

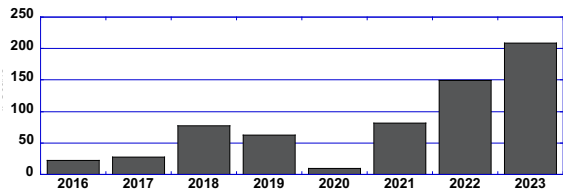
## PET Core Progress

Jan 1, 2024

### Executive Summary:

### History

The original plan for the SBU PET program was to perform funded research scans at Brookhaven National Laboratory (BNL), as there was a well established PET imaging program there. Unexpectedly, the DOE shut down the BNL PET imaging program in 2014. In response Stony Brook funding was pledged to build a PET program at SBU with the support of President Stanley and Dean Kaushansky. This program proceeded in two phases. In the first phase, the FERM, a small radiochemistry lab, was constructed in the Basic Science Tower to produce Fluorine-18 (F-18) labeled radiopharmaceuticals, using F-18 purchased from offsite vendors. Imaging was performed on a shared clinical/research scanner, the PET-MR, located in the Ambulatory Cancer Pavilion and acquired with generous philanthropic support from the Laurie family. The second phase was the construction of the Research PET Center in the MART, which began upon the completion and commissioning of the MART facility. This included construction of the BAML Molecular Imaging Laboratory, with generous support from the BAML family, containing a high powered cyclotron to produce our own radioisotopes on site (Carbon-11, F-18 and Gallium-68) and a modern radiochemistry lab to produce radiopharmaceuticals suitable for human research scans. The Center initially included one PET scanner (an MiE Scinticon) which was soon followed by addition of a modern PET-CT, generously supported by the Laurie and Bahl families. The Center began operation in 2021. The figure shows the number of research scans performed



annually, particularly the increase once the MART Center came fully online in 2021. In 2023 we performed 207 scans in human research participants, and we anticipate doing this many or more in 2024. Additionally, we have entered into

arrangements with two different Industry collaborators to produce radiopharmaceuticals for clinical trials being performed at other sites in the tristate area and beyond. In summary, the PET core construction is complete, all regulatory approvals have been obtained, we are producing radiotracers for internal and external research use, and we are expanding our user base. We'd like to thank the institution and our numerous generous supporters for this success.

## Radiotracers

The power of PET as both a research and clinical imaging modality is its flexibility. The radioisotopes produced by our cyclotron can be incorporated in a virtually limitless number of molecules capable of imaging different biological molecular targets and processes, and we have an ever expanding palate of radiopharmaceuticals (“tracers”) available for investigators to address their research questions. Table 1 shows research tracers currently in use at SBU and those currently under development.

Table 1: Tracers currently in use and in the development pipeline at SBU

Currently In Use; Active Protocols		
Tracer	Target Molecules or Biological Processes	Application Area(s)
[ <sup>18</sup> F]F-AraG	Activated T cells	Immunotherapy in Oncology
[ <sup>18</sup> F]Florbetaben	Amyloid $\beta$ plaques in brain	Dementia, Normal Aging
[ <sup>18</sup> F]T807	Tau fibrillary tangles in brain	Dementia, Normal Aging
[ <sup>18</sup> F]LY245	$\kappa$ opioid receptors in brain	Psychiatry (Schizophrenia, Depression, Substance Use)
[ <sup>18</sup> F]VAT	Vesicular acetylcholine transporter in brain	Psychiatry, Neurology, Dementia and Normal Aging
[ <sup>18</sup> F]FEPPA	Translocator Protein in brain	Neuroinflammation; Activated Microglia
[ <sup>11</sup> C]ABP688	Metabotropic Glutamate Receptor 5 in brain	Psychiatry
[ <sup>11</sup> C]PiB	Amyloid $\beta$ plaques in brain	Dementia, Normal Aging
[ <sup>11</sup> C]UCB-J	Synaptic vesicle protein 2A in brain	Synaptic Density (Psychiatry, Neurology, Epilepsy)
[ <sup>11</sup> C]PS13	Cyclooxygenase-1 in brain	Neuroinflammation
Currently in the Development Pipeline		
Tracer	Target Molecules or Biological Processes	Application Area(s)
[ <sup>18</sup> F]MK6240	Tau fibrillary tangles in brain	Dementia, Normal Aging
[ <sup>18</sup> F]SMBT-1	Monoamine Oxidase-B	Dementia, Reactive Astroglia
[ <sup>11</sup> C]LSN317	Muscarinic receptors type 1 and 4 in brain	Psychiatry (Psychotic Disorders, Depression, Substance Use)
[ <sup>11</sup> C]-(+)-PHNO	Dopamine type D2 and D3 receptors in brain	Psychiatry and Neurology (Psychotic Disorders, Parkinson’s Disease)

\* Organizational Structure and Current Personnel

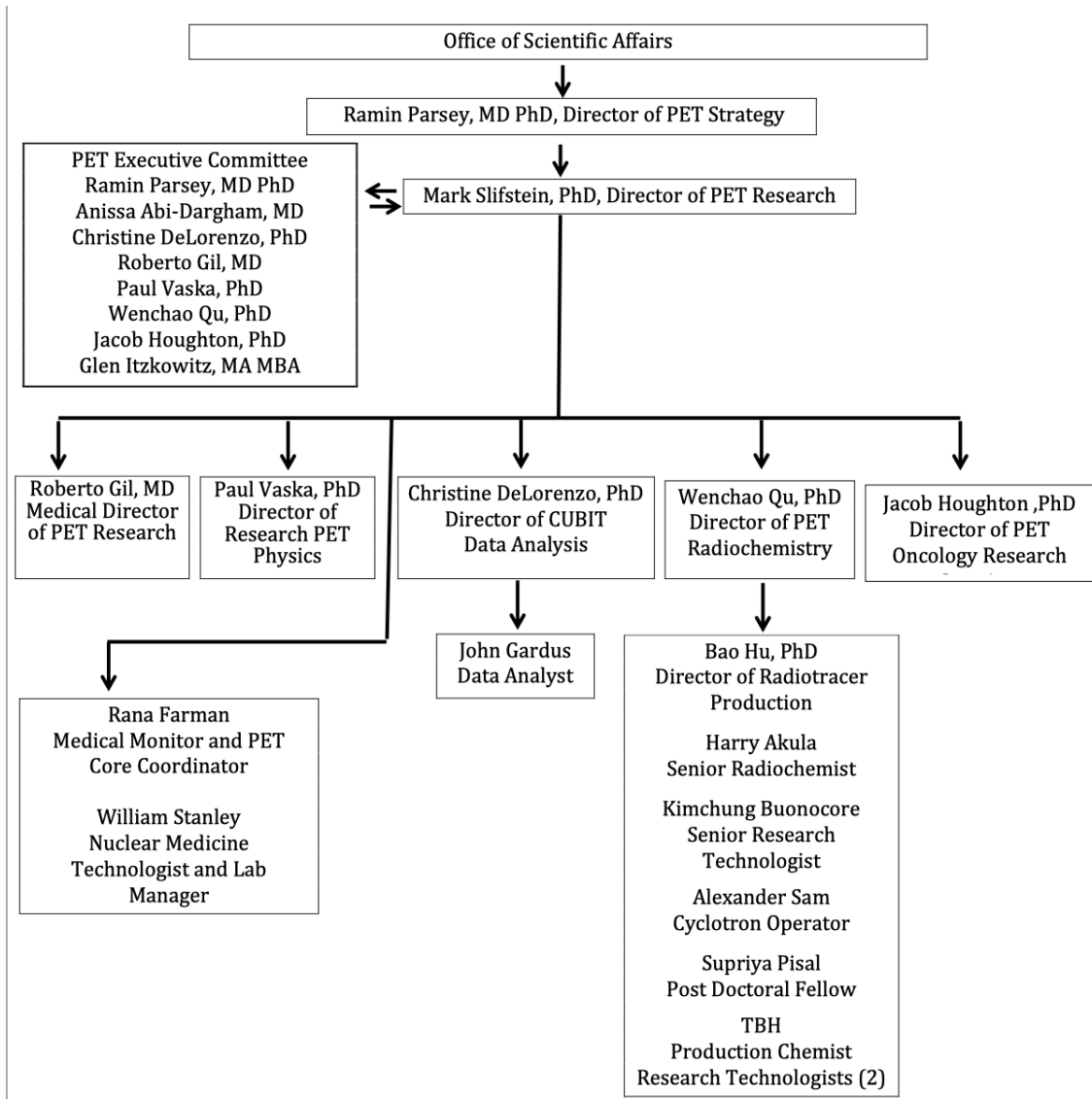
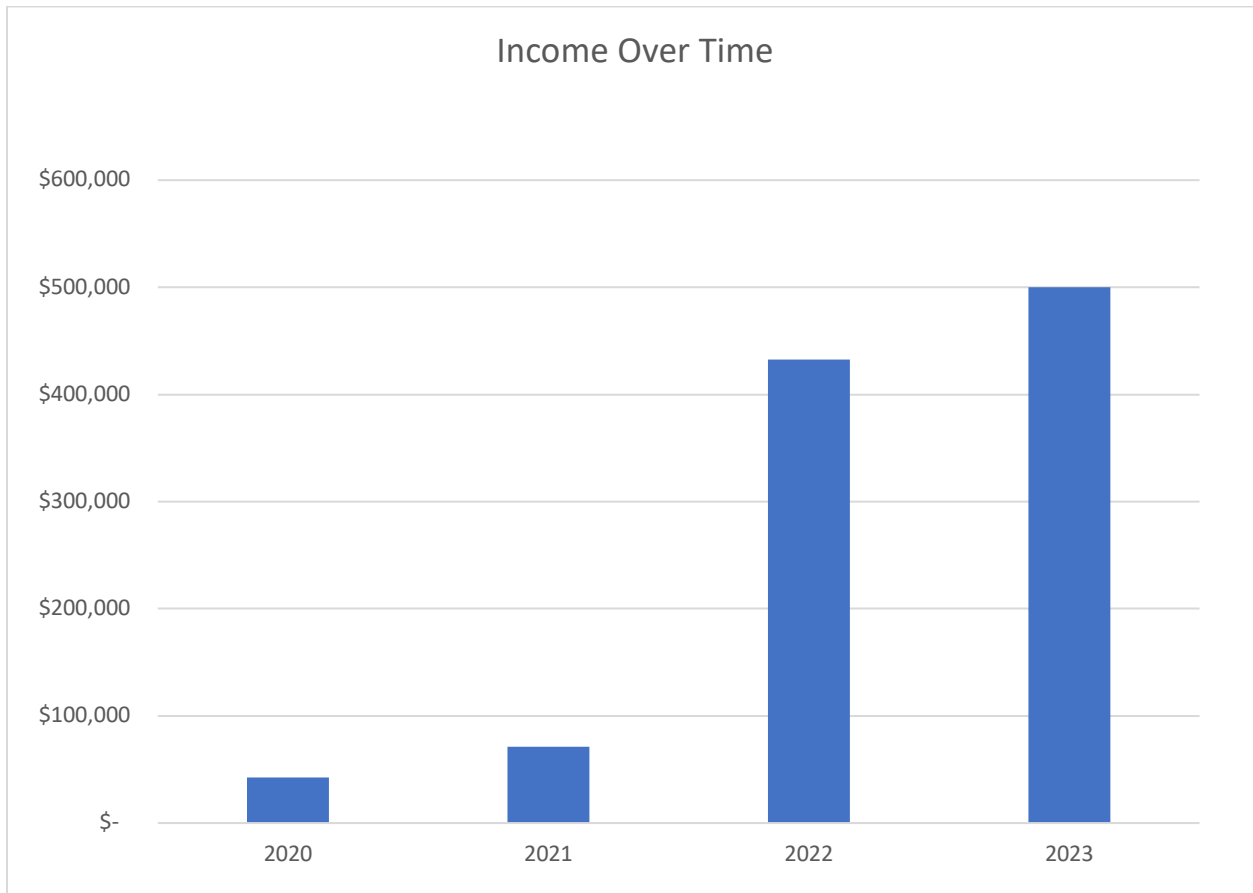


Table 2. Current Equipment

Instrument	Description
<b>MART Research PET Center</b>	
<b>Radiochemistry Laboratory</b>	
GE PetTrace 800 series Cyclotron	High Powered (16.5 MeV) medical cyclotron to support high specific activity tracer production. Currently configured to produce carbon-11, fluorine-18 and gallium-68
Comecer Hot Cells	Nine hot cells including 6 Full Size, 2 Mini and 1 Dispensing Hot Cell to support multiple daily syntheses.
Automated Chemistry Modules	Two GE Tracerlab FXN pro <sup>18</sup> F chemistry systems, 1 SanSys TracerMaker <sup>11</sup> C system, 1 GE FXC <sup>11</sup> C system and 1 GE FastLab system for <sup>68</sup> Ga. These modules support routine daily clinical research tracer production.
Other Chemistry Equipment	The cGMP compliant laboratory is equipped with all necessary additional equipment for producing clinical research tracer doses including a shielded biosafety cabinet for dose dispensing.
Quality Control Laboratory	Prior to releasing for administration to humans, tracers undergo rigorous quality testing for chemical purity and pyrogenicity. Equipment in this lab includes High Performance Liquid Chromatography (HPLC, for radio and chemical purity), Gas Chromatography (for solvents), Multichannel Analyzer (for radioisotopic purity) and various instruments to test for pyrogenicity and endotoxins.
<b>Scanners</b>	
uMI 550 PET-CT	This recently acquired modern PET-CT has high spatial resolution and ultra-modern detector systems and electronics for high quality, low noise, PET imaging. The PET Core has a research agreement with United Molecular Imaging to develop novel tools to benefit research, such as an optical head motion correction system. The scanner is suitable for brain and whole body imaging.
MiE Scintaron	This dedicated PET scanner is a Siemens HR+, the gold standard instrument for decades, rebuilt with modern electronics. Suitable for brain scanning.
Siemens Biograph PET-MR	This combined PET and MRI scanner is operated by the Department of Radiology and is available for research scanning 50% of operating time.
<b>Other Resources at the MART</b>	
Metabolite Laboratory	A dedicated facility for blood analysis used in scan protocols, including 2 HPLC systems, gamma counter and a biosafety hood. We are one of a small group of US sites with the ability to do blood analysis in conjunction with scans, necessary for rigorously quantitative data analysis.
Exam Rooms	Two Exam rooms for patient prep, including arterial catheterization
Miscellaneous	Automated blood collection system, Participant waiting room.
<b>FERM Laboratory</b>	
Radiochemistry	Located in the BSC, the FERM lab has 2 additional hot cells and two GE FXN systems for F-18 tracer production, along with complete QC instrumentation.

## Financials

The PET core has dramatically increased funded research over the few years we have been working. We anticipate continued growth as more SBU researchers and outside collaborators become aware of this major new facility and the Core's expertise.



### Future Directions:

With the addition of Dr. Jacob Houghton to the PET Exec Committee the PET core will work closely with the cancer center to increase the number of PET research studies in oncology. We also look forward to working with the administration to recruit new clinical oncology researchers to help in this endeavor.