**FACILITIES AND OTHER RESOURCES:**

**CLINICAL**: The Yale New Haven Hospital is the 6th largest hospital in the United States and currently has capacity for over 1500 patients at any given time. The Yale Cancer Center and Smilow Cancer Hospital is an NCI-designated Comprehensive Cancer Center and is part of the National Comprehensive Cancer Network. The Genitourinary Cancer Program has an active clinical and translational research team. The hospital is ideally set up adjacent to research laboratories for translational research studies. Patients are consented for research in the clinic and procurement of blood is obtained in the blood draw station or prior to surgery. These specimens are immediately transported to the laboratory. The operating rooms are adjacent to the pathology station to allow procurement and processing of fresh tissue. This allows rapid acquisition of patient material for research purposes.

**OFFICE**: Dr. Shuch also has a 120 sq. ft. office located within the Department of Urology research space adjacent to the Brady Memorial Urology laboratory. Additionally he shares a Department administrator for academic support who is located adjacent to his office.

**PERSONAL COMPUTING**: In Dr. Shuch’s office there is a brand new high-powered Macintosh desktop with 32 GB 1600 MHz with a 3.4 GHz Intel Core. There are also two 27-inch thunderbolt displays. This three-screen set up is useful for running various genomic programs. The machine also has Mac Parallels installed to run Windows for specific genomics programs. Additionally he has a Macbook Pro Laptop 8 GB 1600MHz with a 3 GHz Core.

**LABORATORY:** Dr. Shuch’s laboratory is in a shared Urology Laboratory consisting of resources for molecular biology, cellular biology, and genetics research. His laboratory is approximately 700 sq. ft. of space as is located in the Brady Memorial Laboratory. There are two laminar flow culture hoods, two -80˚C freezers, two -20˚liquid nitrogen tanks, a cold room, shared dark room, several inverted fluorescent/brightfield scopes, and common equipment space. The laboratory is equipped with typical tools of molecular biology and genetics research including BioRad Systems for western blots transfer, an Immunohistochemistry station, a 96-well PCR thermal cyclers, and an Applied Biosystems qRT-PCR analyzer. There is a PerkinElmer Fluorescence reader for 12-96 well microplates. There is an apparatus for both agarose and acrylamide gel electrophoresis.

**YALE TISSUE PROCUREMENT SERVICES (YTPS):** This shared resource is run by the Department of Pathology. The research team ensures that specimens removed from the operating room are procured within 30 minutes. Using standard operating procedures for each approved protocol; specimens can be obtained based on investigator preferences. For our heterogeneity assessment the research team obtains three distinct tumor regions that are snap frozen in liquid nitrogen for later use. Other aspects of this service are the ability to retrieve well-annotated formalin-fixed pathology specimens. The Yale Pathology Archives dates back to the 1950s’ and there are over 2000 nephrectomy specimens available.

**YALE GENTIOURINARY BIOSPECIMEN REPOSITORY:** This Urology Laboratory houses the Genitourinary Biospecimen Repository. Patient blood and urine samples are procured in clinic or prior to surgery. Blood samples are spun down for component separation with an Eppendorf 5804 Refrigeration Centrifuge unit. Cancer tissue obtained from with the YTPS is processed in the laboratory. DNA from whole blood or tumor tissue is extracted using an automated system, the Promega, Maxwell 16 research instrument. A Thermo Scientific Nanodrop unit is available for determination of DNA concentration. Specimens are labeled with a Zebra barcoding system and tracking monitored with an OnCore Biospecimen Management system. All biospecimen materials are barcoded, catalogued, and stored in a dedicated -86˚C Thermo Scientific Ultra-Low Temperature Freezer with storage space for over 86,000 biospecimens.

**YALE CENTER FOR GENOME ANALYSIS (YCGA)** has multiple next-generation sequencing systems including Illumina HiSeq 2000 (8 machines), HiSeq 2500 (2 machines), and MiSeq (1 machine). The core has a Agena MassArray MALDI-TOF system for multiplex PCR analysis of a panel of gene regions. The core facility also has expertise in library preparation for whole genome sequencing, exome sequencing, mRNA sequencing, and ChIP sequencing. They have technical expertise to capture exomes from formalin fixed paraffin embedded tissues and capture mRNA libraries from <10,000 cells. Additionally they have specific expertise in running experiments involving Molecular Inversion Probe (MIP) sequencing.

Other available equipment includes:

* One Pacific Bioscience third generation sequencer
* One Ion Torrent sequencer
* Dell High Performance Cluster; 110 nodes with a total of approximately 1000 cores/CPUs
* Caliper LabChip GX system
* Caliper Sciclone liquid hander for library preparation
* 3 Agilent Bioanalyzer for Q/C of RNA, cDNA, cRNA and fragmented cRNA
* Eppendorf epMotion 5075LH automated liquid handler
* Molecular Devices SpectraMax II 96/384-well spectrophotometer
* Illumina high throughput BeadArray system with two Tecan robotics and HiScan with autoloader.
* Affymetrix GeneChip Model 3000 Scanners with autoloaders
* 4 Affymetrix GeneChip Model 450 fluidics stations
* Nimblegen array platform with three Maui Hybridization instruments

**YALE BIOINFORMATICS RESOURCES:** Four Ph.D. scientists provide technical assistance in the analysis of data generated at YCGA. This includes the analysis of data generated by next gene sequencing platforms, microarray analyses, and MIP sequencing. Additionally there is support from Keck’s Sequencing center for specific bioinformatics and biostatistics needs. Other faculty members of Yale’s Computational Biology and Biology have extensive experience developing new data analysis tools.

**KECK DNA SEQUENCING FACILITY:** For Sanger sequencing needs, the Keck Shared Biotechnology Resource has served as the center for high-end instrumentation at Yale School of Medicine for nearly a quarter century. The Keck Facility performs custom sequencing on templates from over 1,000 users from within Yale and abroad. This facility provides competitive and timely DNA sequencing in a cost effective manner. The Keck Facility has extensive experience designing molecular inversion probes for sequencing. Sequencing is carried out on Applied Biosystems 3730xL DNA Analyzers, along with Applied Biosystems Big Dye chemistries. MIP primers will be synthesized using Dr. Oligo 192 and Applied Biosystems 394 synthesizers.

**HIGH PERFORMANCE COMPUTING (HPC) CENTER:** The HPC center runs 2 linux-based clusters that are free for Yale research faculty. BulldogN is a cluster with 170 computer nodes in size from 8 to 64 computer cores with varying amounts of memory per node. All nodes are connected to several petabytes of high performance parallel storage. BulldogN is dedicated for the production, storage and analysis of genomic data generated from the YCGA. Louise is the main Biomedical and Biological Sciences High-performance computing (HPC) resource. This cluster contains 321 nodes with 3680 computer cores. Louise has a BlueArc file system with over 500 TB of usable storage. Louise is dedicated for the storage and analysis of genomic data generated from external data sources.

**YALE CANCER CENTER CORE LABS:** The Smilow Cancer Center has shared core facilities for members to use at no charge. This equipment is located in 2 common rooms on the medical campus. Equipment includes:

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| * Applied Biosystems ViiA7 Real Time PCR (Two) |
| * Zeiss Axiocam microscope camcer |
| * Zeiss Axio Observer A1- Inverted Microscope (Two) |
| * Sorvall Thermoregulatable RC6+ High Speed Centrifuge (Two) |
| * BioRad Chemidoc MP (Two) |
| * Paradigm Fluorescence Plate Reader |
| * Gentle Max tissue prep and magnetic bead sorter |
| * Cytospin |
| * Leica RM2235 rotary microtome |
| * Leica CM1950 cryostat |
| * GE ÄKTA pure chromatography system |
| * Lonza Nucleofactor/Electroporator |
| * Guava easyCyte Flow Cytometer |
| * The Mitocell S200 micro respirometry system |
| * Virtis Advantage Plus bench top freeze dryer |