

**Inflammation, Infection, Immunity, Immunotherapy (I-4ward) Task Force-2023 Updates.** A survey of the ~300 UAB I-4ward researchers identified four immediate Priority Areas for investment.

**Access to Cutting-edge Technology.** To drive transformational advancements in our understanding of immune, inflammatory, and infectious diseases, I-4ward invested in technologies that support multi-omic analyses in human and animal *tissues* with **single-cell spatial resolution**. With matching investments by the HSOM Immunology Institute (II) and the O'Neal Comprehensive Cancer Center (OCCC), I-4ward purchased the **Lunaphore COMET multiplex imaging system, high-performance computer workstations, and access to Visiopharm software (5 workstations)**. The COMET (<https://lunaphore.com/>) is used to perform immune-fluorescence analysis on fixed or fresh tissue sections (multiplex 40 antibodies). Visiopharm employs deep learning-based algorithms (<https://visiopharm.com/>) to define tissue and cellular structures and is used to analyze the COMET images. In addition, I-4ward and Brain Health raised >\$600K in matching support and were awarded an **HSF-GEF grant** for the **10X-Genomics Xenium single-cell resolution spatial transcriptomics platform**. The Xenium ([Xenium 10X](https://xenium.10xgenomics.com/)) is used to measure gene transcripts at true single cell resolution in fresh or fixed tissue sections. The COMET and Xenium platforms can be linked so that *proteomic and transcriptomic spatial profiling may be performed on the same tissue sections*. Both are housed and managed by the UAB Flow Cytometry and Single-Cell Core. COMET panels [antibodies specific for either human (n=28) or mouse (n=28) proteins that cover the main immune cell types and tissue defining markers] have been validated for healthy and diseased mouse and human tissue arrays. The Visiopharm workstations are open, and training for early adopters is complete. Training sessions were recorded and posted on a UAB Kalutra channel. Azure virtual computing systems were built and are running the analysis suite. Panel design has been discussed with 16 investigators, and at least 10 grants already have been submitted listing this service. Wide rollout of access to COMET is anticipated within the next few weeks. Xenium is awaiting IT support and 10X-Genomics for installation.

*Immediate and long-term priorities* include: (1) rollout of COMET technology to all researchers (March 2024); (2) installation, optimization, and rollout of Xenium technology (late 2024); (3) workshops on uses of spatial platforms (summer 2024); (4) I-4ward supported vouchers for use of platforms (RFA late spring 2024); (5) investment in other multi-omics platforms and imaging modalities (early 2025); and (6) investment in research platforms that facilitate I-4ward focused faculty recruitment and build capabilities of existing faculty (ongoing).

**Informatics Pipelines and Training to Build and Expand I-4ward Relevant Research.** To best leverage the new single cell 'omics platforms, individuals with specialized training in informatics are critical. I-4ward is partnering with the Brain Health and Disease group and **has invested in an informatics group specializing in single cell datasets**. This group is embedded within the UAB Biologic Data Science Core (BDSC). One full-time informaticist has been identified and is responsible for building pipelines that will allow investigators to process the single cell data sets spatial datasets. A working group that includes technical, data informatics, and IT experts is being established. Group members will be provided with financial support (effort) to build advanced analytic tools and COMET/Xenium integration tools.

*Immediate and long-term priorities* include: (1) supporting existing experts to design and validate a multi-omic platform to integrate different types of single cell and other imaging modality data sets; (2) performing more advanced analyses that are not available "out of the box" (ongoing); (2) developing and supporting training workshops for scientists (summer 2024); (3) deploy early pipeline analytic tools (fall 2024); (4) establishing a single cell consulting service for scientists (fall 2024); (4) initiating I-4ward supported vouchers for analytic support; (5) hiring additional informatics staff members for analytic and training support (late 2024); and (6) participating in cluster hires for I-4ward focused faculty. These efforts by I-4ward will support the infrastructure needed to recruit these faculty and to build capabilities of existing faculty (ongoing).

**Recruiting a Talented Trainee Pool for I-4ward Researchers.** These efforts will begin in 2024. Analysis of I-4ward focused multi-omics data sets require a workforce with training in complimentary fields like computational biology, medical and biologic informatics, (bio)statistics, epidemiology, and (pre)clinical models of disease. Post-doctoral fellows (PDF) with expertise in these areas are in high demand and difficult to recruit to UAB. Our *Immediate Goal* is to build on the early success of the post-doctoral program (Brain-PRIME) established by the Brain Health group to recruit PDFs who will advance multi-'omics research and analysis in I-4ward laboratories.

**Service Centers to Develop Resources for Bench, Translational and Clinical Researchers.** These efforts will begin in 2024. *Immediate Goals* include complementing single cell, imaging, and associated informatics platforms with a service center to help researchers link their biologic data sets to the clinical data associated with the tissue samples. I-4ward will partner with the UAB Health Equity Task Force to provide resources to deploy the Learning Health System Platform that will allow researchers to define data bundles of clinical information that can be queried for cohorts of interest on demand. In the coming year, I-4ward will provide resources and expertise to build and validate I-4ward-centric clinical data bundles. A second goal is to develop a platform to link I-4ward scientists with UAB clinicians who can identify patient cohorts and patient repository samples for studies.