DHVI Biomolecular Interaction Analysis (BIA) Core Facility

**Mission**
The DHVI Biomolecular Interaction Analysis (BIA) Core Facility offers state-of-the-art Surface Plasmon Resonance (SPR) and Biolayer Interferometry (BLI) instruments, expertise, training, and support for label-free, real-time analysis of biomolecular interactions to basic and clinical researchers within the Duke Community.

**Leadership / Experience**
- **Director:** S. Munir Alam, PhD
  - Munir Alam is a Professor of Medicine and Pathology at Duke University, a DHVI Principal Investigator, and the Founding Director of the DHVI BIA Core Facility. Dr. Alam is a recognized expert in biochemical and biophysical analyses of receptor-ligand interactions, including TCR-ligand and antibody-antigen binding, and HIV-1 envelope protein antigenicity characterization. He is Director of Protein Analytics at both the DHVI and its GMP facility, a Co-Investigator in the Duke CHAVD program, and was the Proteomics Director for the Duke CHAVD program.
- **Manager:** Kenneth Cronin
  - Ken Cronin has served as Lab Manager for Dr. Alam for 7 years and recently has taken on role of BIA Core Manager. He has extensive experience in assay development and biophysical characterization of molecular interactions by SPR, BLI, and FPLC.

**Services**
- **Binding Specificity and Screening**
  - Yes/No Binding
  - Ranking of Binding Response
- **Kinetics and Affinity**
  - Direct Binding Kinetics
  - Steady State Affinity
  - In-solution Affinity
  - Avidity Assessment
- **Active Concentration**
  - Surface Competition
  - Solution Inhibition
- **Thermodynamics**
- **Epitope Mapping**
- **Conformation Changes**

**Technology / Instruments / Resources**

**Surface Plasmon Resonance**

- Biacore SPR systems are **low sample consumption** (typically < 25 μg) and are **compatible with a wide-range of biomolecules**
  - Proteins, peptides, DNA/RNA, small molecules, carbohydrates, polymers, lipid membranes, micelles, liposomes, polymers, whole viruses, and whole cells
  - Crude cell culture lysates or clinical sera/bodily fluids
  - Biomolecules can be functionalized on sensor chips via:
    - Covalent coupling
    - High-affinity capture (with any affinity tag)
    - Hydrophobic adsorption

**DHVI BIA Core Facility Platforms**

- **Biacore 3000**
  - Standard platform
  - Simultaneously detects 4 interactions
  - 10 RU Sensitivity

- **Biacore T200/S200**
  - LMW screening
  - Simultaneously detects 4 interactions
  - 1 RU Sensitivity
  - T200 available for Independent Use

- **ForteBio Octet-RED96**
  - Biolayer Interferometry (BLI)
  - Ligand-coated biosensors in 96-well plate
  - Crude sample compatibility
  - Simultaneously detects 8 interactions

- **ForteBio Octet HTX**
  - High-throughput Biolayer Interferometry (BLI) analysis Supports 96- and 384-well plate racks

**Recent Projects / Publications**

- **Affinity Maturation and Kinetic Trends** in the CH103 bnAb Lineage. Kinetic association rates (kₐ, red), dissociation rates (kₑ, purple), and apparent affinities (Kₐₑ, blue) of the CH103 lineage mAbs for HIV-1 heterologous gp120 Envelope antigen (B.62521). In this lineage, affinity maturation proceeded via two distinct kinetic regimes: early stage improvement in kₐ (8 to 13) and late stage improvement in kₑ (33 to 34), highlighting the importance of kinetic characterization in the investigation of binding mechanisms and immunogen design.¹


- **Competition** – *Tomaras, G.D., et al., Vaccine-induced plasma IgA specific for the C1 region of the HIV-1 envelope blocks binding and effector function of IgG. PNAS-USA 2013, 110 (22).*

- **Epitope Mapping** – *Liao, H.K., et al., Vaccine Induction of Antibodies against a Structurally Heterogeneous Site of Immune Pressure within HIV-1 Envelope Protein Variable Regions 1 and 2. Immunity 2013, 38 (1).*

- **NanoParticle/Liposome Antigenicity** – *Alam, S.M., et al., Role of HIV nanoparticle in neutralization by two broadly neutralizing antibodies. PNAS-USA 2009, 106 (48).*

**Reservations / Service Requests**

- **Independent Use** – Self-Service, T200 only
  - Complete training in the independent operation of the Biacore T200
  - Available 24/7/365 through CoreResearch@Duke

- **Sample Submission** – Limited Full-Service, All platforms
  - All experimentation, optimization, and analysis will be performed by Core Staff.

- **Consultation**
  - Assistance in experimental design and analysis/interpretation of data
  - Contact Ken Cronin to schedule an initial consultation

**Contact Us**

- **BIA Core Facility website:** dhvi.duke.edu/programs-and-centers/shared-resources/courses/biomolecular-interaction-analysis-bia-core-facility
- **Email:** kenneth.cronin@duke.edu
- **Phone:** (919) 684-4380

¹ Alam, S.M., et al., Solution Inhibition Direct Binding Kinetics Binding Specificity and Screening Biacore SPR systems are low sample consumption (typically < 25 μg) and are compatible with a wide-range of biomolecules Proteins, peptides, DNA/RNA, small molecules, carbohydrates, polymers, lipid membranes, micelles, liposomes, polymers, whole viruses, and whole cells Crude cell culture lysates or clinical sera/bodily fluids Biomolecules can be functionalized on sensor chips via: Covalent coupling High-affinity capture (with any affinity tag) Hydrophobic adsorption DHVI BIA Core Facility Platforms Biacore 3000 Standard platform Simultaneously detects 4 interactions 10 RU Sensitivity Biacore T200/S200 LMW screening Simultaneously detects 4 interactions 1 RU Sensitivity T200 available for Independent Use ForteBio Octet-RED96 Biolayer Interferometry (BLI) Ligand-coated biosensors in 96-well plate Crude sample compatibility Simultaneously detects 8 interactions ForteBio Octet HTX High-throughput Biolayer Interferometry (BLI) analysis Supports 96- and 384-well plate racks Recent Projects / Publications Affinity Maturation and Kinetic Trends in the CH103 bnAb Lineage. Kinetic association rates (kₐ, red), dissociation rates (kₑ, purple), and apparent affinities (Kₐₑ, blue) of the CH103 lineage mAbs for HIV-1 heterologous gp120 Envelope antigen (B.62521). In this lineage, affinity maturation proceeded via two distinct kinetic regimes: early stage improvement in kₐ (8 to 13) and late stage improvement in kₑ (33 to 34), highlighting the importance of kinetic characterization in the investigation of binding mechanisms and immunogen design.¹ Kinetics/Affinity – *Henderson R., Watts, B.E., et al., Selection of immunoglobulin elbow region mutations impacts interdomain conformational flexibility in HIV-1 broadly neutralizing antibodies. Nature Communications 2019, 10 (654).* Vaccine-induced Avidity Screening – *Lynch, H.E., et al., Surface plasmon resonance measurements of plasma antibody avidity during primary and secondary responses to anthrax protective antigen. Journal of Immunological Methods 2014, 404.* Competition – *Tomaras, G.D., et al., Vaccine-induced plasma IgA specific for the C1 region of the HIV-1 envelope blocks binding and effector function of IgG. PNAS-USA 2013, 110 (22).* Epitope Mapping – *Liao, H.K., et al., Vaccine Induction of Antibodies against a Structurally Heterogeneous Site of Immune Pressure within HIV-1 Envelope Protein Variable Regions 1 and 2. Immunity 2013, 38 (1).* NanoParticle/Liposome Antigenicity – *Alam, S.M., et al., Role of HIV nanoparticle in neutralization by two broadly neutralizing antibodies. PNAS-USA 2009, 106 (48).* Reservations / Service Requests Independent Use – Self-Service, T200 only Complete training in the independent operation of the Biacore T200 Available 24/7/365 through CoreResearch@Duke Sample Submission – Limited Full-Service, All platforms All experimentation, optimization, and analysis will be performed by Core Staff. Consultation Assistance in experimental design and analysis/interpretation of data Contact Ken Cronin to schedule an initial consultation