LEFT: Medical Director of Molecular Oncology/Genetics Laboratory, **Noah Brown, M.D.**, joined the faculty of the University of Michigan in 2014. His areas of interest include novel molecular alterations in head and neck and hematolymphoid neoplasms; optimal techniques for the detection of clinically actionable molecular alterations.

RIGHT: Technical Director of Molecular Oncology/Genetics Laboratory, **Bryan Betz, Ph.D.**, joined the faculty of the University of Michigan in 2007. His areas of interest include application of emerging technologies to clinical molecular diagnostics; cancer molecular genetics.
Dr. Rohit Mehra, MLabs Genitourinary Service Line Director, joined the U-M faculty in 2012. His areas of interest include discovery of new diagnostic, prognostic and therapeutic biomarkers for genitourinary cancers and development of novel biomarkers and high throughput validation and visualization techniques for tissue microarrays (TMAs).

Michigan Medicine Laboratories (MLabs) is a CLIA-certified/CAP accredited laboratory offering state of the art molecular testing services that support diagnosis, prognosis and therapeutic guidance for your patients.

Our highly experienced faculty, ABMGG board-certified geneticist, medical technologist and bioinformaticians are dedicated to delivering the highest quality laboratory results to meet the needs of today’s patients in a cost effective and personalized manner.

| 142k SQUARE FOOT BRAND NEW STATE OF THE ART FACILITY | 30+ YEARS OF EXPERIENCE | 26 MOLECULAR, PEDIATRIC & GENETIC COUNSELORS AND CONSULTANTS |
SERVICES

MOLECULAR ONCOLOGY/GENETICS
Performing over 14,000 assays annually with an average turn-around-time of 4.1 days, our Molecular Oncology and Genetics Laboratory specializes in offering cutting-edge molecular tests to aid in cancer diagnosis, selection of therapy, determination of prognosis, and monitoring of residual disease. An expanding menu of tests are offered in disease-specific service lines to provide a comprehensive testing solution for each disease, including colorectal cancer, non-small cell lung cancer, melanoma, gastrointestinal stromal tumor, glioma, sarcoma, myeloproliferative neoplasms, acute myeloid leukemia, lymphoproliferative disorders, and others. The implementation of next generation sequencing technology to many tests and panels now provides the ability to detect mutations with excellent sensitivity and broad coverage while also preserving the ability to test small biopsies and challenging specimens with low neoplastic cell content.

MOLECULAR GENETICS
MLab’s Molecular Genetics Laboratory has two ABMGG board certified Geneticists, Marwan Tayeh, PhD; Jeffry Innis, MD, PhD and a board certified Genetic Counselor. Molecular Genetics Laboratory offers comprehensive clinical testing for germline genetic diseases and is committed to assisting clinicians in identifying genetic aberrations to facilitate clinical diagnosis, management, and genetic counseling. Molecular Genetics offers a variety of NGS germline cancer panels including: Breast and Ovarian, Colorectal, Pancreatic, Renal, Endometrial/Uterine, Melanoma, Stomach, Prostate, and Paraganglioma. In addition, the laboratory offers Sanger sequencing for a long list of genes, SNP Chromosomal Microarray, mutation screening for cystic fibrosis, Methylation-Specific PCR for Prader-Willi/Angelman syndrome and Fragile X, MLPA for deletion/duplication detection of BRCA1, BRCA2, TP53, PTEN, MECP2, CFTR, and SMN1 exons 7 and 8 deletions.

TRANSLATIONAL PATHOLOGY
MLabs comprehensively characterize disease using novel bioinformatics approaches and high-throughput technologies. This work facilitates more accurate, early detection methods, assists in the prediction of prognosis, defines disease subtypes, as well as assists in the assessment of treatment efficacy. These efforts could result in the future development of targeted therapies.

Our featured tests include PCA3 (Gen-Probe) test for prostate cancer detection and MiPS (Mi-Prostate Score (MiPS) an early detection test for prostate cancer that combines the amount of serum PSA, with the amounts of two genes in the urine. These two genes, TMPRSS2:ERG and PCA3, are specific for prostate cancer, meaning they are rarely present at high levels in the urine of men without prostate cancer.
### Molecular Oncology

#### ACUTE MYELOID LEUKEMIA
- NPM1 Mutation (PCR)
- FLT3 Mutation (PCR)
- CEPBA Mutation (Sanger)
- IDH1 and IDH2 Mutation (Sanger)
- KIT D816V Mutation (PCR)
- KIT Mutation for AML - Exons 8, 17 (Sanger)
- PML/RARA t(15;17) Translocation Qualitative (PCR)

#### MYELOPROLIFERATIVE NEOPLASMS
- JAK2 V617F Mutation (PCR)
- JAK2 Exon 12 Mutation (PCR)
- CALR Mutation (PCR)
- MPL Mutation (PCR)
- KIT D816V Mutation (PCR)
- BCR/ABL1 Analysis, Quantitative (PCR)
- BCR/ABL1 Kinase Domain Mutation (Sanger)

#### GASTROINTESTINAL STROMAL TUMOR
- KIT Mutation - Exons 9,11,13,17 (Sanger)
- PDGFRA Mutation for GIST (Sanger)

#### GENITOURINARY TUMOR
- BRAF (7q34) Rearrangement (FISH)
- ERG Rearrangement (FISH)
- TFE3 (Xp11,2) Rearrangement (FISH) for Renal Cell CA & Other Tumors
- TFE3 (Xp11,2) Rearrangement (FISH) for Renal Cell Carcinoma
- BRAF V600E/V600K Mutations (PCR)
- MGMT Promoter Methylation (PCR)
- TERT Promoter Mutation (PCR)

#### LUNG CANCER
- Lung Cancer (NGS) Panel*
- EGFR Mutation (NGS)
- BACR V600E/V600K Mutations (PCR)
- KRAS Mutation (NGS)
- ALK Rearrangement for NSCLC (FISH)
- ROS1(6q22) Rearrangement (FISH)
- RET (10q11) Rearrangement (FISH)
- PD-L1 (IHC)
- MET Amplification (FISH)

#### MELANOMA
- Melanoma (NGS) Panel*
- BRAF (7q34) Rearrangement (FISH)
- BRAF V600E/V600K Mutations (PCR)
- KIT Mutation for Melanoma - Exons 11,13,17 (Sanger)
- NRAS Mutation (NGS)
- Chromosomal (Microarray) for Melanoma
- Multiprobe (FISH) for Melanoma
- TERT Promoter Mutation (PCR)

#### PROSTATE CANCER
- Prostate Cancer Antigen 3 (PCA3)
- MiPS (Mi-Prostate Score)

#### GLIOMA
- BRAF (7q34) Rearrangement (FISH)
- IDH1 and IDH2 Mutations (Sanger)
- 1p/19q Deletion (FISH)
- BRAF V600E/V600K Mutations (PCR)
- MGMT Promoter Methylation (PCR)
- TERT Promoter Mutation (PCR)

#### THYROID CANCER
- BRAF V600 E/V600K Mutations (PCR)
- BRAF (7q34) Rearrangement (FISH)
- TERT Promoter Mutation (PCR)

#### MISCELLANEOUS
- Solid Tumor (NGS) Panel*
  - Bilary Tract Malignancy (FISH)
  - Bone Marrow Transplant Engraftment Analysis (PCR)
  - Circulating Tumor Cells for Breast, Colorectal and Prostate Cancer
  - HER2 (FISH)
  - UGT1A1 Promoter Genotyping (PCR)
  - UroVysion™ (FISH) (Bladder Cancer)

*NGS Panels include: mutations (35 genes), amplification (19 genes) and gene fusion (21 genes)
## Genetics (Germline)

**AUTISM SPECTRUM DISORDERS/INTELLECTUAL DISABILITY**
- Chromosomal Microarray Analysis
- Fragile X Syndrome Mutation
- Prader-Willi/Angelman Syndrome
- CDKL5 Gene Sequencing
- GD1 Gene Sequencing
- MBD5 Gene Sequencing
- MEF2C Gene Sequencing
- NLGN3 Gene Sequencing
- NLGN4X Gene Sequencing
- SHANK2 Gene Sequencing
- SHANK3 Gene Sequencing
- SLC9A6 Gene Sequencing
- TCF4 Gene Sequencing
- UBE3A Gene Sequencing

**MECP2 (RETT SYNDROME)**
- MECP2 Gene Sequencing
- MECP2 Deletion/Duplication
- MECP2 Targeted Sequencing Familial

**PTEN HAMARTOMA TUMOR SYNDROME**
- PTEN Gene Sequencing
- PTEN Deletion/Duplication
- PTEN Targeted Sequencing Familial

**BREAST AND OVARIAN CANCER**
- BRCA1 and BRCA2 Gene Sequencing
- BRCA1 and BRCA2 Targeted Sequencing, Familial
- BRCA1 and BRCA2 Deletion/Duplication
- BRCA Ashkenazi Jewish Founder Mutations
- BRCA Panel

**Endometrial/Uterine Cancer Germline NGS Panel**
- 13 Genes: BRCA1, BRAC2, CHEK2, EPCAM, MLH1, MSH2, MSH6, MUTYH, PMS2, PTEN, TP53, STK11, POLD1

**Hereditary Breast and Ovarian Cancer Comprehensive Germline NGS Panel**
- 21 Genes: ATM, BARD1, BRAC1, BRAC2, BRIP1, CDH1, STK11, CHEK2, EPCAM, MLH1, MSH2, MSH6, NBN, PALB2, PMS2, PTEN, RAD51C, RAD51D, TP53, FANCC, XRCC2

**Hereditary Breast and Ovarian Cancer High-Moderate Risk Germline NGS Panel**
- 9 Genes: ATM, BRAC1, BRAC2, BRIP1, CDH1, CHEK2, PALB2, PMS2, TP53

**Melanoma Cancer Germline NGS Panel**
- 6 Genes: BRCA1, BRCA2, CDKN2A, CDK4, TP53, PTEN

**Neurofibromatosis Germline NGS Panel**
- 3 Genes: NF1, NF2, SPRED1

**Pancreatic Cancer Germline NGS Panel**
- 18 Genes: APC, ATM, BRCA1, BRCA2, CDKN2A, EPCAM, MLH1, MSH2, MSH6, PALB2, PMS2, STK11, TP53, CDK4, BMPR1A, SMAD4, VHL, HRCC2

**Paraganglioma Cancer Germline NGS Panel**
- 12 Genes: SDHAF2, MAX, TMEM127, FH, MEN1, NF1, RET, VHL, SDHB, SDHC, SDHD, SDHA

**Prostate Cancer Germline NGS Panel**
- 6 Genes: BRCA1, BRCA2, CHEK2, HOXB13, NBN, TP53

**Renal Cancer Germline NGS Panel**
- 19 Genes: VHL, PMS2, PTEN, TP53, EPCAM, FH, FLCN, MET, MLH1, MSH2, MSH6, SDHB, SDHC, SDHD, SDHA, BAP1, TSC1, TSC2, MITF

**Stomach Cancer Germline NGS Panel**
- 11 Genes: MLH1, MSH2, MSH6, EPCAM, PMS2, APC, TP53, STK11, CDH1, BMPR1A, SMAD4

### Genetics (Germline) (Cont.)

#### COLORECTAL CANCER
- Colorectal Cancer Germline NGS Panel
- MSH2 Gene Sequencing

#### CYSTIC FIBROSIS
- Cystic Fibrosis Carrier Screening
- Cystic Fibrosis Full Gene Sequencing
- Cystic Fibrosis Deletion/Duplication
- Cystic Fibrosis Diagnostic Mutation Detection
- Cystic Fibrosis Targeted Sequencing Familial

#### HEARING LOSS
- GJB2 (Connexin 26) Mutation Analysis
- GJB2 (Connexin 26) Targeted Sequencing Familial
- GJB6 (Connexin 30) Deletion Analysis
- WFS1 (Wolfram Syndrome) Gene Sequencing

#### NOONAN SYNDROME
- PTPN11 Gene Sequencing
- KRAS Gene Sequencing
- RAF1 Gene Sequencing
- SOS1 Gene Sequencing

#### FRAGILE X SYNDROME
- Fragile X Syndrome Mutation Detection

#### LI-FRAUMENI SYNDROME
- TP53 Gene Sequencing
- TP53 Deletion/Duplication

#### NEUROFIBROMATOSIS
- NF1 Gene Sequencing

#### SPINAL MUSCULAR ATROPHY
- SNM1 and SNM2 Deletion/Duplication

#### MISCELLANEOUS
- Apolipoprotein E Genotyping
- Factor V Leiden Mutation
- Hereditary Hemochromatosis Mutation
- Prothrombin 202010 Mutation

### Cancer Germline NGS Panels (64 Genes)

#### Coloorectal Cancer Germline NGS Panel
- 19 Genes: MLH1, MSH2, MSH6, MUTYH, PMS2, EPCAM, APC, TP53, PTEN, STK11, SMAD4, BMPR1A, CDH1, CHEK2, GREM1, POLD1, POLE, ATM, AXIN2

#### Endometrial/Uterine Cancer Germline NGS Panel
- 13 Genes: BRCA1, BRAC2, CHEK2, EPCAM, MLH1, MSH2, MSH6, MUTYH, PMS2, PTEN, TP53, STK11, POLD1

#### Hereditary Breast and Ovarian Cancer Comprehensive Germline NGS Panel
- 21 Genes: ATM, BARD1, BRAC1, BRAC2, BRIP1, CDH1, STK11, CHEK2, EPCAM, MLH1, MSH2, MSH6, NBN, PALB2, PMS2, PTEN, RAD51C, RAD51D, TP53, FANCC, XRCC2

#### Hereditary Breast and Ovarian Cancer High-Moderate Risk Germline NGS Panel
- 9 Genes: ATM, BRAC1, BRAC2, BRIP1, CDH1, CHEK2, PALB2, PMS2, TP53

#### Melanoma Cancer Germline NGS Panel
- 6 Genes: BRCA1, BRCA2, CDKN2A, CDK4, TP53, PTEN

#### Neurofibromatosis Germline NGS Panel
- 3 Genes: NF1, NF2, SPRED1

#### Pancreatic Cancer Germline NGS Panel
- 18 Genes: APC, ATM, BRCA1, BRCA2, CDKN2A, EPCAM, MLH1, MSH2, MSH6, PALB2, PMS2, STK11, TP53, CDK4, BMPR1A, SMAD4, VHL, HRCC2

#### Paraganglioma Cancer Germline NGS Panel
- 12 Genes: SDHAF2, MAX, TMEM127, FH, MEN1, NF1, RET, VHL, SDHB, SDHC, SDHD, SDHA

#### Prostate Cancer Germline NGS Panel
- 6 Genes: BRCA1, BRCA2, CHEK2, HOXB13, NBN, TP53

#### Renal Cancer Germline NGS Panel
- 19 Genes: VHL, PMS2, PTEN, TP53, EPCAM, FH, FLCN, MET, MLH1, MSH2, MSH6, SDHB, SDHC, SDHD, SDHA, BAP1, TSC1, TSC2, MITF

#### Stomach Cancer Germline NGS Panel
- 11 Genes: MLH1, MSH2, MSH6, EPCAM, PMS2, APC, TP53, STK11, CDH1, BMPR1A, SMAD4