**Molecular Pathology Rotations Goals and Objectives**

**Rotation Directors: Noah Brown, M.D.**

The goal of the **First Molecular Pathology Rotation** is for the resident to move from being a

**Novice**  (A novice knows little about the subject, and rigidly adheres to rules with little situational perception. He/she does not feel responsible for outcomes. )

To

**Advanced Beginner** (The advanced beginner is still dependent on rules, but can adapt rules to changing circumstances. However, all attributes of a situation tend to be given equal importance, and there is still little feeling of personal responsibility for outcomes.)

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| **First Rotation Goals** | **First Rotation Objectives** |
| **Medical Knowledge**Acquires knowledge of pathophysiology and laboratory manifestations of routinely-encountered conditions; knows where to access information to fill gaps in knowledge. | The resident will gain an broad overview of:* The human genome, its organization, nucleic acid structure and function, and gen organization and expression
* Mutations and genetic variation
* Genetics of inherited diseases
* Genetics of cancer
* Molecular diagnostic technologies, including
	+ Nucleic acid isolation and quantification
	+ Enzymatic digestion
	+ Polymerase chain reaction (PCR), including allele-specific PCR and real-time PCR
	+ DNA sequencing
	+ Invader
	+ Fluorescence in-situ hybridization (FISH)
	+ Specimen requirements, collection, and handling
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| **Patient Care**Is able to perform procedures necessary to generate laboratory information, gather clinical information needed to establish a diagnosis, and make observations relevant to the clinical situation. | With appropriate supervision (see below), the resident will:* participate in molecular case sign-outs as assigned by the faculty, previewing cases before signout to arrive at his/her own diagnosis
* assist in daily H&E review of specimens submitted for AP-molecular testing.
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| **Practice-based Learning and Improvement**Uses feedback and evaluations to generate or modify learning plan and improve skills. | The resident will:* conduct a journal club wherein the resident performs critical review of a published paper in Molecular Pathology
* complete all reading and problem assignments
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| **Interpersonal and Communication Skills**Establishes collegial interactive and communication skills in dealing with others; structures reports that are clear, succinct, and follow templates; listens to and fulfills requests from other providers. | The resident will:* Listen to and communicate clearly with all members of the laboratory.
* Communicate results as requested to clinicians, with approval of the attending pathologist.
* Prepare a research topic (literature review) and present this as a formal seminar at the end of the rotation. The resident will focus on a single area of clinical molecular testing and critically examine the impact on diagnosis and disease management.
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| **Professionalism**Is honest, compassionate, and respectful of others; complies with laws and regulations pertaining to medical practice; fulfills patient care and educational responsibilities faithfully. Understands professional responsibility to appear for duty rested and fit to provide service. | The resident will demonstrate professionalism at all times by:* Being on time for all sign-outs, journal club presentations, lectures and conferences.
* Demonstrate respect for all members of the laboratory.
* Respond in a prompt manner for any issues related to patient care and clinical requests.
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| **Systems-based Practice**Identifies issues related to error, cost, and the need for interdisciplinary collaboration in the delivery of health care. Conducts handoff at the conclusion of rotation with care and thoroughness. | The resident will develop a systems-based practice approach to molecular pathology practice by:* Interacting with members of other laboratories to discuss test results that will impact a patient’s diagnosis as necessary.
* Beginning to understand how molecular pathology assays can be best utilized in a cost-efficient manner that most directly impacts patient care.
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The goal of the **Second and Third Molecular Pathology Rotations** is for the resident to move from being an

**Advanced Beginner** (The advanced beginner is still dependent on rules, but can adapt rules to changing circumstances. However, all attributes of a situation tend to be given equal importance, and there is still little feeling of personal responsibility for outcomes.)

To

**Proficient** (The competent learner grasps the relevant facts, can sort information by relevance, can bring his/her own judgment to each case, and solve problems. Guidelines are adapted to unexpected events. He/she feels accountable for outcomes because of increasing decision-making.)

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| **Second and Third Rotation Goals** | **Second and Third Rotation Objectives** |
| **Medical Knowledge**Acquires knowledge of less commonly-encountered conditions and laboratory techniques; critically evaluates knowledge sources and uses evidence-based approach to acquire new knowledge. | The resident will develop further understanding of molecular pathology techniques and applications:1. Molecular Oncology Testing – Solid Tumor
	1. KRAS mutation
	2. BRAF mutation
	3. EGFR mutation
	4. ALK (2p23) rearrangement by FISH
	5. Microsatellite instability
	6. KIT mutation for GIST
	7. KIT mutation for melanoma
	8. IDH1 and IDH2 mutation
	9. Sarcoma testing
		1. EWSR1/FLI1 and EWSR1/ERG translocation (Ewing Sarcoma)
		2. EWSR1/WT1 translocation (Desmoplastic Small Round Cell Tumor)
		3. PAX/FOXO1 translocation (Alveolar Rhabdomyosarcoma)
		4. SYT/SSX translocation (Synovial Sarcoma)
		5. EWSR1/ATF1 translocation (Clear Cell Sarcoma)
		6. EWSR1 rearrangement by FISH
	10. HER2 FISH
	11. UroVysion FISH
2. Molecular Oncology Testing – Hematopathology
	1. Lymphoma
		1. T Cell Clonality (TRG Gene Rearragement)
		2. B Cell Clonality (IGH Gene Rearrangement)
		3. IGH/BCL2 t(14;18) translocation by PCR
		4. IGH/BCL2 t(14;18) translocation by FISH
		5. MYC (8q24) rearrangement by FISH
		6. BCL6 (3q27) rearrangement by FISH
	2. Acute Leukemia
		1. NPM1 mutation
		2. FLT3 mutation
		3. IDH1 and IDH2 mutation
		4. CEBPA mutation
		5. KIT D816V mutation
		6. PML/RARA t(15;17) translocation
	3. Myeloproliferative Neoplasms (MPN)/CML
		1. BCR/ABL1 analysis, quantitative
		2. BCR/ABL1 kinase domain mutation
		3. JAK2 V617F mutation
		4. JAK2 Exon 12 mutation
		5. MPL mutation
		6. KIT D816V mutation
3. Inherited Disease Testing
	1. Cystic fibrosis carrier screening
	2. Apolipoprotein E genotyping
	3. Hereditary Hemochromatosis mutation
	4. Factor V Leiden mutation
	5. Prothrombin 20210 mutation
	6. Methylenetetrahydrofolate Reductase mutation
4. Pharmacogenetic Testing
	1. Irinotecan sensitivity
	2. Warfarin sensitivity
5. Identity Testing (Bone marrow engraftment monitoring)
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| **Patient Care**Uses laboratory data and own observations to generate accurate diagnoses and differential diagnoses; suggests appropriate ancillary studies as needed; responds to requests for consultation. | With appropriate supervision, the resident will contribute to patient care by :* Developing expertise in the interpretation of the above types of test, forming independent interpretations. The resident will then review their interpretation with the attending pathologist during sign-out.
* Offering suggestions as to the appropriate follow up testing that may be indicated
* Working with faculty to respond to consultative requests from pathologists and other health care providers
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| **Practice-based Learning and Improvement**Adapts practices based on literature review, case outcomes, peer reviews, and system demands; seeks and gives feedback to improve self and others. | The resident will continue to develop practice-based learning and improvement by:* Discussing the assigned topics with the attending pathologist as well as any junior residents on service.
* The resident is expected to attend and participate actively in all lectures.
* The resident is expected to attend continuing education program at the Molecular Diagnostics Laboratory at Traverwood, and other additional seminars and lectures related to molecular pathology as applicable.
* Prepare and present a teaching case, as assigned, at CP Case conference
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| **Interpersonal and Communication Skills**Effectively communicates in a variety of settings, including during conferences, while providing consultations, and teaching peers.  | The resident will demonstrate interpersonal and communication skills by:* Communicating independently and clearly with all members of the laboratory.
* Serving as the first line contact to clinicians requesting laboratory results or consultative advice for selecting the correct assay given a specific clinical situation.
* Again, prepare a research topic (literature review) and present this as a formal seminar at the end of the rotation. The resident will focus on a single area of clinical molecular testing and critically examine the impact on diagnosis and disease management.
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| **Professionalism**Manages patient care duties and interacts with other providers with compassion and respect for diversity; recognizes and responds to need for help from colleagues. | The resident will demonstrate professionalism at all times by:* Being on time for all sign-outs, journal club presentations and conferences.
* Demonstrating respect for all members of the laboratory team and others that they interact.
* Responding in a prompt manner for any issues related to patient care and clinical requests.
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| **Systems-based Practice**Improves patient outcomes and promotes efficiency by making decisions based on best evidence of outcomes, and by involvement in quality initiatives. | The resident will continue to develop a systems-based practice by:* Participating in laboratory quality control and quality assurance projects related to current assays, or the validation and implementation of new assays.
* Serving as a mentor for any junior resident on service to impart their knowledge of the laboratory and the role of the laboratory in medical decision making.
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**Plan for Training**

**GOALS**

The overall goal of this rotation is to familiarize the trainee with the fundamentals and principles of molecular biology, nucleic acid biology, the genetics of inherited diseases, cancer genetics and nucleic acid technology relevant to the rapidly evolving practice of Molecular Pathology.

Guidelines for training and resident expectations:

1. **Didactic**: Lectures will review principles of nucleic acid biochemistry and molecular biology relevant to an understanding of modern clinical and anatomic pathology. Topics will include basic nucleic acid structure and function, overview of gene expression and regulation, molecular basis of human genetic disease, genetic mechanisms of neoplasia, and molecular basis of pathogen identification and resistance typing. These broad conceptual areas will be reviewed generally, allowing the resident to assess individual background competencies in molecular biology. Assigned reading and problems will help the resident expand general molecular competencies. Disease oriented lectures will cover topics relevant to the practice of molecular pathology, emphasizing laboratory diagnosis and disease management. In parallel, the resident will be expected to get familiarized with the technologies underlying modern molecular testing.
2. **Research**: A research topic (literature review) will be chosen by the resident and presented as a formal seminar at the end of the rotation. The resident will focus on a single area of clinical molecular testing and critically examine the impact on diagnosis and disease management.
3. **Pre-test**:An assessment of the resident’s level of knowledge will be performed at the beginning of the rotation.
4. **Post**-**test**: A test covering aptitude in material similar to that administered in the Pre-test will be given at the end of the rotation to determine the effectiveness of the learning experience.

**DUTIES AND RESPONSIBILITIES OF RESIDENTS**

1. The resident is expected to attend and participate actively in all lectures.
2. The resident is expected to attend continuing education program at the Molecular Diagnostics Laboratory at Traverwood, and other additional seminars and lectures related to molecular pathology as applicable.
3. The resident is expected to complete all reading and problem assignments.
4. The resident is expected to participate in molecular case sign-outs as assigned by the faculty.
5. The resident is expected to assist in daily H&E review of specimens submitted for AP-molecular testing.
6. The resident is expected to conduct a journal club wherein the resident performs critical review of a published paper in Molecular Pathology. This will be presented to members of the literature review of a salient topic in molecular genetic pathology and present a formal seminar based on this research.

**Supervision**

The following activities are to be conducted with **Direct Supervision** (the supervising physician is physically present with the resident):

Interpretation of completed molecular assays performed with the attending faculty.

The following activities are to be conducted with **Indirect Supervision**:

 Consultative activities

The following activities are to be conducted with **Oversight**:

 Reading and other learning assignments, preparation of Journal Club, Research, and CP Case presentations

**TEACHING STAFF RESPONSIBLE FOR SUPERVISION**

The resident will be evaluated based on attendance, interaction with professional and ancillary staff, problem solving, and conference presentation.

Kojo S. J. Elenitoba-Johnson,, MD, Professor

Thomas E. Wilson, MD, PhD. Associate Professor

Jeff Warren, M.D. Professor

Megan Lim, MD, Ph.D. Associate Professor

Ram Iyer, Ph.D. Assistant Professor

Bryan Betz, PhD Assistant Professor

David Ferguson, MD, PhD. Assistant Professor

David Lombard, MD, PhD. Assistant Professor

**Evaluation**

* Electronic (MedHub) evaluation completed by faculty at the conclusion of each rotation
* Pre- and Post-tests, as outlined above
* 360 evaluation completed by fellows and technical staff semi-annually
* Resident Inservice Examination (annually)