any problems that arise during the rotation should be communicated to the Site Director.

GOALS AND OBJECTIVES

The following sections outline the rotation expectations in CanMED roles with the domains of medical expert, communicator, collaborator, manager, health advocate, scholar and professional.

A. Medical Expert

Key Competencies: Physicians are able to...

1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-related medical care
2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their practice
3. Perform a complete and appropriate assessment of a patient
4. Use preventive and therapeutic interventions effectively
5. Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic
6. Seek appropriate consultation from other health professionals, recognizing the limits of their expertise

Specific Requirements:
1. The rheumatology resident must demonstrate in depth knowledge in the following general areas:

   1. Classification and diagnosis of rheumatic diseases
   2. Economic and social consequences of rheumatic disease
   3. Evaluation of disability
   4. Functional status and disease activity indicators
   5. Laboratory tests, and diagnostic imaging techniques in diagnosis and assessment of rheumatic diseases
   6. Therapeutics
      - Non pharmacological Therapy
      - Surgical Intervention
      - Therapeutic agents and techniques: indications/contraindications, administration, monitoring and complications
CLINICAL COMPETENCIES AND SKILL REQUIREMENTS

1. Elicit a history that is relevant, concise, and accurate and appropriate to the patient's problem(s).
2. Perform a physical examination (with special attention to the musculoskeletal system) that is relevant and appropriate to the patient's problems.
These skills should include the following:
   - Measures of arthritic disease activity
   - Measures of arthritic damage and deformity
   - Detection of Extra-articular Complications
   - Functional Assessment
   - Pain Amplification
   - Assessment of Spinal Disease
   - Assessment of Regional Pain Syndrome
3. Demonstrate knowledge of, indications for, and interpretation of:
   - Specialized immunological and serologic investigations
   - Joint aspiration and synovial fluid analysis.
   - Tissue biopsies
   - Electromyography and nerve conduction studies
   - Diagnostic imaging of joint and skeletal diseases.
4. Synthesize data derived by the above processes to derive the most likely diagnosis(es) and differential diagnosis(es).
5. Apply knowledge and expertise to performance of technical skills relevant to Rheumatology including joint and soft tissue aspiration and injections and synovial fluid analysis.
6. Develop an appropriate management and therapeutic plan in both inpatient and outpatient settings
7. Demonstrate effective consultation skills in the provision of timely well-documented assessments and recommendations in written and/or verbal forms.

B. Communicator
Key Competencies: Physicians are able to...

1. Develop rapport, trust and ethical therapeutic relationships with patients and families
2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues and other professionals
3. Accurately convey relevant information and explanations to patients and families, colleagues and other professionals
4. Develop a common understanding on issues, problems and plans with patients and families, colleagues and other professionals to develop a shared plan of care
5. Convey effective oral and written information about a medical encounter
Specific Requirements:
The resident must be able to:

i) Communicate effectively with all staff including nursing, allied health and physicians and discuss appropriate information with patients and families and all members of the interdisciplinary health care team

ii) Establish effective relationships with patients, family members and other caregivers in order to obtain a meaningful history, conduct a relevant physical examination, and to properly manage a patient’s medical problem

iii) Understand the psychosocial aspects of caring for patients with acute, chronic and life threatening disorders, and the impact of illness on their families

iv) Understand the biomedical ethics involved in the investigation and care of patients with rheumatologic disorders, including the appropriate treatment of patients whose families hold religious or other beliefs that preclude the use of “standard medical treatments”

v) Demonstrate effective communication skills by presenting concise, informative overviews on topics in the diagnosis of rheumatologic disorders

C. Collaborator

Key Competencies: Physicians are able to...
1) Participate effectively and appropriately in an interprofessional healthcare team
2) Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict

Specific Requirements:
The rheumatology resident should be able to:

i) Contribute clinically useful rheumatological opinions on patients referred for consultation, including ordering and arranging for specific testing, administering required therapy, and conveying the results of the rheumatological opinion to referring physicians. This process involves integrating information from multiple sources to construct a clear diagnosis which is then used to guide the patient’s therapy. This may require integrating the results of the clinical, laboratory, EMG, radiological data.

ii) Consult and collaborate with physicians, laboratory staff, clinic staff, and other health care professionals, and contribute effectively to interdisciplinary team activities within and between hospitals, other health care facilities and collaborative groups
D. Manager

Key Competencies:  *Physicians are able to*...

1. Participate in activities that contribute to the effectiveness of their healthcare organizations and systems
2. Manage their practice and career effectively
3. Allocate finite healthcare resources appropriately
4. Serve in administration and leadership roles, as appropriate

Specific Requirements:
The rheumatology resident should be able to:

a. Demonstrate knowledge of the definitions and role of audits, quality improvement, risk management and incident reporting in a hospital and ambulatory setting, particularly as applied to rheumatology
b. Demonstrate understanding of cost/benefit ratios of diagnostic and therapeutic interventions, cost containment and efficacy as they relate to quality assurance, particularly as they apply to rheumatology

E. Health Advocate

Key Competencies:  *Physicians are able to*...

1. Respond to individual patient health needs and issues as part of patient care
2. Respond to the health needs of the communities that they serve
3. Identify the determinants of health of the populations that they serve
4. Promote the health of individual patients, communities and populations

Specific Requirements:
The rheumatology resident should be able to:

a. Demonstrate an appreciation of the health care needs of patients with all serious rheumatological conditions that necessitates admission to hospital
b. Encourage the promotion of active family involvement in decision-making and continuing management
c. Understand the ways effective laboratory support is important to patients with rheumatological and medical problems
d. Advocate for patients if there are delays in diagnosis and management as a result of limited resources
**F. Scholar**

**Key Competencies:** Physicians are able to...

1. Maintain and enhance professional activities through ongoing learning
2. Critically evaluate information and its sources, and apply this appropriately to practice decisions
3. Facilitate the learning of patients, families, students, residents, other health professionals, the public, and others, as appropriate
4. Contribute to the creation, dissemination, application, and translation of new medical knowledge and practices

**Specific Requirements:**
The rheumatology resident should:
1. Provide evidence in the material that they present during their presentations of cases to rheumatology attendings that they are acquiring an appropriate level of in-depth knowledge pertaining to rheumatology diagnostics and a current understanding of the pathophysiology of the attendant rheumatologic disorder
2. Develop critical appraisal skills specific to the rheumatologic literature, particularly as it applies to the physiology and pathophysiology of the particular rheumatologic disorder being treated

**G. Professional**

**Key Competencies:** Physicians are able to...

1. Demonstrate a commitment to their patients, profession, and society through ethical practice
2. Demonstrate a commitment to their patients, profession, and society through participation in profession-led regulation
3. Demonstrate a commitment to physician health and sustainable practice.

**Specific Requirements:**
1. The rheumatology resident should:
   a. Deliver highest quality care with integrity, honesty and compassion
   b. Exhibit appropriate personal and interpersonal professional behaviour
   c. Practice medicine ethically consistent with obligations of a physician
   d. Be courteous and punctual
   e. Follow-up on patients evaluated
   f. Arrange additional laboratory investigations, as appropriate
Rheumatology Fellow training will consist of rotations as well as ongoing course work in clinical epidemiology and immunology (basic science).

This Rheumatology rotation will consist of both inpatient and outpatient care. The bulk of the Rheumatology rotation will be in the outpatient setting but inpatient care will also be available. Evaluation and care of the patient as well as interpretation of laboratory procedures appropriate to Rheumatologists will be emphasized.

In addition to adult rheumatology clinics, fellows will attend immunology and pediatric rheumatology outpatient clinics. The Fellow is also expected to do a separate 2-3 week rotation involving the study of inflammatory muscle problems and EMG interpretation.

Ongoing course work will focus on the basics of clinical epidemiology (in the form of Clinical Epidemiology 721, An Introduction to Clinical Epidemiology). As well, fellows are expected to attend immunology rounds or basic science immunology courses, when they are of relevance to rheumatology.

The fellow will continue to attend rheumatology academic half day including X ray rounds (see below).

**Outpatient care**

This will be the main focus of the rotation. The objectives and responsibilities include:

1) Obtain an appropriate rheumatologic history and physical exam for new consults
2) Obtain an appropriate focused rheumatologic history and physical for followup patients
3) Develop an appropriate differential diagnosis based on critical analysis of clinical data and its integration with basic fund of medical knowledge
4) Understand the rational for ordering and an understanding of the principals of serology, imaging studies including computerized tomography and magnetic resonance imaging
5) Learn synovial aspiration of, and injections of peripheral joints amenable to bedside procedures.
6) Generate a differential diagnosis based on analysis of synovial fluid and rational for aspiration
7) Understand basic anatomy, pharmacology, epidemiology and pathophysiology and clinical manifestations
8) Develop skills in those of communication and in providing consultation services in Rheumatology
9) Display professionalism and humanism, including respect and compassion for patients and peers

**Inpatient Care**

The objectives and responsibilities are as follows:

1) Obtain an appropriate rheumatologic history and physical exam for new consults for the various services at Hamilton Health Sciences
2) See followup patients and communicate findings to the appropriate Rheumatology attending.
3) Communicate findings to the appropriate service after discussing case with the Rheumatology attending.

**Clinical Skills**

After exposure to the various aspects of the rotation, the rheumatology fellow will have a basic understanding of the following set of problems in Rheumatology:

1) The evaluation and treatment of Osteoarthritis and Crystalline Associated Synovitis
2) The evaluation and differential diagnosis of monoarticular arthritis. The focus will be on urgent evaluation and appropriate therapeutic intervention
3) The evaluation and differential diagnosis of polyarticular arthritis.
4) An understanding in the evaluation and treatment of Rheumatoid Arthritis, Seronegative Spondyloarthropathy, Systemic Lupus Erythematosus, Antiphospholipid Syndrome, Scleroderma, Inflammatory Myopathies, Vasculitides, Crystalline Arthritis and Infectious arthritis.
5) The understanding of arthritides in the realm of systemic disease such as Amyloidosis, Hemophilia, Myeloproliferative Disorders, Hemochromatosis, Hypertrophic Osteoarthritis, Neoplastic diseases and Endocrine Disorders
6) A basic understanding of Soft tissue Rheumatism and its appropriate anatomy

**Rounds**

Residents will be expected to attend certain rounds including:

1) Xray rounds which are held in the Radiology Conference Room at St. Joseph’s Hospital every Wednesday from 7-8am. The residents are expected to ask the Site Director before each session if there is a cancellation.
2) Rheumatology rounds/Academic Half Day held every Wednesday at 3-6PM.
Schedule

The schedule will be emailed to you before the rotation starts. Wednesday afternoons will be set aside for the required Academic Half Day. Study time, research time and elective time can be negotiated in advance.

Evaluation

The resident will be evaluated by all Rheumatology attendings who will submit their evaluations to the Site Director who will then compile a summary to be sent to the Program Director. Residents will be able to evaluate the rotation both formally and informally. Any problems that arise during the rotation should be communicated to the Site Director.

GOALS AND OBJECTIVES

The following sections outline the rotation expectations in CanMED roles with the domains of medical expert, communicator, collaborator, manager, health advocate, scholar and professional.

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2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their practice
3. Perform a complete and appropriate assessment of a patient
4. Use preventive and therapeutic interventions effectively
5. Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic
6. Seek appropriate consultation from other health professionals, recognizing the limits of their expertise

Specific Requirements:
1. The rheumatology resident must demonstrate in depth knowledge in the following general areas:

   1. Classification and diagnosis of rheumatic diseases
   2. Economic and social consequences of rheumatic disease
   3. Evaluation of disability
   4. Functional status and disease activity indicators
   5. Laboratory tests, and diagnostic imaging techniques in diagnosis and
assessment of rheumatic diseases

6. Therapeutics
   • Non pharmacological Therapy
   • Surgical Intervention
   • Therapeutic agents and techniques: indications/contraindications, administration, monitoring and complications

CLINICAL COMPETENCIES AND SKILL REQUIREMENTS

1. Elicit a history that is relevant, concise, and accurate and appropriate to the patient's problem(s).
2. Perform a physical examination (with special attention to the musculoskeletal system) that is relevant and appropriate to the patient's problems. These skills should include the following:
   • Measures of arthritic disease activity
   • Measures of arthritic damage and deformity
   • Detection of Extra-articular Complications
   • Functional Assessment
   • Pain Amplification
   • Assessment of Spinal Disease
   • Assessment of Regional Pain Syndrome
3. Demonstrate knowledge of, indications for, and interpretation of:
   • Specialized immunological and serologic investigations
   • Joint aspiration and synovial fluid analysis.
   • Tissue biopsies
   • Electromyography and nerve conduction studies
   • Diagnostic imaging of joint and skeletal diseases.
4. Synthesize data derived by the above processes to derive the most likely diagnosis (es) and differential diagnosis (es).
5. Apply knowledge and expertise to performance of technical skills relevant to Rheumatology including joint and soft tissue aspiration and injections and synovial fluid analysis.
6. Develop an appropriate management and therapeutic plan in both inpatient and outpatient settings
7. Demonstrate effective consultation skills in the provision of timely well-documented assessments and recommendations in written and/or verbal forms.
B. Communicator

**Key Competencies:** *Physicians are able to...*

1. Develop rapport, trust and ethical therapeutic relationships with patients and families
2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues and other professionals
3. Accurately convey relevant information and explanations to patients and families, colleagues and other professionals
4. Develop a common understanding on issues, problems and plans with patients and families, colleagues and other professionals to develop a shared plan of care
5. Convey effective oral and written information about a medical encounter

**Specific Requirements:**
The resident must be able to:

1. Communicate effectively with all staff including nursing, allied health and physicians and discuss appropriate information with patients and families and all members of the interdisciplinary health care team
2. Establish effective relationships with patients, family members and other caregivers in order to obtain a meaningful history, conduct a relevant physical examination, and to properly manage a patient’s medical problem
3. Understand the psychosocial aspects of caring for patients with acute, chronic and life threatening disorders, and the impact of illness on their families
4. Understand the biomedical ethics involved in the investigation and care of patients with rheumatologic disorders, including the appropriate treatment of patients whose families hold religious or other beliefs that preclude the use of “standard medical treatments”
5. Demonstrate effective communication skills by presenting concise, informative overviews on topics in the diagnosis of rheumatologic disorders

C. Collaborator

**Key Competencies:** *Physicians are able to...*

1. Participate effectively and appropriately in an interprofessional healthcare team
2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict
Specific Requirements:
The rheumatology resident should be able to:

i) Contribute clinically useful rheumatological opinions on patients referred for consultation, including ordering and arranging for specific testing, administering required therapy, and conveying the results of the rheumatological opinion to referring physicians. This process involves integrating information from multiple sources to construct a clear diagnosis which is then used to guide the patient’s therapy. This may require integrating the results of the clinical, laboratory, EMG, radiological data.

ii) Consult and collaborate with physicians, laboratory staff, clinic staff, and other health care professionals, and contribute effectively to interdisciplinary team activities within and between hospitals, other health care facilities and collaborative groups.

D. Manager
Key Competencies: Physicians are able to...

1. Participate in activities that contribute to the effectiveness of their healthcare organizations and systems
2. Manage their practice and career effectively
3. Allocate finite healthcare resources appropriately
4. Serve in administration and leadership roles, as appropriate

Specific Requirements:
The rheumatology resident should be able to:

a. Demonstrate knowledge of the definitions and role of audits, quality improvement, risk management and incident reporting in a hospital and ambulatory setting, particularly as applied to rheumatology
b. Demonstrate understanding of cost/benefit ratios of diagnostic and therapeutic interventions, cost containment and efficacy as they relate to quality assurance, particularly as they apply to rheumatology

E. Health Advocate
Key Competencies: Physicians are able to...

1. Respond to individual patient health needs and issues as part of patient care
2. Respond to the health needs of the communities that they serve
3. Identify the determinants of health of the populations that they serve
4. Promote the health of individual patients, communities and populations
Specific Requirements:
The rheumatology resident should be able to:

a. Demonstrate an appreciation of the health care needs of patients with all serious rheumatological conditions that necessitates admission to hospital
b. Encourage the promotion of active family involvement in decision-making and continuing management
c. Understand the ways effective laboratory support is important to patients with rheumatological and medical problems
d. Advocate for patients if there are delays in diagnosis and management as a result of limited resources

F. Scholar
Key Competencies: Physicians are able to...

1. Maintain and enhance professional activities through ongoing learning
2. Critically evaluate information and its sources, and apply this appropriately to practice decisions
3. Facilitate the learning of patients, families, students, residents, other health professionals, the public, and others, as appropriate
4. Contribute to the creation, dissemination, application, and translation of new medical knowledge and practices

Specific Requirements:
The rheumatology resident should:

1. Provide evidence in the material that they present during their presentations of cases to rheumatology attendings that they are acquiring an appropriate level of in-depth knowledge pertaining to rheumatology diagnostics and a current understanding of the pathophysiology of the attendant rheumatologic disorder

2. Develop critical appraisal skills specific to the rheumatologic literature, particularly as it applies to the physiology and pathophysiology of the particular rheumatologic disorder being treated

G. Professional
Key Competencies: Physicians are able to...

1. Demonstrate a commitment to their patients, profession, and society through ethical practice
2. Demonstrate a commitment to their patients, profession, and society through participation in profession-led regulation
3. Demonstrate a commitment to physician health and sustainable practice.
Specific Requirements:
1. The rheumatology resident should:
   a. Deliver highest quality care with integrity honesty and compassion
   b. Exhibit appropriate personal and interpersonal professional behaviour
   c. Practice medicine ethically consistent with obligations of a physician
   d. Be courteous and punctual
   e. Follow-up on patients evaluated
   f. Arrange additional laboratory investigations, as appropriate
Hamilton General/ Henderson General/ West Haldimand General Hospital Site
Dr Alfred Cividino Site Director
McMaster University

This Rheumatology rotation will consist of both inpatient and outpatient care. The bulk of the Rheumatology rotation will be in the outpatient setting but inpatient care will also be available. Evaluation and care of the patient and interpretation of laboratory procedures appropriate to Rheumatologists will be emphasized.

**Outpatient care**

This will be the main focus of the core rotation. The objectives and responsibilities include:

1. Obtain an appropriate rheumatologic history and physical exam for new consults
2. Obtain an appropriate focused rheumatologic history and physical for followup patients
3. Develop an appropriate differential diagnosis based on critical analysis of clinical data and its integration with basic fund of medical knowledge
4. Understand the rational for ordering and a basic understanding of the principals of serology, imaging studies including computerized tomography and magnetic resonance imaging
5. Learn synovial aspiration of joints especially knee
6. Generate a differential diagnosis based on analysis of synovial fluid and rational for aspiration
7. Understand basic anatomy, pharmacology, epidemiology and pathophysiology and clinical manifestations
8. Develop skills in those of communication and in providing consultation services in Rheumatology
9. Display professionalism and humanism, including respect and compassion for patients and peers

**Inpatient Care**

An important aspect of care in the Rheumatology patient. The objectives and responsibilities are as follows:

1) Obtain an appropriate rheumatologic history and physical exam for new consults for the various services at Hamilton Health Sciences
2) See followup patients and communicate findings to appropriate Rheumatology attending
3) Communicate findings to the appropriate service after discussing case with Rheumatology attending
Clinical Skills

After exposure to the various aspects of the core rotation, the medical resident will have a basic understanding of the following (non-exhaustive) set of problems in Rheumatology.

1) The evaluation and treatment of Osteoarthritis and Crystalline Associated Synovitis
2) The evaluation and differential diagnosis of monoarticular arthritis. The focus will be on urgent evaluation and appropriate therapeutic intervention
3) The evaluation and differential diagnosis of polyarticular arthritis.
4) A basic understanding in the evaluation and treatment of Rheumatoid Arthritis, Seronegative Spondyloarthropathy, Systemic Lupus Erythematosus, Antiphospholipid Syndrome, Scleroderma, Inflammatory Myopathies, Vasculitides, and Infectious arthritis.
5) The understanding of arthritides in the realm of systemic disease such as Amyloidosis, Hemophilia, Myeloproliferative Disorders, Hemochromatosis, Hypertrophic Osteoarthropathy, Neoplastic diseases and Endocrine Disorders
6) A basic understanding of Soft tissue Rheumatism and its appropriate anatomy

Rounds

Residents will be expected to attend certain rounds including:

1) Xray rounds which are held in the Radiology Conference Room at St. Joseph’s Hospital every Wednesday from 7-8am. The residents are expected to ask the Site Director before each session if there is a cancellation.
2) Academic Half Day/Rheumatology rounds held every Wednesday at 3-6pm.

Schedule

The schedule will be emailed to you before the rotation starts. Wednesday afternoons will be set aside for the required Academic Half Day. The main clinic days will be Monday afternoon, Thursday afternoon and Friday mornings. Study time, research time and elective time can be negotiated in advance.

Evaluation

The resident will be evaluated by all Rheumatology attendings who will submit their evaluations to the Site Director who will then compile a summary to be sent to the Program Director. Residents will be able to evaluate the rotation both formally and informally. Any problems that arise during the rotation should be communicated to the Site Director.
GOALS AND OBJECTIVES

The following sections outline the rotation expectations in CanMED roles with the domains of medical expert, communicator, collaborator, manager, health advocate, scholar and professional.

A. Medical Expert

Key Competencies: Physicians are able to...

1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-related medical care
2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their practice
3. Perform a complete and appropriate assessment of a patient
4. Use preventive and therapeutic interventions effectively
5. Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic
6. Seek appropriate consultation from other health professionals, recognizing the limits of their expertise

Specific Requirements:
1. The rheumatology resident must demonstrate in depth knowledge in the following general areas:

   1. Classification and diagnosis of rheumatic diseases
   2. Economic and social consequences of rheumatic disease
   3. Evaluation of disability
   4. Functional status and disease activity indicators
   5. Laboratory tests, and diagnostic imaging techniques in diagnosis and assessment of rheumatic diseases
   6. Therapeutics
      a. Non pharmacological Therapy
      b. Surgical Intervention
      c. Therapeutic agents and techniques: indications/contraindications, administration, monitoring and complications
CLINICAL COMPETENCIES AND SKILL REQUIREMENTS

1. Elicit a history that is relevant, concise, and accurate and appropriate to the patient's problem(s).
2. Perform a physical examination (with special attention to the musculoskeletal system) that is relevant and appropriate to the patient's problems.

These skills should include the following:

- Measures of arthritic disease activity
- Measures of arthritic damage and deformity
- Detection of Extra-articular Complications
- Functional Assessment
- Pain Amplification
- Assessment of Spinal Disease
- Assessment of Regional Pain Syndrome

3. Demonstrate knowledge of, indications for, and interpretation of:
   - Specialized immunological and serologic investigations
   - Joint aspiration and synovial fluid analysis.
   - Tissue biopsies
   - Electromyography and nerve conduction studies
   - Diagnostic imaging of joint and skeletal diseases.

4. Synthesize data derived by the above processes to derive the most likely diagnosis(es) and differential diagnosis(es).
5. Apply knowledge and expertise to performance of technical skills relevant to Rheumatology including joint and soft tissue aspiration and injections and synovial fluid analysis.
6. Develop an appropriate management and therapeutic plan in both inpatient and outpatient settings
7. Demonstrate effective consultation skills in the provision of timely well-documented assessments and recommendations in written and/or verbal forms.

B. Communicator

Key Competencies: Physicians are able to...

1. Develop rapport, trust and ethical therapeutic relationships with patients and families
2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues and other professionals
3. Accurately convey relevant information and explanations to patients and families, colleagues and other professionals
4. Develop a common understanding on issues, problems and plans with patients and families, colleagues and other professionals to develop a shared plan of care
5. Convey effective oral and written information about a medical encounter
Specific Requirements:
The resident must be able to:

1. Communicate effectively with all staff including nursing, allied health and physicians and discuss appropriate information with patients and families and all members of the interdisciplinary health care team
2. Establish effective relationships with patients, family members and other caregivers in order to obtain a meaningful history, conduct a relevant physical examination, and to properly manage a patient’s medical problem
3. Understand the psychosocial aspects of caring for patients with acute, chronic and life threatening disorders, and the impact of illness on their families
4. Understand the biomedical ethics involved in the investigation and care of patients with rheumatologic disorders, including the appropriate treatment of patients whose families hold religious or other beliefs that preclude the use of “standard medical treatments”
5. Demonstrate effective communication skills by presenting concise, informative overviews on topics in the diagnosis of rheumatologic disorders

C. Collaborator

Key Competencies: Physicians are able to...

1. Participate effectively and appropriately in an interprofessional healthcare team
2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict

Specific Requirements:
The rheumatology resident should be able to:

i) Contribute clinically useful rheumatological opinions on patients referred for consultation, including ordering and arranging for specific testing, administering required therapy, and conveying the results of the rheumatological opinion to referring physicians. This process involves integrating information from multiple sources to construct a clear diagnosis which is then used to guide the patient’s therapy. This may require integrating the results of the clinical, laboratory, EMG, radiological data.

   ii) Consult and collaborate with physicians, laboratory staff, clinic staff, and other health care professionals, and contribute effectively to interdisciplinary team activities within and between hospitals, other health care facilities and collaborative groups
D. Manager

Key Competencies: *Physicians are able to...*

1. Participate in activities that contribute to the effectiveness of their healthcare organizations and systems  
2. Manage their practice and career effectively  
3. Allocate finite healthcare resources appropriately  
4. Serve in administration and leadership roles, as appropriate

Specific Requirements:
The rheumatology resident should be able to:  
  a. Demonstrate knowledge of the definitions and role of audits, quality improvement, risk management and incident reporting in a hospital and ambulatory setting, particularly as applied to rheumatology  
  b. Demonstrate understanding of cost/benefit ratios of diagnostic and therapeutic interventions, cost containment and efficacy as they relate to quality assurance, particularly as they apply to rheumatology

E. Health Advocate

Key Competencies: *Physicians are able to...*

1. Respond to individual patient health needs and issues as part of patient care  
2. Respond to the health needs of the communities that they serve  
3. Identify the determinants of health of the populations that they serve  
4. Promote the health of individual patients, communities and populations

Specific Requirements:
The rheumatology resident should be able to:  
  a. Demonstrate an appreciation of the health care needs of patients with all serious rheumatological conditions that necessitates admission to hospital  
  b. Encourage the promotion of active family involvement in decision-making and continuing management  
  c. Understand the ways effective laboratory support is important to patients with rheumatological and medical problems  
  d. Advocate for patients if there are delays in diagnosis and management as a result of limited resources
F. Scholar
Key Competencies: Physicians are able to...

1. Maintain and enhance professional activities through ongoing learning
2. Critically evaluate information and its sources, and apply this appropriately to practice decisions
3. Facilitate the learning of patients, families, students, residents, other health professionals, the public, and others, as appropriate
4. Contribute to the creation, dissemination, application, and translation of new medical knowledge and practices

Specific Requirements:
The rheumatology resident should:
1. Provide evidence in the material that they present during their presentations of cases to rheumatology attendings that they are acquiring an appropriate level of in-depth knowledge pertaining to rheumatology diagnostics and a current understanding of the pathophysiology of the attendant rheumatologic disorder

2. Develop critical appraisal skills specific to the rheumatologic literature, particularly as it applies to the physiology and pathophysiology of the particular rheumatologic disorder being treated

G. Professional
Key Competencies: Physicians are able to...
1. Demonstrate a commitment to their patients, profession, and society through ethical practice
2. Demonstrate a commitment to their patients, profession, and society through participation in profession-led regulation
3. Demonstrate a commitment to physician health and sustainable practice.

Specific Requirements:
1. The rheumatology resident should:
   a. Deliver highest quality care with integrity honesty and compassion
   b. Exhibit appropriate personal and interpersonal professional behaviour
   c. Practice medicine ethically consistent with obligations of a physician
   d. Be courteous and punctual
   e. Follow-up on patients evaluated
   f. Arrange additional laboratory investigations, as appropriate
Core Metabolic Bone Disease in Rheumatology for Rheumatology Residents

St. Joseph’s Hospital Site
Dr. J.D. Adachi Site Director
McMaster University

The Rheumatology Metabolic Bone Disease rotation will consist of both inpatient and outpatient care. The bulk of the Rheumatology rotation will be in the outpatient setting but some inpatient consultation will be provided. Evaluation and care of the patient and interpretation of laboratory procedures appropriate to Rheumatologists will be emphasized.

Outpatient care

This will be the main focus of the core rotation. The objectives and responsibilities include:

1. Obtain an appropriate history and physical exam for new consults with common bone disorders such as osteoporosis, osteomalacia, hyperparathyroidism and Paget’s disease.
2. Obtain an appropriate focused history and physical for followup patients with bone disease
3. Develop an appropriate differential diagnosis based on critical analysis of clinical data and its integration with basic fund of medical knowledge
4. Understand the rational for ordering and a basic understanding of the principals of serology obtained in those with bone disease, imaging studies including bone densitometry, computerized tomography and magnetic resonance imaging
5. Learn how to interpret BMD measurements
6. Generate a differential diagnosis based on results of investigations
7. Understand basic anatomy, pharmacology, epidemiology and pathophysiology and clinical manifestations in patients with bone diseases
8. Develop skills in those of communication and in providing consultation services in Rheumatology
9. Display professionalism and humanism, including respect and compassion for patients, particularly the elderly and peers

Inpatient Care

An important aspect of care in the Rheumatology patient. The objectives and responsibilities include:

1. Obtain an appropriate rheumatologic history and physical exam for new consults with bone disease for the various services at St. Joseph’s Hospital, in particular the orthopedic service where we may be asked to consult on patients
with fractures
2. See followup patients and communicate findings to appropriate Rheumatology attending
3. Communicate findings to the appropriate service after discussing case with Rheumatology attending
4. Admit patients and see followup patients on the Rheumatology ward on 7MS when asked by a Rheumatology attending

Clinical Skills

After exposure to the various aspects of the core rotation, the rheumatology resident will have a basic understanding of the following (non-exhaustive) set of problems in bone disease as seen by the rheumatologist.

1. The evaluation and treatment of Osteoporosis
2. The evaluation and treatment of Osteomalacia
3. The evaluation and differential diagnosis of Pagets disease.
4. The evaluation and differential diagnosis of an elevated alkaline phosphatase, and an elevated calcium level.
5. A basic understanding in the evaluation and treatment of genetic disorders of bone metabolism such as Osteogenesis imperfecta.
6. The understanding of bone disease in the realm of systemic disease such as chronic obstructive pulmonary disease, renal disease, liver disease, inflammatory bowel disease, malabsorption, Neoplasia including, myeloma, breast and prostate cancer, Drug –Induced bone disease including corticosteroid-induced bone disease and anticonvulsant induced bone disease, and Endocrine Disorders such as hyperparathyroidism, hyperthyroidism, diabetes and acromegaly

A. Medical Expert/Clinical Decision Maker

Key Competencies: Physicians are able to...

1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-related medical care
2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their practice
3. Perform a complete and appropriate assessment of a patient
4. Use preventive and therapeutic interventions effectively
5. Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic
5. Seek appropriate consultation from other health professionals, recognizing the limits of their expertise
Specific Requirements:

1. The rheumatology resident must demonstrate in depth knowledge in the following general areas:

   1. Classification and diagnosis of metabolic bone diseases
   2. Economic and social consequences of metabolic bone diseases
   3. Evaluation of disability in metabolic bone diseases
   4. Functional status and risk factors for fracturing
   5. Laboratory tests, and diagnostic imaging techniques in diagnosis and assessment of metabolic bone diseases
   6. Therapeutics
      a. Non pharmacological Therapy
      b. Surgical Intervention, vertebroplasty, kyphoplasty
      c. Therapeutic agents and techniques: indications/contraindications, administration, monitoring and complications

B. Communicator

Key Competencies: Physicians are able to...

1. Develop rapport, trust and ethical therapeutic relationships with patients and families
2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues and other professionals
3. Accurately convey relevant information and explanations to patients and families, colleagues and other professionals
4. Develop a common understanding on issues, problems and plans with patients and families, colleagues and other professionals to develop a shared plan of care
5. Convey effective oral and written information about a medical encounter

Specific Requirements:

The resident must be able to:

1. Communicate effectively with all staff including nursing, allied health and physicians and discuss appropriate information with patients and families and all members of the interdisciplinary health care team
2. Establish effective relationships with patients, family members and other caregivers in order to obtain a meaningful history, conduct a relevant physical examination, and to properly manage a patient’s bone related problems
3. Understand the psychosocial aspects of caring for patients with acute, chronic and life threatening disorders, and the impact of illness on their families
4. Understand the biomedical ethics involved in the investigation and care of patients with metabolic bone diseases, including the appropriate treatment of patients whose families hold religious or other beliefs that preclude the use of “standard medical treatments”

5. Demonstrate effective communication skills by presenting concise, informative overviews on topics in the diagnosis of metabolic bone disorders

C. Collaborator

Key Competencies: Physicians are able to...

1. Participate effectively and appropriately in an interprofessional healthcare team
2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict

Specific Requirements:
The rheumatology resident should be able to:

1. Contribute clinically useful rheumatological opinions on patients referred for consultation, including ordering and arranging for specific testing, administering required therapy, and conveying the results of the rheumatological opinion to referring physicians. This process involves integrating information from multiple sources to construct a clear diagnosis which is then used to guide the patient’s therapy. This may require integrating the results of the clinical, laboratory, BMD, and radiological data.
2. Consult and collaborate with physicians, laboratory staff, clinic staff, and other health care professionals, and contribute effectively to interdisciplinary team activities within and between hospitals, other health care facilities and collaborative groups

D. Manager

Key Competencies: Physicians are able to...

1. Participate in activities that contribute to the effectiveness of their healthcare organizations and systems
2. Manage their practice and career effectively
3. Allocate finite healthcare resources appropriately
4. Serve in administration and leadership roles, as appropriate
Specific Requirements:

The rheumatology resident should be able to:

1. Demonstrate knowledge of the definitions and role of audits, quality improvement, risk management and incident reporting in a hospital and ambulatory setting, particularly as applied to metabolic bone diseases
2. Demonstrate understanding of cost/benefit ratios of diagnostic and therapeutic interventions, cost containment and efficacy as they relate to quality assurance, particularly as they apply to rheumatology

E. Health Advocate

Key Competencies: *Physicians are able to...*

1. Respond to individual patient health needs and issues as part of patient care
2. Respond to the health needs of the communities that they serve
3. Identify the determinants of health of the populations that they serve
4. Promote the health of individual patients, communities and populations

Specific Requirements:

The rheumatology resident should be able to:

1. Demonstrate an appreciation of the health care needs of patients with all serious metabolic bone conditions such as fractures that necessitates admission to hospital
2. Encourage the promotion of active family involvement in decision-making and continuing management
3. Understand the ways effective BMD support is important to patients with osteoporosis
4. Advocate for patients if there are delays in diagnosis and management as a result of limited resources

F. Scholar

Key Competencies: *Physicians are able to...*

1. Maintain and enhance professional activities through ongoing learning about the ever changing science of metabolic bone diseases
2. Critically evaluate information and its sources, and apply this appropriately to practice decisions, in particular as it realtes to osteoporosis
3. Facilitate the learning of patients, families, students, residents, other health professionals, the public, and others, as appropriate about bone diseases
4. Contribute to the creation, dissemination, application, and translation of new medical knowledge and practices

Specific Requirements:

The rheumatology resident should:

1. Provide evidence in the material that they present during their presentations of cases to rheumatology attendings that they are acquiring an appropriate level of in-depth knowledge pertaining to metabolic bone disease diagnostics and a current understanding of the pathophysiology of the attendant bone disorder
2. Develop critical appraisal skills specific to the bone related literature, particularly as it applies to the physiology and pathophysiology of the particular bone disorder being treated, in particular osteoporosis, osteomalacia and Paget’s disease

G. Professional

Key Competencies: Physicians are able to...

1. Demonstrate a commitment to their patients, profession, and society through ethical practice
2. Demonstrate a commitment to their patients, profession, and society through participation in profession-led regulation
3. Demonstrate a commitment to physician health and sustainable practice.

Specific Requirements:

1. The rheumatology resident should:
   a. Deliver highest quality care with integrity honesty and compassion
   b. Exhibit appropriate personal and interpersonal professional behaviour
   c. Practice medicine ethically consistent with obligations of a physician
   d. Be courteous and punctual to clinic
   e. Follow-up on patients evaluated
   f. Arrange additional laboratory investigations, as appropriate
St. Catharine’s Community Rheumatology Site
Dr. Shaikh, Site Director
McMaster University

The Rheumatology rotation will consist of almost exclusively of outpatient care, however, for at least one week there will be hospital on-call responsibilities at St. Catharine’s General Hospital.

Evaluation and care of the patient and interpretation of laboratory procedures appropriate to Rheumatologists will be emphasized. A special emphasis will also focus on procedural skills encountered in the rheumatology clinic.

Outpatient care

The Resident will be assigned to the private practice clinic of Dr. Saeed Shaikh at 589 Lake St., Suite 204, St. Catharine’s, Ontario. This clinic has a wide variety of clinical cases, including, but not confined to inflammatory arthritides, degenerative arthritis, soft tissue rheumatism, connective tissue disorders, vasculitis, and metabolic bone diseases.

The objectives and responsibilities include:

1. Obtain an appropriate rheumatologic history and physical exam for new consults
2. Obtain an appropriate focused rheumatologic history and physical for followup patients
3. Develop an appropriate differential diagnosis based on critical analysis of clinical data and its integration with basic fund of medical knowledge
4. Understand the rational for ordering and a basic understanding of the principals of serology, imaging studies including computerized tomography and magnetic resonance imaging
5. Learn synovial aspiration of joints, particularly the knee
6. Injection techniques for less common joints, such as
   a. wrist
   b. elbow
   c. ankle
   d. MCP/PIP/MTP joints
7. Be able to develop skill in injecting soft tissue rheumatic structures, such as:
   a. trigger finger tendon nodules
   b. deQuervain’s tenosynovitis
   c. epicondylitis
   d. periarticular structures around the shoulder, knee, and ankle
   e. carpal tunnel median nerve blocks
   f. trochanteric bursitis of the hip
8. Generate a differential diagnosis based on analysis of synovial fluid and rational for aspiration
9. Understand basic anatomy, pharmacology, epidemiology and pathophysiology and clinical manifestations
10. Develop skills in those of communication and in providing consultation services in Rheumatology to community based physicians
11. Display professionalism and humanism, including respect and compassion for patients and peer
12. Obtain skills in managing the logistics of a private practice

Inpatient Care

There are consultations at St. Catharine’s General Hospital for at least one consecutive week during a month long rotation

The objectives and responsibilities are as follows:

1. Obtain an appropriate rheumatologic history and physical exam for new consults for the various services at St. Joseph’s Hospital
2. See followup patients and communicate findings to appropriate Rheumatology attending
3. Communicate findings to the appropriate service after discussing case with Rheumatology attending

Clinical Skills

After exposure to the various aspects of the core rotation, the Rheumatology resident will have a basic understanding of the following (non-exhaustive) set of problems in rheumatology.

1) The evaluation and treatment of Osteoarthritis and Crystalline Associated Synovitis
2) The evaluation and treatment of Osteoporosis
3) The evaluation and differential diagnosis of monoarticular arthritis. The focus will be on urgent evaluation and appropriate therapeutic intervention
4) The evaluation and differential diagnosis of polyarticular arthritis.
5) A basic understanding in the evaluation and treatment of Rheumatoid Arthritis, Seronegative Spondyloarthritis, Systemic Lupus Erythematosus, Antiphospholipid Syndrome, Scleroderma, Inflammatory Myopathies, Vasculitides, and Infectious arthritis.
6) The understanding of arthritides in the realm of systemic disease such as
Amyloidosis, Hemophilia, Myeloproliferative Disorders, Hemochromatosis, Hypertrophic Osteoarthropathy, Neoplastic diseases and Endocrine Disorders
7) A basic understanding of Soft tissue Rheumatism and its appropriate anatomy

Evaluation

The resident will be evaluated by the Rheumatology attending, Dr. Shaikh, who will submit an evaluation to the Site Director who will then compile a summary to be sent to the Program Director. A Clinical Evaluation Card will be used for assessments in the clinics. Residents will be able to evaluate the rotation both formally and informally. Any problems that arise during the rotation should be communicated to the Site Director.

GOALS AND OBJECTIVES

The following sections outline the rotation expectations in CanMED roles with the domains of medical expert, communicator, collaborator, manager, health advocate, scholar and professional.

A. Medical Expert

Key Competencies: Physicians are able to...

1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-related medical care
2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their practice
3. Perform a complete and appropriate assessment of a patient
4. Use preventive and therapeutic interventions effectively
5. Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic
6. Seek appropriate consultation from other health professionals, recognizing the limits of their expertise

Specific Requirements:
1. The rheumatology resident must demonstrate in depth knowledge in the following general areas:
   1. Classification and diagnosis of rheumatic diseases
   2. Economic and social consequences of rheumatic disease
   3. Evaluation of disability
   4. Functional status and disease activity indicators
   5. Laboratory tests, and diagnostic imaging techniques in diagnosis and assessment of rheumatic diseases
   6. Therapeutics
      a. Non pharmacological Therapy

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b. Surgical Intervention
c. Therapeutic agents and techniques: indications/contraindications, administration, monitoring and complications

CLINICAL COMPETENCIES AND SKILL REQUIREMENTS

1. Elicit a history that is relevant, concise, and accurate and appropriate to the patient's problem(s).
2. Perform a physical examination (with special attention to the musculoskeletal system) that is relevant and appropriate to the patient's problems.
These skills should include the following:
  • Measures of arthritic disease activity
  • Measures of arthritic damage and deformity
  • Detection of Extra-articular Complications
  • Functional Assessment
  • Pain Amplification
  • Assessment of Spinal Disease
  • Assessment of Regional Pain Syndrome
3. Demonstrate knowledge of, indications for, and interpretation of:
  • Specialized immunological and serologic investigations
  • Joint aspiration and synovial fluid analysis.
  • Tissue biopsies
  • Electromyography and nerve conduction studies
  • Diagnostic imaging of joint and skeletal diseases.
4. Synthesize data derived by the above processes to derive the most likely diagnosis(es) and differential diagnosis(es).
5. Apply knowledge and expertise to performance of technical skills relevant to Rheumatology including joint and soft tissue aspiration and injections and synovial fluid analysis.
6. Develop an appropriate management and therapeutic plan in both inpatient and outpatient settings
7. Demonstrate effective consultation skills in the provision of timely well-documented assessments and recommendations in written and/or verbal forms.

B. Communicator
Key Competencies: Physicians are able to...

1. Develop rapport, trust and ethical therapeutic relationships with patients and families
2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues and other professionals
3. Accurately convey relevant information and explanations to patients and families,
colleagues and other professionals
4. Develop a common understanding on issues, problems and plans with patients and families, colleagues and other professionals to develop a shared plan of care
5. Convey effective oral and written information about a medical encounter

Specific Requirements:
The resident must be able to:

vi) Communicate effectively with all staff including nursing, allied health and physicians and discuss appropriate information with patients and families and all members of the interdisciplinary health care team
vii) Establish effective relationships with patients, family members and other caregivers in order to obtain a meaningful history, conduct a relevant physical examination, and to properly manage a patient’s medical problem
viii) Understand the psychosocial aspects of caring for patients with acute, chronic and life threatening disorders, and the impact of illness on their families
ix) Understand the biomedical ethics involved in the investigation and care of patients with rheumatological disorders, including the appropriate treatment of patients whose families hold religious or other beliefs that preclude the use of “standard medical treatments”
x) Demonstrate effective communication skills by presenting concise, informative overviews on topics in the diagnosis of rheumatologic disorders

C. Collaborator

Key Competencies: Physicians are able to...

1. Participate effectively and appropriately in an interprofessional healthcare team
2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict

Specific Requirements:
The rheumatology resident should be able to:

i) Contribute clinically useful rheumatological opinions on patients referred for consultation, including ordering and arranging for specific testing, administering required therapy, and conveying the results of the rheumatological opinion to referring physicians. This process involves integrating information from multiple sources to construct a clear diagnosis which is then used to guide the patient’s therapy. This may require integrating the results of the clinical, laboratory, EMG, radiological data.
ii) Consult and collaborate with physicians, laboratory staff, clinic staff, and other health care professionals, and contribute effectively to interdisciplinary team activities within and between hospitals, other health care facilities and collaborative groups

D. Manager
Key Competencies: Physicians are able to...

1. Participate in activities that contribute to the effectiveness of their healthcare organizations and systems
2. Manage their practice and career effectively
3. Allocate finite healthcare resources appropriately
4. Serve in administration and leadership roles, as appropriate

Specific Requirements:
The rheumatology resident should be able to:
  a. Demonstrate knowledge of the definitions and role of audits, quality improvement, risk management and incident reporting in a hospital and ambulatory setting, particularly as applied to rheumatology
  b. Demonstrate understanding of cost/benefit ratios of diagnostic and therapeutic interventions, cost containment and efficacy as they relate to quality assurance, particularly as they apply to rheumatology

E. Health Advocate
Key Competencies: Physicians are able to...

1. Respond to individual patient health needs and issues as part of patient care
2. Respond to the health needs of the communities that they serve
3. Identify the determinants of health of the populations that they serve
4. Promote the health of individual patients, communities and populations

Specific Requirements:
The rheumatology resident should be able to:

  a. Demonstrate an appreciation of the health care needs of patients with all serious rheumatological conditions that necessitates admission to hospital
  b. Encourage the promotion of active family involvement in decision-making and continuing management
  c. Understand the ways effective laboratory support is important to patients with rheumatological and medical problems
  d. Advocate for patients if there are delays in diagnosis and management as a result of limited resources
F. Scholar
Key Competencies: Physicians are able to...

1. Maintain and enhance professional activities through ongoing learning
2. Critically evaluate information and its sources, and apply this appropriately to practice decisions
3. Facilitate the learning of patients, families, students, residents, other health professionals, the public, and others, as appropriate
4. Contribute to the creation, dissemination, application, and translation of new medical knowledge and practices

Specific Requirements:
The rheumatology resident should:
1. Provide evidence in the material that they present during their presentations of cases to rheumatology attendings that they are acquiring an appropriate level of in-depth knowledge pertaining to rheumatology diagnostics and a current understanding of the pathophysiology of the attendant rheumatologic disorder
2. Develop critical appraisal skills specific to the rheumatologic literature, particularly as it applies to the physiology and pathophysiology of the particular rheumatologic disorder being treated

G. Professional
Key Competencies: Physicians are able to...
1. Demonstrate a commitment to their patients, profession, and society through ethical practice
2. Demonstrate a commitment to their patients, profession, and society through participation in profession-led regulation
3. Demonstrate a commitment to physician health and sustainable practice.

Specific Requirements:
1. The rheumatology resident should:
   a. Deliver highest quality care with integrity, honesty, and compassion
   b. Exhibit appropriate personal and interpersonal professional behaviour
   c. Practice medicine ethically consistent with obligations of a physician
   d. Be courteous and punctual
   e. Follow-up on patients evaluated
   f. Arrange additional laboratory investigations, as appropriate
MSK Radiology for Rheumatology Residents  
St. Joseph’s Hospital  
Rotation Director Dr. John O’Neill

RADIOLOGY ROTATION

The Radiology Rotation will be for a period of four (4) weeks within the Diagnostic Imaging Department at St. Joseph’s Healthcare Hamilton. The rotation will be divided into two, each of two weeks duration and commencing within the first three months of the first and second year. The first year will concentrate on an introduction to diagnostic imaging in all aspects as related to rheumatology. The second year will be a more in depth review of advanced imaging. Academic and research will be promoted throughout the rotation.

Rheumatology Residents will be involved with the management of in patients and out patients as it pertains to musculoskeletal imaging.

**Year 1**

**TECHNICAL ASPECTS**

A brief overview of the technical aspects including the physics of image acquisition of plain radiographs, ultrasound, MRI, CT and Fluoroscopy.

UNDERSTANDING OF RADIATION EXPOSURE

COMMONLY-ENCOUNTERED ARTEFACTS

NORMAL ANATOMY

This is an essential component in the interpretation of imaging studies. Residents should obtain a good understanding of normal anatomical structures of the musculoskeletal system and imaging appearance on plain films, CT, MRI, Fluoroscopy and Ultrasound.

INTERVENTIONAL RADIOLOGY

Residents will be exposed to musculoskeletal interventional procedures including joint injections and aspirations under fluoroscopy, arthrography (CT/MRI) bone biopsy, role of vertebroplasty.

**APPROPRIATENESS CRITERIA**

REVIEW OF THE CANADIAN GUIDELINES WITH RESPECT TO MUSCULOSKELETAL IMAGING REVIEWED IN CONJUNCTION WITH RHEUMATOLOGY MANAGEMENT GUIDELINES

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PATHOLOGY

Acquire ability in the interpretation of plain radiographic findings in inflammatory arthropathies, osteoarthritis & osteoporosis.

Obtain a basic understanding of the role of MRI and Ultrasound in the investigation of rheumatological disease.

Obtain a basic understanding of the imaging appearance of systemic disease in rheumatological conditions.

RESEARCH

Partake in radiological/clinical research projects in co-ordination with supervisor of rotation

Year 2

There will be ongoing close interaction between the fellow and the diagnostic imaging department throughout the two year rotation. The second dedicated 2 week block will reinforce already achieved knowledge base and will provide deeper insight to future developments within imaging as they pertain to rheumatology.

ELECTIVE INFORMATION

At 8am on the first morning of the elective, the Resident should introduce himself/herself to the Program Director or substitute if the former is not available. The Resident should appropriately dress for the rotation as they would for any clinical rotation.

Residents will obtain an academic half-day on Wednesday pm.

Attendance at clinical radiological rounds for rheumatology – 7am to 8am with presentation of cases.

Contribution to and advancement of the radiology/rheumatology database.

Residents will have full access to the Diagnostic Imaging Library (Centre of Advanced Radiological Learning) CARL, which includes textbooks, case reviews, web-based resources for self-directed learning. Residents will have available a MSK Imaging Clinical Fellow and MSK Staff Radiologist as supervision and as part of a dynamic interactive forum.
GOALS AND OBJECTIVES

The following sections outline the rotation expectations in CanMEDS roles with the domains of medical expert, communicator, collaborator, manager, health advocate, scholar and professional.

A. Medical Expert

Key Competencies: Physicians are able to...

1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-related medical care
2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their practice
3. Perform a complete and appropriate assessment of a patient
4. Use preventive and therapeutic interventions effectively
5. Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic
6. Seek appropriate consultation from other health professionals, recognizing the limits of their expertise

Specific Requirements:
1. The rheumatology resident must demonstrate in depth knowledge in the following general areas:
   1. The basic technical aspects of imaging including the physics of image acquisition of plain radiographs, ultrasound, MRI, CT and Fluoroscopy
   2. Understanding of radiation exposure
   3. Normal anatomical structures of the musculoskeletal system and imaging appearance on plain films, CT, MRI, Fluoroscopy and Ultrasound.
   4. Indications and technique of MSK interventional procedures including joint injections and aspirations under fluoroscopy, arthrography (CT/MRI) and role of vertebroplasty
   5. The interpretation of plain radiographic findings in inflammatory arthropathies, Osteoarthritis and osteoporosis.
   6. Basic understanding of the role of MRI and ultrasound in the investigation of rheumatological disease
   7. Imaging appearance of systemic disease in rheumatological conditions

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B. Communicator

**Key Competencies: Physicians are able to...**

1. Establish appropriate therapeutic relationships with patients/families.
2. Listen effectively.
3. Obtain the appropriate information during consultation with referring physicians in order to be able to make recommendations regarding the most appropriate testing and/or management of patients.
4. Discuss appropriate information with patients/families and the health care team, and be able to obtain informed consent for tests and procedures when this is needed.

**Specific Requirements:**
The resident must be able to:

1. Understand the importance of communication with referring physicians, including an understanding of when the results of an investigation or procedure should be urgently communicated.
2. Communicate effectively with patients and their families and have a compassionate interest in them.
3. Recognize the physical and psychological needs of the patient and their families undergoing radiological investigations and/or treatment, including the needs of culture, race and gender.

C. Collaborator

**Key Competencies: Physicians are able to...**

1. Participate effectively and appropriately in an interprofessional healthcare team.
2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict.

**Specific Requirements:**
The rheumatology resident should be able to:

1) Contribute clinically useful rheumatological opinions on patients referred for consultation utilizing radiological data.
2) Have the ability to function as a member of a multi-disciplinary health care team in the optimal practice of radiology as it applies to rheumatology.
D. Manager

Key Competencies: Physicians are able to...

1) Utilize resources effectively to balance patient care, learning needs, and other activities.
2) Allocate finite health care resources wisely.
3) Work effectively and efficiently in a health care organization.
4) Utilize information technology to optimize patient care, life-long learning and other activities.

Specific Requirements:
The rheumatology resident should be able to:

1) Be competent in conducting or supervising quality assurance including an understanding of safety issues and economic considerations.
2) Be competent in computer science as it pertains to the practice of radiology as it applies to rheumatology.
3) Effectively manage their time

E. Health Advocate

Key Competencies: Physicians are able to...

1. Respond to individual patient health needs and issues as part of patient care
2. Respond to the health needs of the communities that they serve
3. Identify the determinants of health of the populations that they serve
4. Promote the health of individual patients, communities and populations

Specific Requirements:
The rheumatology resident should be able to:

1) Understand and communicate the benefits and risks of radiological investigation and treatment in a rheumatologic population
2) Recognize when radiological investigation or treatment would be detrimental to the health of a patient in the rheumatologic patient.
3) Educate and advise on the use and misuse of radiological imaging in a rheumatologic patient.
F. Scholar
Key Competencies: *Physicians are able to*...

1) Maintain and enhance professional activities through ongoing learning
2) Critically evaluate information and its sources, and apply this appropriately to practice decisions
3) Facilitate the learning of patients, families, students, residents, other health professionals, the public, and others, as appropriate
4) Contribute to the creation, dissemination, application, and translation of new medical knowledge and practices

Specific Requirements:
The rheumatology resident should:

1) Have competence in evaluation of the medical literature.
2) Be an effective teacher of radiology to medical students, residents, technologists and clinical colleagues as it applies to rheumatologic conditions.
3) Have the ability to understand how to conduct a radiology research project in rheumatology, which may include quality assurance.
4) Have an appreciation of the important role that basic and clinical research plays in the critical analysis of current scientific developments related to radiology in rheumatology.
5) Understand and effectively undertake self directed learning

G. Professional
Key Competencies: *Physicians are able to*...

1) Deliver highest quality care with integrity, honesty and compassion.
2) Exhibit appropriate personal and interpersonal professional behaviours.
3) Practice medicine ethically consistent with the obligations of a physician respecting the needs of culture, race and gender.

Specific Requirements:
1. The rheumatology resident should:

1) Be able to accurately assess one's own performance, strengths and weaknesses.
2) Deliver highest quality care with integrity honesty and compassion
3) Exhibit appropriate personal and interpersonal professional behaviour
4) Practice medicine ethically consistent with obligations of a physician
5) Be courteous and punctual
Laboratory Training for Rheumatology Residents
Immunology and Histocompatibility Laboratories, HRLMP, HHS
Laboratory Supervisor – Dr. Denis Snider

OVERVIEW:

This program of teaching is designed to introduce immunology and histocompatibility testing procedures to the Rheumatology residents at McMaster University, during their training. The course is a concise in-lab experience that details the methods used in standard testing, with the intent of providing critical understanding of (1) test interpretation, (2) the meaning of reported results and comments, (3) critical values and normal ranges, and (4) typical case results.

A. Basic Format and Logistics:

Residents must make a request directly to the laboratory staff (HSC 2N49, x76268 – ask for Gloria) or the histocompatibility lab staff (HSC 4H4, x22760 – ask for Sara) to set up time(s) for each of the six different areas of testing areas.

One half day is spent on each area of testing. The resident will arrange for each of these according to their time and the availability of laboratory staff to provide the training. It is required that all areas be completed within a 1 month period. It is recommended that all areas be completed within 2 weeks. No more than two residents may be trained in a specific area at the same time.

The technologist assigned to teach each area will explain the principle of the test, basic functions of the instrumentation, and simplified instructions on the performance of the test, requiring approximately 45-60 minutes. The resident will observe performance of the test, as time permits. The technologist will provide information on reporting language, cutoff values, critical values and reference intervals. The technologist will provide each resident with a bench copy of a portfolio with patient examples, including normal and abnormal results for review. The portfolio will also include 2 or more “case” studies illustrating test results in evaluation of specific patient types. A one-page evaluation quiz will then be given to each resident and completed before leaving the lab. At the end of each session the resident and the lab technologist will complete and sign the teaching checklist.

Following completion of the entire program, the resident will notify the immunology and histocompatibility laboratory scientist (Dr. Snider – x22813 or sniderd@mcmaster.ca) that their training is complete. The resident and scientist will meet to discuss the results of evaluation tests and review the learning experience. The scientist will then administer a short oral evaluation test, related to any of the testing areas covered in the lab experience. A final written report on the evaluation will be provided to the resident and the Head of the Training Program.

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B. Testing areas to cover:

(1) **Protein Electrophoresis** – including serum and urine protein electrophoresis with cryoglobulins, and immuno-fixation electrophoresis

(2) **Tissue Immunofluorescence** – Indirect tissue immunofluorescence for auto-antibodies including ANA, Skeletal, and Endomysial antibodies

(3) **Elisa**- Antibodies to ENA, Celiac disease panel, GBM, dsDNA, ANCA, CyclicCitrullinated Peptide (CCP), SCL 70

(4) **BNII (Nephelometry)** – quantitation of serum proteins including immunoglobulins, C3, C4, CRP, Rheumatoid factor, and other acute phase reaction proteins.

(5) **Flow Cytometry** – T & B lymphocyte subsets, HLA-B27

(6) **Histocompatibility B**: HLA A,B,DR typing, HLA-B27 typing by SSP-PCR
FINAL EVALUATION REPORT: 2007

Laboratory Training for Rheumatology Residents
Immunology and Histocompatibilty Laboratories, HRLMP, HHS

Date: ______________
Evaluator: ______________
Resident: ______________
Oral Evaluation Results: Satisfactory ______ Not Satisfactory _______

Evaluator’s comments:

Review of In-lab Evaluation and Experience:

Evaluator’s Comments:  

Resident’s Comments:  

I hereby certify that Dr. _______________ has successfully completed the Rheumatology Residents Laboratory Training, in the Immunology and Histocompatibility Laboratories, at McMaster University Medical Center.

Evaluator  
Resident

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The following sections outline the rotation expectations in CanMED roles with the domains of medical expert, communicator, collaborator, manager, health advocate, scholar and professional.

**A. Medical Expert/Clinical Decision-Maker**

**General Requirements**

1. Demonstrate diagnostic and therapeutic skills for ethical and effective patient care.
2. Access and apply relevant information to clinical practice
3. Demonstrate effective consultation services with respect to patient care, education and legal opinions.

**Specific Requirements**

1. **Pathophysiology**
   Acquire a basic knowledge of normal and abnormal immunology and histocompatibility testing procedures and to apply this knowledge to the understanding of rheumatologic disease.
2. **Consultation**
   Integrate history and physical findings with the laboratory investigation and plan further investigations to aid in differential diagnosis and management, and to incorporate these into a formal written medical biochemistry consultation report.
3. **Interpretation of Results**
   Understand the principles and limitations of immunologic and histocompatibility analyses and apply these concepts to the interpretation of test results. The resident must demonstrate a methods of estimating reference values, concepts or normality and drug and other interferences with test results.
4. **Analytical Methods**
   Basic knowledge of general and special technical analyses currently used in clinical immunologic and histocompatibility laboratories. This will include knowledge of their principles and an understanding of the limitations of the procedures.
5. **Instrumentation**
   Understand the operating principles of manual and automated analytical instruments and to understand the limitations of their use.

**B. Communicator**

1. Establish therapeutic relationships with patients and families.
2. Obtain and synthesize relevant history from patients, families and communities.
3. Listen effectively.
4. Discuss appropriate information with patients and families and the health care team.
C. Collaborator

1. Consult effectively with other physicians and health care professionals.
2. Contribute effectively to other interdisciplinary team activities.

D. Manager

General Requirements

1. Utilize resources effectively to balance patient care, learning needs, and professional activities.
2. Allocate finite health care resources wisely.
3. Work effectively and efficiently in a health care organization.
4. Utilize information technology to optimize patient care, life-long learning and other activities.

Specific Requirements

Quality Control
Understand the basic principles of quality control

Management of a Laboratory
Have a basic understanding of the administrative, legal, and physical requirements for the operation of a hospital immunology laboratory.

E. Health Advocate

1. Identify the important determinants of health affecting patients.
2. Contribute effectively to improved health of patients and communities.
3. Recognize and respond to those issues where advocacy is appropriate.

F. Scholar

General Requirements

1. Develop, implement and monitor a personal continuing education strategy.
2. Critically appraise sources of medical information.
3. Facilitate learning of patients, housestaff/students and other health professionals.
4. Contribute to development of new knowledge.

Specific Requirements

Teaching
Demonstrate an ability to teach basic immunology and histocompatibility testing as it applies to rheumatology. This will require that the resident learn the techniques of effective teaching in both informal and formal settings.
G. Professional

1. Deliver highest quality care with integrity, honesty and compassion.
2. Exhibit appropriate personal and interpersonal professional behaviors.
3. Practice medicine ethically consistent with obligations of a physician.
ELECTIVES ROTATION

Electives Supervisor Dr. T. Scocchia

The electives rotation is designed to help fulfill any objectives or rotations that are not found in the mandatory rotations. This rotation is relatively flexible and any elective will be considered as long as it meets Royal College Standards. Objectives for this rotation should be drawn up and discussed with and approved by Dr. Scocchia well in advance of the chosen elective (6-8 weeks prior to your elective). A copy of this will also need to be forwarded to Dr. Khalidi and Ms. Rennee Tremblay.

Available electives would be considered in the following disciplines for which our institution has many superb physician educators. Examples of available disciplines and physicians are below:

1) Orthopedics - Dr. Adili, hip and knee
   Dr. Moro- shoulder and upper limb
   Dr. Saunders – hand and foot surgery
   Dr. DeBeer – hip and knee surgery
   Dr. Mandell- shoulder and upper limb

2) Physical Medicine and Rehabilitation – Drs. Kumbhare, Mathoo
3) Neuromuscular Clinic - Drs. Tarnopolsky and Baker
4) Plastic surgery- Drs. C. Levis, A. Thoma
5) Pathology – SJH and HGH
6) Radiology – Drs. O’Neill, Harish
7) EMG Clinic – Dr. Kean, Dr. Kumbhare, Dr. Mathoo

Rotations for pediatric rheumatology are available through the Hospital for Sick Children

An elective can also be chosen anywhere meeting Royal College Standards for Rheumatology.

GOALS AND OBJECTIVES

The following sections outline the rotation expectations in CanMED roles with the domains of medical expert, communicator, collaborator, manager, health advocate, scholar and professional. The following roles are generic but should be discussed and revised by the resident with Dr. Scocchia if appropriate.

A. Medical Expert

Key Competencies: Physicians are able to...

1. Function effectively as consultants, integrating all of the CanMEDS Roles
to provide optimal, ethical and patient-related medical care
2. Establish and maintain clinical knowledge, skills and attitudes appropriate
to their practice
3. Perform a complete and appropriate assessment of a patient
4. Use preventive and therapeutic interventions effectively
5. Demonstrate proficient and appropriate use of procedural skills, both
diagnostic and therapeutic
6. Seek appropriate consultation from other health professionals, recognizing
the limits of their expertise

Specific Requirements:
1. The rheumatology resident must demonstrate in depth knowledge in the following
general areas:

   1. Classification and diagnosis of rheumatic diseases
   2. Economic and social consequences of rheumatic disease
   3. Evaluation of disability
   4. Functional status and disease activity indicators
   5. Laboratory tests, and diagnostic imaging techniques in diagnosis and assessment
      of rheumatic diseases
   6. Therapeutics
      a. Non pharmacological Therapy
      b. Surgical Intervention
      c. Therapeutic agents and techniques: indications/contraindications,
         administration, monitoring and complications
CLINICAL COMPETENCIES AND SKILL REQUIREMENTS

1. Elicit a history that is relevant, concise, and accurate and appropriate to the patient's problem(s).
2. Perform a physical examination (with special attention to the musculoskeletal system) that is relevant and appropriate to the patient's problems.

These skills should include the following:
- Measures of arthritic disease activity
- Measures of arthritic damage and deformity
- Detection of Extra-articular Complications
- Functional Assessment
- Pain Amplification
- Assessment of Spinal Disease
- Assessment of Regional Pain Syndrome

3. Demonstrate knowledge of, indications for, and interpretation of:
- Specialized immunological and serologic investigations
- Joint aspiration and synovial fluid analysis.
- Tissue biopsies
- Electromyography and nerve conduction studies
- Diagnostic imaging of joint and skeletal diseases.

4. Synthesize data derived by the above processes to derive the most likely diagnosis(es) and differential diagnosis(es).

5. Apply knowledge and expertise to performance of technical skills relevant to Rheumatology including joint and soft tissue aspiration and injections and synovial fluid analysis.

6. Develop an appropriate management and therapeutic plan in both inpatient and outpatient settings.

7. Demonstrate effective consultation skills in the provision of timely well-documented assessments and recommendations in written and/or verbal forms.

B. Communicator

Key Competencies: Physicians are able to...

1. Develop rapport, trust and ethical therapeutic relationships with patients and families
2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues and other professionals
3. Accurately convey relevant information and explanations to patients and families, colleagues and other professionals
4. Develop a common understanding on issues, problems and plans with patients and families, colleagues and other professionals to develop a shared plan of care
5. Convey effective oral and written information about a medical encounter
Specific Requirements:
The resident must be able to:

xii) Communicate effectively with all staff including nursing, allied health and physicians and discuss appropriate information with patients and families and all members of the interdisciplinary health care team
xiii) Establish effective relationships with patients, family members and other caregivers in order to obtain a meaningful history, conduct a relevant physical examination, and to properly manage a patient’s medical problem
xiv) Understand the psychosocial aspects of caring for patients with acute, chronic and life threatening disorders, and the impact of illness on their families
xvi) Understand the biomedical ethics involved in the investigation and care of patients with rheumatological disorders, including the appropriate treatment of patients whose families hold religious or other beliefs that preclude the use of “standard medical treatments”
xvii) Demonstrate effective communication skills by presenting concise, informative overviews on topics in the diagnosis of rheumatologic disorders

C. Collaborator

Key Competencies: Physicians are able to...

1. Participate effectively and appropriately in an interprofessional healthcare team
2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict

Specific Requirements:
The rheumatology resident should be able to:

i) Contribute clinically useful rheumatological opinions on patients referred for consultation, including ordering and arranging for specific testing, administering required therapy, and conveying the results of the rheumatological opinion to referring physicians. This process involves integrating information from multiple sources to construct a clear diagnosis which is then used to guide the patient’s therapy. This may require integrating the results of the clinical, laboratory, EMG, radiological data.

ii) Consult and collaborate with physicians, laboratory staff, clinic staff, and other health care professionals, and contribute effectively to interdisciplinary team activities within and between hospitals, other health care facilities and collaborative groups
D. Manager

Key Competencies: *Physicians are able to...*

1. Participate in activities that contribute to the effectiveness of their healthcare organizations and systems
2. Manage their practice and career effectively
3. Allocate finite healthcare resources appropriately
4. Serve in administration and leadership roles, as appropriate

Specific Requirements:
The rheumatology resident should be able to:

a. Demonstrate knowledge of the definitions and role of audits, quality improvement, risk management and incident reporting in a hospital and ambulatory setting, particularly as applied to rheumatology
b. Demonstrate understanding of cost/benefit ratios of diagnostic and therapeutic interventions, cost containment and efficacy as they relate to quality assurance, particularly as they apply to rheumatology

E. Health Advocate

Key Competencies: *Physicians are able to...*

1. Respond to individual patient health needs and issues as part of patient care
2. Respond to the health needs of the communities that they serve
3. Identify the determinants of health of the populations that they serve
4. Promote the health of individual patients, communities and populations

Specific Requirements:
The rheumatology resident should be able to:

a. Demonstrate an appreciation of the health care needs of patients with all serious rheumatological conditions that necessitates admission to hospital
b. Encourage the promotion of active family involvement in decision-making and continuing management
c. Understand the ways effective laboratory support is important to patients with rheumatological and medical problems
d. Advocate for patients if there are delays in diagnosis and management as a result of limited resources
F. Scholar
Key Competencies: *Physicians are able to*...

1. Maintain and enhance professional activities through ongoing learning
2. Critically evaluate information and its sources, and apply this appropriately to practice decisions
3. Facilitate the learning of patients, families, students, residents, other health professionals, the public, and others, as appropriate
4. Contribute to the creation, dissemination, application, and translation of new medical knowledge and practices

Specific Requirements:
The rheumatology resident should:
1. Provide evidence in the material that they present during their presentations of cases to rheumatology attendings that they are acquiring an appropriate level of in-depth knowledge pertaining to rheumatology diagnostics and a current understanding of the pathophysiology of the attendant rheumatologic disorder
2. Develop critical appraisal skills specific to the rheumatologic literature, particularly as it applies to the physiology and pathophysiology of the particular rheumatologic disorder being treated

G. Professional
Key Competencies: *Physicians are able to*...
1. Demonstrate a commitment to their patients, profession, and society through ethical practice
2. Demonstrate a commitment to their patients, profession, and society through participation in profession-led regulation
3. Demonstrate a commitment to physician health and sustainable practice.

Specific Requirements:
1. The rheumatology resident should:
   a. Deliver highest quality care with integrity honesty and compassion
   b. Exhibit appropriate personal and interpersonal professional behaviour
   c. Practice medicine ethically consistent with obligations of a physician
   d. Be courteous and punctual
   e. Follow-up on patients evaluated
   f. Arrange additional laboratory investigations, as appropriate
RESEARCH ROTATION

Research Supervisor – Dr. J.D. Adachi

The research rotation is designed to help fulfill scholarly activities that the resident is encouraged to participate in.

Ideally, the resident should sit down with Dr. Adachi well in advance of the time allotted for research and discuss a project. Acceptable research projects may include:

1) Analysis of a contemporary clinical problem, involving human subjects, using acceptable statistical methods as required, the results of which are reported at local or national meetings and are eligible for publication in scientific journals.

2) Supervised participation in an ongoing project in experimental medicine

3) Quality assurance study of contemporary practice

4) Study in Medical Education

A resident is encouraged to actively seek out these research opportunities with the multitude of attendings that are available.

Many of the Rheumatologists are engaged in Clinical research and are approachable. Wet lab experience can be obtained and this should be discussed with Dr. Adachi. Similarly, McMaster has a strong Clinical Epidemiology Program and if desired an extra year could be negotiated and is strongly encouraged for those who wish to continue in Academic Medicine.

II. GOALS AND OBJECTIVES

A. Medical Expert

Key Competencies: *Physicians on this rotation are able to...*

1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-centred research
2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their ultimate research goals and expectations
3. Seek appropriate consultation from other health professionals and researchers, recognizing the limits of their expertise
Enabling Competencies: Physicians are able to…

1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-centred research.
   
   1.1 Recognize and respond to the ethical dimensions in research
   1.2 Demonstrate medical expertise in situations other than patient care, such as providing expert legal testimony or advising governments, as needed

2. Establish and maintain clinical knowledge, skills and attitudes appropriate to their ultimate research goals and expectations

   2.1 Apply knowledge of the clinical, socio-behavioural, and fundamental biomedical sciences relevant to the physician’s research interests
      a. Develop a research project, from formulation to execution that will expose the resident to relevant research techniques and new core content area
   2.2 Describe the RCPSC framework of competencies relevant to Rheumatology and Internal Medicine
   2.3 Apply lifelong learning skills of the Scholar Role to implement a personal program to keep up to date, and enhance areas of professional competence

3. Seek appropriate consultation from other health professionals and researchers, recognizing the limits of their expertise

   3.1 Demonstrate insight into his/her limitations of expertise via self-assessment
   3.2 Demonstrate effective, appropriate, and timely consultation of another health professional as needed for their research goals

B. Communicator

Key Competencies: Physicians on this rotation are able to…

1. Develop rapport, trust, and ethical therapeutic relationships with fellow researchers and, if applicable, research subjects
2. Accurately convey relevant information and explanations to patients and families, colleagues and other professionals
3. Accurately convey relevant information and explanations to fellow researchers and the lay public
4. Develop a common understanding on issues, problems and plans with fellow researchers
5. Convey effective oral and written information about research
Enabling Competencies: Physicians are able to...

1. Develop rapport, trust, and ethical therapeutic relationships with fellow researchers and, if applicable, research subjects

   1.1 Recognize that being a good communicator is a core clinical skill for researchers, and that effective communication can foster satisfaction, adherence and improved research and clinical outcomes
   1.2. Establish positive relationships with fellow researchers and, if appropriate, research subjects, that are characterized by understanding, trust, respect, honesty and empathy
   1.3. Respect patient confidentiality, privacy and autonomy
   1.4. Listen effectively

2. Accurately convey relevant information and explanations to patients and families, colleagues and other professionals

   2.1 Gather information
   2.2 Seek out and synthesize relevant information from other sources

3. Accurately convey relevant information and explanations to fellow researchers and the lay public

   3.1 Physicians are able to deliver information to a patient and families, as well as colleagues and other professionals, in such a way that it is understandable and encourages discussion

4. Develop a common understanding on issues, problems and plans with fellow researchers

   4.1 Effectively identify and explore the research problem to be addressed
   4.2 Respect diversity and difference, including but not limited to the impact of gender, religion and cultural beliefs on decision-making
   4.3 Encourage discussion, questions, and interaction
   4.4 Effectively address challenging communication issues such as obtaining informed consent, delivering scientific results, and denying access to research protocols by ineligible patients

5. Convey effective oral and written information about research

   5.1 Maintain clear, accurate, and appropriate records (e.g., written or electronic)
   5.2 Effectively present verbal reports describing research methodology and results
   5.3 Prepare a written report on a research project describing methodology and results
   5.4 When appropriate, effectively present medical information to the public or media about a medical or research issue
C. Collaborator

Key Competencies: Physicians on this rotation are able to...

1. Participate effectively and appropriately in an interprofessional team
2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict

Enabling Competencies: Physicians are able to...

1. Participate effectively and appropriately in an interprofessional team
   1.1 Clearly describe their roles and responsibilities to other professionals
   1.2 Describe the roles and responsibilities of other professionals within the research team
   1.3 Recognize and respect the diversity of roles, responsibilities and competences of other professionals in relation to their own
   1.4 Work with others to assess, plan, provide and integrate research activities
   1.5 Where appropriate, work with others to assess, plan, provide and review other tasks, such as research problems, educational work, program review or administrative responsibilities
   1.6 Participate effectively in interprofessional team meetings
   1.7 Enter into interdependent relationships with other research professionals
   1.8 Describe the principles of team dynamics
   1.9 Respect team ethics, including confidentiality, resource allocation and professionalism
   1.10 Where appropriate, demonstrate leadership in a research team

2. Effectively work with other health professionals to prevent, negotiate, and resolve interprofessional conflict
   2.1 Demonstrate a respectful attitude towards other colleagues and members of an interprofessional team
   2.2 Work with other professionals to prevent conflicts
   2.3 Employ collaborative negotiation to resolve conflicts
   2.4 Respect differences, misunderstandings and limitations in other professionals
   2.5 Recognize one’s own differences, misunderstanding and limitations that may contribute to interprofessional tension
   2.6 Reflect on interprofessional team function

D. Manager

Key Competency: Physicians on this rotation are able to...

1. Participate in activities that contribute to the effectiveness of their research organizations and system
2. Manage their practice and career effectively
3. Allocate finite healthcare resources appropriately
4. Serve in administration and leadership roles, as appropriate

**Enabling Competencies:** *Physicians are able to...*

1. **Participate in activities that contribute to the effectiveness of their research organizations and systems**
   1.1 Work collaboratively with others in their organizations
   1.2 Participate in systemic quality process evaluation and improvement
   1.3 Describe the structure and function of the healthcare system as it relates to their specialty and research project, including the roles of physicians

2. **Manage their practice and career effectively**
   2.1 Set priorities and manage time to complete a research project, while balancing outside activities and personal life
   2.2 Manage a research organization including finances and human resources
   2.3 Implement processes to ensure personal practice improvement
   2.4 Employ information technology appropriately

3. **Allocate finite healthcare resources appropriately**
   3.1 Recognize the importance of just allocation of research resources
   3.2 Apply evidence and management processes for cost-appropriate research

4. **Serve in administration and leadership roles, as appropriate**
   4.1 Chair or participate effectively in committees and meetings
   4.2 Lead or implement a change in research
   4.3 Plan relevant elements of research (e.g. supply management, ethics submissions)

**E. Health Advocate**

**Key Competencies:** *Physicians on this rotation are able to...*

1. Respond to the health needs of the communities that they serve
2. Identify the determinants of health for the populations that they serve
   4. Promote the health of individual patients, communities, and populations
   5.

**Enabling Competencies:** *Physicians are able to...*

1. **Respond to the health needs of the communities that they serve**
   1.1 Describe the practice communities that they serve
   1.2 Identify opportunities for advocacy, health promotion and disease prevention
in the communities that they serve, and respond appropriately
1.3 Appreciate the possibility of competing interests between the communities served and other populations

2. Identify the determinants of health for the populations that they serve
   2.1 Identify the determinants of health of the populations, including barriers to access to care and resources
   2.2 Identify vulnerable or marginalized populations within those served and respond appropriately

3. Promote the health of individual patients, communities, and populations
   3.1 Describe an approach to implementing a change in a determinant of health of the populations they serve
   3.2 Describe how public policy impacts on the health of the populations served
   3.3 Identify points of influence in the healthcare system and its structure
   3.4 Describe the ethical and professional issues inherent in health advocacy, including altruism, social justice, autonomy, integrity and idealism
   3.5 Appreciate the possibility of conflict inherent in their role as a health advocate for a patient or community with that of manager or gatekeeper
   3.6 Describe the role of the medical profession in advocating collectively for health and patient safety

F. Scholar

Key Competencies: Physicians on this rotation are able to...

1. Maintain and enhance professional activities through ongoing learning
2. Critically evaluate information and its sources, and apply this appropriately to research decisions
3. Facilitate the learning of patients, families, students, residents, other health professionals, the public and others, as appropriate
4. Contribute to the development, dissemination, and translation of new knowledge and practices

Enabling Competencies: Physicians are able to...

1. Maintain and enhance professional activities through ongoing learning
   1.1 Describe the principles of maintenance of competence
   1.2 Describe the principles and strategies for implementing a personal knowledge management system
   1.3 Recognize and reflect learning issues in practice and in research
   1.4 Pose an appropriate research question
   1.5 Access and interpret the relevant literature
   1.6 Integrate new learning into research protocol/clinical practice
1.7 Evaluate the impact of any change in practice
1.8 Document the learning process

2. Critically evaluate information and its sources, and apply this appropriately to research decisions
   2.1 Describe the principles of critical appraisal
   2.2 Critically appraise retrieved evidence in order to address a research question
   2.3 Integrate critical appraisal conclusions into research practice

3. Facilitate the learning of patients, families, students, residents, other health professionals, the public and others, as appropriate
   3.1 Describe principles of learning relevant to medical education
   3.2 Collaboratively identify the learning needs and desired learning outcomes of others
   3.3 Select effective teaching strategies and content to facilitate others’ learning
   3.4 Demonstrate an effective lecture or presentation
   3.5 Assess and reflect on a teaching encounter
   3.6 Provide effective feedback
   3.7 Describe the principles of ethics with respect to teaching

4. Contribute to the development, dissemination, and translation of new knowledge and practices
   4.1 Describe the principles of research and scholarly inquiry
   4.2 Describe the principles of research ethics
   4.3 Pose a scholarly question
   4.4 Conduct a systematic search for evidence
   4.5 Select and apply appropriate methods to address the question
   4.6 Appropriately disseminate the findings of a study

G. Professional

Key Competencies: Physicians on this rotation are able to...
1. Demonstrate a commitment to their patients, profession, and society through ethical practice
2. Demonstrate a commitment to their patients, profession and society through participation in profession-led regulation
3. Demonstrate a commitment to physician health and sustainable practice

Enabling Competencies: Physicians are able to...
1. Demonstrate a commitment to their patients, profession, and society through ethical practice
   1.1 Exhibit appropriate professional behaviours in research and practice, including honesty, integrity, commitment, compassion, respect and altruism
   1.2 Demonstrate a commitment to performing high quality research and to
delivering the highest quality care and maintenance of competence
1.3 Recognize and appropriately respond to ethical issues encountered in research and in clinical practice
1.4 Appropriately manage conflicts of interest
1.5 Recognize the principles and limits of research subject and patient confidentiality as defined by professional practice standards and the law
1.6 Maintain appropriate relations with collaborators, research subjects and patients

2. Demonstrate a commitment to their patients, profession and society through participation in profession-led regulation
   2.1 Appreciate the professional, legal and ethical codes of practice
   2.2 Fulfil the regulatory and legal obligations required of current practice
   2.3 Demonstrate accountability to professional regulatory bodies and to research colleagues
   2.4 Recognize and respond to others’ unprofessional behaviours in practice and in research
   2.5 Participate in peer review

3. Demonstrate a commitment to physician health and sustainable practice
   3.1 Balance personal and professional priorities to ensure personal health and a sustainable practice
   3.2 Strive to heighten personal and professional awareness and insight
   3.3 Recognize other professionals in need and respond appropriately
**Academic Mentoring**  
Supervisor – Dr. Pauline Boulos

All residents will be expected to meet with Dr. Boulos at the beginning of their Residency and then will be asked to meet periodically throughout their 2 years to see if they are achieving their goals.

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**Academic Mentoring Checklist for Rheumatology Residency**  
**At McMaster University**

Name of Trainee: ________________________________________________

Year of Training: ________________________________________________

Date of Meeting: ________________________________________________

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**Questions to review and options to explore with Rheumatology Trainee**

(Circle all applicable on left side and add comments on right)

1) What type of practice they are interested in?

   a. Academic  
      i. Clinical Research  
      ii. Basic Science Research  
      iii. Education

   b. Community

2) What type of medical practice are they considering?

   a. Rheumatology only  
      i. Adult  
      ii. Pediatrics  
      iii. Both adult & pediatrics  
         (imp. for community)

   b. Rheumatology + General Internal Medicine
3) How are they planning to achieve their goals?

<table>
<thead>
<tr>
<th>a. Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. mentors/collaborators</td>
</tr>
<tr>
<td>ii. projects?</td>
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<table>
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<tr>
<th>b. Supplementary degrees</th>
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<tbody>
<tr>
<td>i. Master’s in</td>
</tr>
<tr>
<td>- HRM</td>
</tr>
<tr>
<td>- Education</td>
</tr>
<tr>
<td>ii. PhD</td>
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</tbody>
</table>

| c. Adequate community rheumatology experience? |

4) Do they know where they would like to practice?

| City, province, country? |

5) When they are nearing the end of their Fellowship training discuss:

| a. Applying for an academic position (if applicable) – the various universities and arranging contact persons |
| b. Finding a community to work in (if applicable) and arranging to meet with a contact person in that community |
| c. Opening own office (location, equipment, leases, support staff) |
| d. Billing |
Additional Comments:

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

__________________________________________  _________________
Academic Mentoring Advisor                   Date
Examinations

Supervisors – Drs. T. Scocchia and Bobba

Residents will be periodically be tested formally by the use of a variety of methods such as written and performance based assessment. This provides us with important information about strengths and deficiencies. It also is an excellent opportunity for all o to do practice exams.

This will include an OSCE, which will usually be performed at a National level at the National Rheumatology Resident’s Weekend but will also be administered locally.

Additionally multiple choice and short answer questions as well as long case orals will be administered throughout the 2 years of residency.

All practice exams will be reviewed with the resident in a timely fashion and feedback will be given at that time.
Call

Call for the Rheumatology Resident will be 1 in 3. A call schedule will be prepared through Dr. Khalidi’s office by the Administrative Assistant, Rennee Tremblay and reviewed by Dr. Khalidi. Call will be from home and will be citywide i.e. covering the four major hospitals (St. Joseph’s Hospital, Hamilton General Hospital, Henderson Hospital and McMaster University Medical Center). There will be a Rheumatology resident (PGY4 and higher) on first call at night from 5pm-8am. There will be an attending on second call with the resident, one for SJH, HGH and Henderson and a separate attending for MUMC.

During the day when the resident is on the SJH rotation the following will apply:

1. First call will go to the PGY 1-3 resident who is on inpatient service
2. Second call to the Rheumatology resident
3. Third call to the Attending on service
4. During Academic half day, the residents will be relieved of any and all calls to devote themselves to this academic endeavor i.e. 2-6pm. ALL first calls will go to the attending for that time period

During all other rotations, daytime calls will be determined by the rotation they are on and by their site coordinator. In most cases there will be no fixed daytime call. For example, during the research rotation there is no daytime call.

All requests for preferred call times should be submitted at least 30 days prior to Rennee Tremblay.
Ombudsperson

There is a faculty representative in the Department of Medicine that is assigned as an Ombudsperson, Dr. Alexandra Papaioannou that is not otherwise involved in Residency Program Administration. She is available for residents as a liaison between the resident and their supervisors, if there are any difficulties. Residents will be encouraged to discuss any difficulties with the program director. If difficulties are encountered that cannot be resolved with the program director, then the postgraduate office may be contacted. A list of resources for help is provided by the postgraduate office, which includes a PAIRO hotline.

Dr. Papaioannou will receive evaluations of all attendings and no other attending will be privy to these evaluations, including the program director, Dr. Khalidi. These will be used by Dr. Papaioannou to determine any further course of action that would be needed if difficulties arise.
Immunology Lab Tests
Background Reading

Rheumatology Residents Lab Rotation
HRLMP, HHS

Some of the major laboratory technologies used to provide important tests for clinical immunology at McMaster are reviewed in this document. These are some of the technologies and tests you will observe in your lab rotation.

1. ELISA – Enzyme Linked Immunosorbent Assay (for serum antibodies)
2. Serum Protein Electrophoresis (eg. mono/oligo clonal gammopathies)
3. ImmunoFixation (a kind of western blot)
4. SSP-PCR (sequence-specific primers - polymerase chain reaction)
5. Flow Cytometry (eg. phenotyping, CGD)
6. Indirect Immunofluorescence (eg. ANA testing)
**Enzyme-Linked Immunosorbent Assay (ELISA)**

ELISA is a widely-used method for measuring the concentration of a particular molecule (e.g., a hormone or drug) in a fluid such as serum or urine. It is also known as enzyme immunoassay or EIA.

However, the major use of this method in the immunology lab at HHS is detection of serum antibodies as diagnostic indicators of disease. For this, a diagnostic antigen (e.g. DNA, gliadin, ANCA, etc.) is bound to a solid phase (plastic well) in order to allow binding of serum antibodies from the patient to that purified antigen (Figure 1). The antibodies are then detected with anti-human IgG/IgA/IgM reagents that are conjugated to an enzyme. Bound enzyme can then cleave a substrate and produce a colour product that is measured by a spectrophotometer.

**Performing the Test**

1. The plastic wells in a commercially prepared microtitre plates are coated with antigen.
2. The serum is added in dilution if necessary, incubated and then the wells are washed free of serum.
3. The anti-human Ig-enzyme conjugate is added to the well. The antibody part of the conjugate binds to any serum antibodies molecules that were bound previously, creating an antigen-antibody-enzyme complex".
4. After washing away any unbound anti-Ig-enzyme conjugate, the substrate solution is added.
5. After a set interval, the reaction is stopped and the amount of colored product formed is measured in a spectrophotometer.

The intensity of color is proportional to the concentration of bound antibodies, provided that the intensity of the colour is in the linear range of the standard curve provided by a purified antibody control. However, in practice most antibody results by ELISA are reported as positive/negative, where the intensity of colour must exceed the intensity calculated for a negative serum control. The test may be modified to provide a titre of antibody, by making dilutions of the test serum, and determining the highest dilution that continues to show a positive result.

**NOTE:** Strictly speaking, any measurement of the enzyme cleaved product is not reliably proportional to the concentration of bound antibody. Rather, the rate at which the cleaved product is produced is directly proportional to the amount of bound enzyme. That is estimates of the concentration of antibody based on that bound to a solid phase antigen must include a standard curve based of a control positive containing a known concentration of antibody.
Antibody detection by ELISA

- An antigen (example here is HIV gp120 protein) coats plastic wells

- Sample serum is applied and if Ab is in the sample it binds to gp120, then excess sample is washed out

- A secondary reagent (a labeled antibody that reacts to human IgG, IgM and/or IgA) is used next to detect bound Ab

- An enzyme is conjugated to the anti-Ig antibody

- Wash step removes excess secondary reagent

- Substrate is incubated and enzyme-cleaved product is measured by spectrophotometer
Serum Protein Electrophoresis

Proteins make up 6–8% of the blood. They are about equally divided between serum albumin and a great variety of serum globulins.

Serum is blood plasma without fibrinogen and other clotting factors.

The serum proteins can be separated by electrophoresis.

- A drop of serum is applied in a band to a thin sheet of supporting material, that has been soaked in a slightly-alkaline salt solution.
- At alkaline pH (8.6 typical), nearly all serum proteins are negatively charged; some more strongly than others.

- A direct current is applied and the serum proteins move toward the positive electrode.
- The stronger the negative charge on a protein, the faster it migrates.
- After a set time, the current is turned off and the proteins are stained to make them visible.
- The separated proteins appear as distinct bands. (Figure 3)
- The most prominent of these and the one that moves closest to the positive electrode is serum albumin.
- The other proteins are the various serum globulins.
- They migrate in the order
  - alpha globulins (e.g., thyroxine binding protein)
  - beta globulins (e.g., transferrin)
  - gamma globulins.
    - Gamma globulins are the least negatively-charged serum proteins. Most antibodies are gamma globulins (immunoglobulins).
    - Gamma globulins become more abundant following infections or immunizations (more Ig produced) or if the patient has myeloma (single clone of cells produce a dominant Ig molecule in serum).
Figure 3.

1. *normal* human serum with its diffuse band of gamma globulins;
2. serum from a patient with **multiple myeloma** producing an *IgG*
3. serum from a patient with Waldenström's macroglobulinemia where the cancerous clone secretes an *IgM* antibody;
4. serum with an *IgA* myeloma protein.

Note: The test does not specifically identify IgG, IgA or IgM, but these Ig have typical locations in the serum electrophorsis
Isoelectric Focussing (IF)

For identification of serum Ig isotype of unusual gammaglobulins.

Serum Protein Electrophoresis can determine if an unusual amount of one or other type of protein is present, but does not identify that protein. In the case of myeloma proteins, identification of the type of Ig is important.

To provide this identification a modification of Western blotting is done. This is known as isoelectric focussing (IF).

IF makes use of serum electrophoresis to separate serum proteins, in effect isolating the aberrant protein into a single concentrated band, on the electrophoretic solid phase material. The post electrophoresis serum proteins can then be incubated with anti-Ig antibodies that are conjugated to an enzyme. These antibodies bind to specific Ig isotypes (IgG, IgA etc.) so a specific isotype can be detected. The enzyme cleaves a dye that precipitates near the enzyme, marking the location of those Ig proteins. A myeloma protein, in high concentration relative to all other Ig will be detected as a distinct band and identified by its isotype.

Figure 4

Serum Electrophoresis: SE
- serum proteins are separated by charge and stained (see Fig 1)
- aberrant protein detection in the γ-globulin region of the serum from myeloma patient (P) compared to control (C)

Immunofixation: IF
- proteins separated by SE
- Separated reacted with anti-Ig reagents conjugated to an enzyme
- reaction product of enzyme stains IgG and K-chains of IgG proteins
The Polymerase Chain Reaction (PCR)

The polymerase chain reaction is a method to rapidly identify and make a large number of copies of any gene encoded by DNA. For gene identification the DNA source is typically genomic DNA taken from blood cells or tissues. Unique sequences within each gene allow specific identification of that gene. The PCR technique requires knowledge of the gene sequence, so that ‘primers’ can be produced that bind to specific regions at the beginning and end of the gene. These are referred to as sequence specific primers (SSP). Hence a common method for gene identification is SSP-PCR, where the primers identify a specific gene, and the PCR amplifies copies of the gene allowing detection of that DNA by size in gel electrophoresis. This method is applied routinely in most HLA labs to type the HLA genes of a patient or donor, prior to transplantation.

The procedure

- The DNA sample is heated to separate its strands and mixed with the primers.
- If the primers find their complementary sequences in the DNA, they bind to them.
- Synthesis begins (as always 5’ -> 3’) using the original strand as the template.
- The reaction mixture must contain
  - all four deoxynucleotide triphosphates (dATP, dCTP, dGTP, dTTP)
  - a DNA polymerase. It helps to use a DNA polymerase that is not denatured by the high temperature needed to separate the DNA strands.
- DNA being double stranded is amplified in opposite directions on each strand. After the first few rounds of amplification the primers bind primarily to PCR products that are of the correct size. Thereafter multiple copies are produced all of the same sequence and size. This is because each cycle doubles the number of DNA molecules.

See Figure 5

Using automated equipment, each cycle of replication can be completed in less than 5 minutes. After 30 cycles, what began as a single molecule of DNA has been amplified into more than a billion copies ($2^{30} = 1.02 \times 10^9$).
With PCR, it is routinely possible to amplify enough DNA from a single hair follicle for DNA typing. Some workers have successfully amplified DNA from a single sperm cell. The PCR technique has even made it possible to analyze DNA from microscope slides of tissue preserved years before. However, the great sensitivity of PCR makes contamination by extraneous DNA a constant problem.

In HLA typing, commercial kits contain many sets of primers, that identify a single or a
few HLA gene types. A “pattern” of reaction products identifies specific HLA types. The high polymorphism of HLA genes/alleles provides a significant challenge to HLA typing by SSP-PCR, because most alleles differ from others by only 1 or 2 base pairs.

**Flow Cytometry**

A significant amount of clinical information on immune cells is provided by analyzing the distribution of WBC types based on their relative size, complexity, and surface or intracellular molecule expression. Flow cytometry allows characterization of a large heterogenous population of cells based on these characteristics. It is especially powerful in looking at multiple parameters cellular phenotype.

A flow cytometer works on the basis of highly controlled fluid stream that allows a linear array of cells to pass through an optical chamber, through which one or more laser beams are projected. Laser light hits each cell, for a brief period of time and scatters or is reemitted to be collected as emission spectra by various detectors. Antibodies with specific fluorochromes attached are used to identify surface or intracellular molecules. Each fluorochromes can be detected separate from others, so each antibody provides identification of a specific marker in the cell population. (Figure 6)

The data generated in flow cytometry are stored on computer for later analysis by software. The data is stored so that multiple parameters of information is associated with each cell that passes through the cytomter. Software analysis of these large data sets reveals specific subsets of cells based on the fluorescence pattern of emitted light.
Figure 6

Flow Cytometry Technology

- fluorescent Ab specific for lymphocyte surface molecules

Mixture of cells is labeled with fluorescent antibody

Laser excitation

Fluorescence detection

CPU

Red PMT

Side scatter

Forward scatter

Green photomultiplier tube (PMT)

Stream of fluid containing antibody-labeled cells
Here are some examples (all courtesy of Becton Dickinson Immunocytometry Systems).

**Figure 7**

Counting T and B cells by flow cytometry. A sample of normal human blood was treated with a fluorescent monoclonal antibody specific for the T cell surface antigen CD3 and a monoclonal antibody conjugated to a different fluorescent dye and specific for the B cell surface antigen designated CD19. Fluorescence intensity (logarithmic) is plotted on the x axis; cell number on the y axis. Note that the number of B cells is substantially less than that of T cells. The right-hand panel 2 dimensional plot of data.

Counting T-cell subsets in normal human blood. Fluorescent monoclonal antibodies were directed against the CD4 molecule (left) and CD8 molecule (right). The preponderance of CD4⁺ over CD8⁺ cells shown here is typical of healthy humans. In AIDS patients, this ratio becomes reversed and the CD4⁺ subset may eventually disappear.
Nephelometry - measures IgA, IgM, IgG

This technique is widely used in clinical laboratories because it is relatively easily automated. It is based on the principle that a dilute suspension of small particles will scatter light (usually a laser) passed through it rather than simply absorbing it. The amount of scatter is determined by collecting the light at an angle (usually about 70 or 75 degrees).

Antibody and antigen (the analyte of interest) are mixed slowly so that only small aggregates formed in suspension. The amount of light scatter is measured and compared to the amount of scatter from known mixtures. The amount of the unknown is determined from a standard curve.
Figure 8: Immune complexes form in solution, principle of Nephelometry
INDIRECT IMMUNOFUORESCENCE

Screening for autoimmune diseases is often performed with the antinuclear antibody (ANA) test in which patient serum is incubated with a tissue substrate to which any autoantibodies in the serum that can bind to nuclear antigens are allowed to bind. Then, a fluoresceinated antibody is added and the tissue is observed under fluorescence microscopy to see if staining is present. Seen here is the typical "homogenous" pattern of nuclear staining of a positive ANA.
Here is another positive ANA in which the substrate cells are a human cell line known as Hep2. Any positive ANA is reported with a titer. The titer is simply the dilution of patient serum at which the test is still positive. The test has to be positive at greater than 1:16 or 1:20 (depending upon the lab) to be positive at all. In general, the higher the titer, the more likely a serious autoimmune disease is present. Thus, a 1:40 result might not mean much, but a 1:1012 certainly should not be ignored.
Sometimes when performing the ANA test, the substrate cells demonstrate particular patterns of staining. This is the so-called "rim" pattern that is more characteristic of SLE.
This is the so-called "speckled" pattern of staining, characteristic of autoantibodies to extractable nuclear antigens, particularly ribonucleoprotein. This pattern is not specific, and may be seen with an "mixed connective tissue disease" (a mix of SLE, scleroderma, and polymyositis, but without serious renal or pulmonary disease. Autoimmune diseases are very hard to classify, even for the experts.

This is the so-called "nucleolar pattern" of staining in which the bright fluorescence is seen within the nucleoli of the Hep2 cells. This pattern is more suggestive of progressive systemic sclerosis.
Here is the famous "LE cell" test which has value only in demonstrating how the concept of autoantibodies work. The pink blobs are denatured nuclei. Here are two, with one seen being phagocytosed in the center by a PMN. This test is not nearly as sensitive as the ANA which has supplanted the LE cell test.