

VBI Immunology Research Thrust

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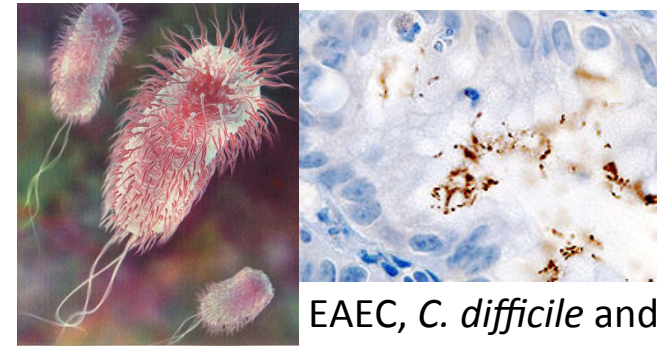
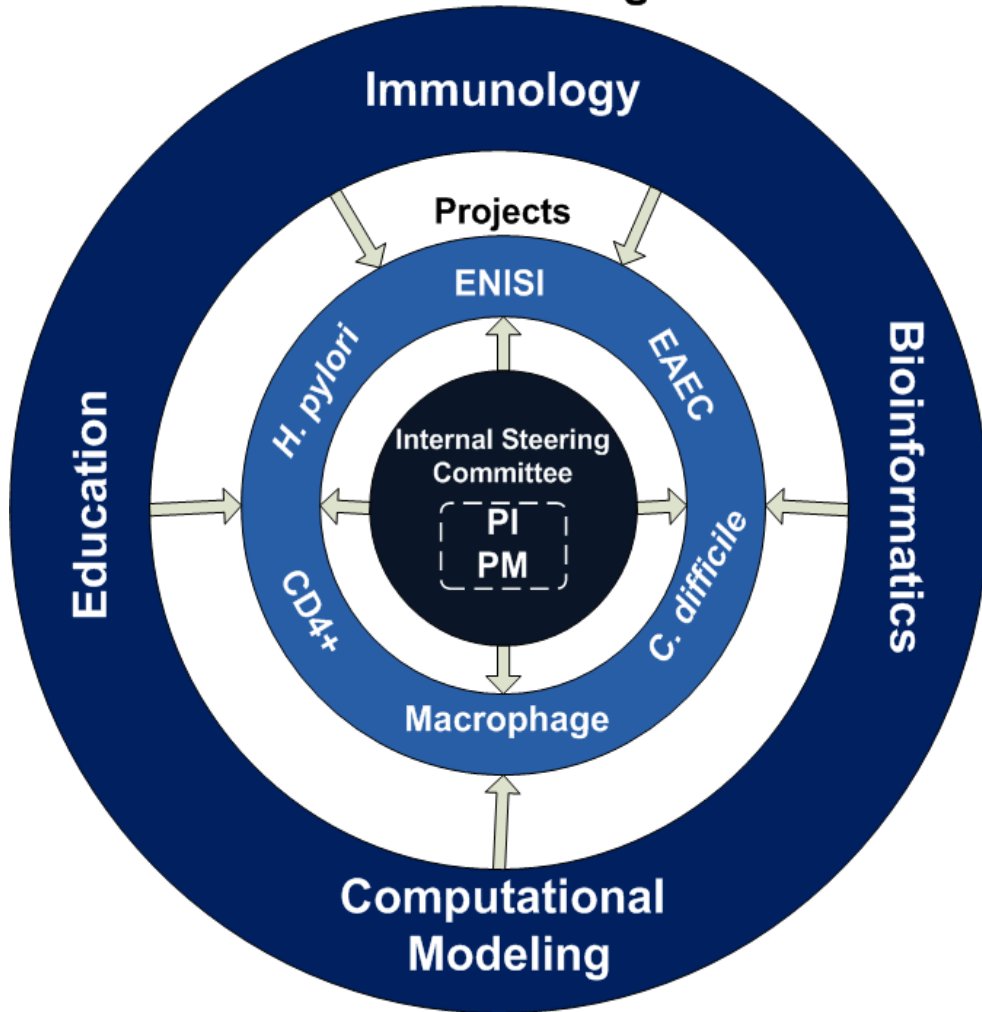
Complex Human Diseases

- Immune-mediated diseases
 - IBD, multiple sclerosis, rheumatoid arthritis, T1D
- Chronic Inflammatory diseases
 - Obesity, T2D, heart disease, inflammation-associated cancer
- Infectious diseases
 - Gut and respiratory infections
 - Infection-associated cancer

Approaches

- Mechanistic studies
 - Animal models of human disease
- Translational research
 - IBD and ID clinical trials
- Integration of experimental and computational approaches
 - Center for Modeling Immunity to Enteric Pathogens (MIEP)

Center for Modeling Immunity to Enteric Pathogens



EAEC, *C. difficile* and *H. pylori*

\$10.6M, 30 researchers, 3 Institutions

Virginia Bioinformatics Institute

- Nutritional Immunology & Molecular Medicine Lab
- Network Dynamics and Simulation Science Lab

University of Virginia

- Center for Global Health

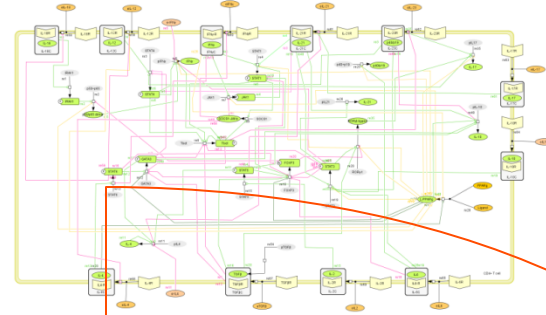
Caprion Proteomics

www.modelingimmunity.org

Computational Immunology



Literature & data mining



The Network Model



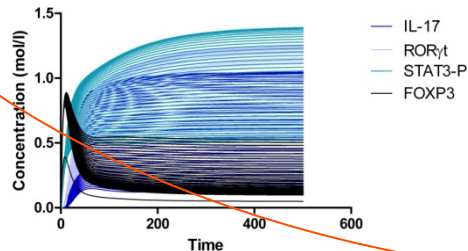
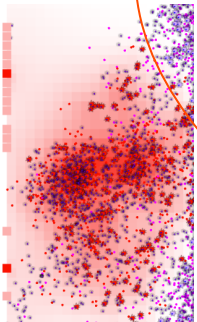
ENteric Immunity Simulator

Modeling tools



In vivo hypothesis testing

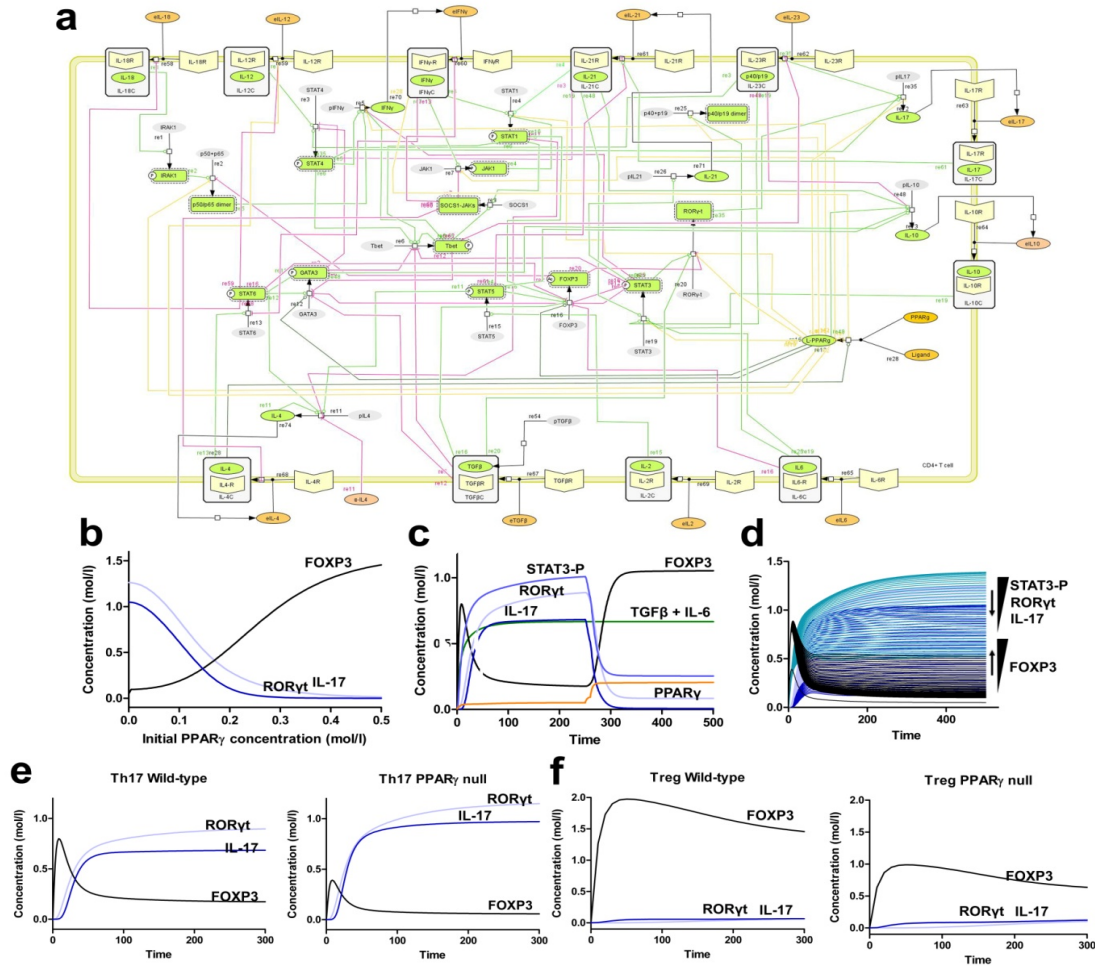
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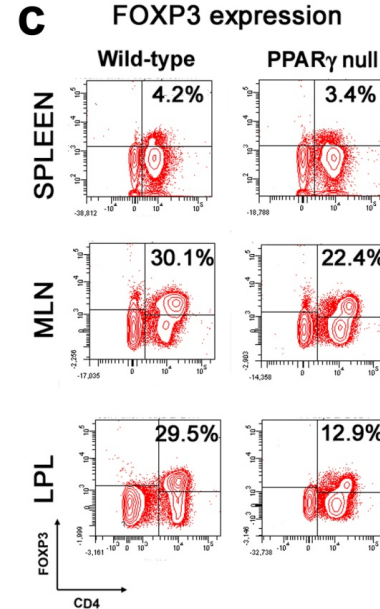
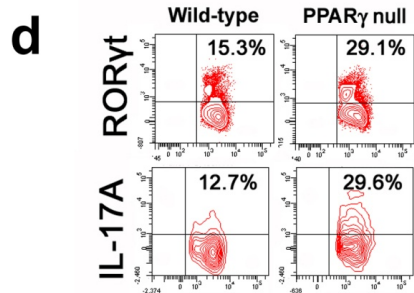
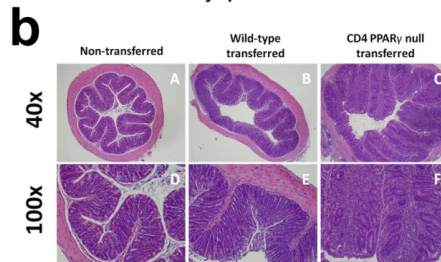
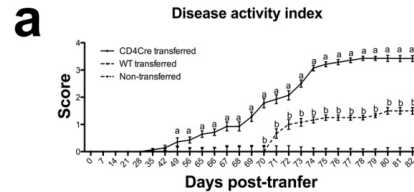
In silico experiments
Hypothesis generation



CD4+ T cell Differentiation

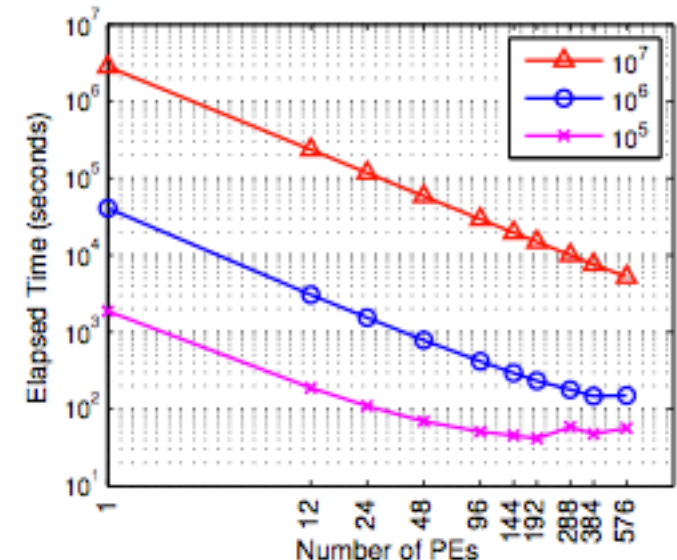
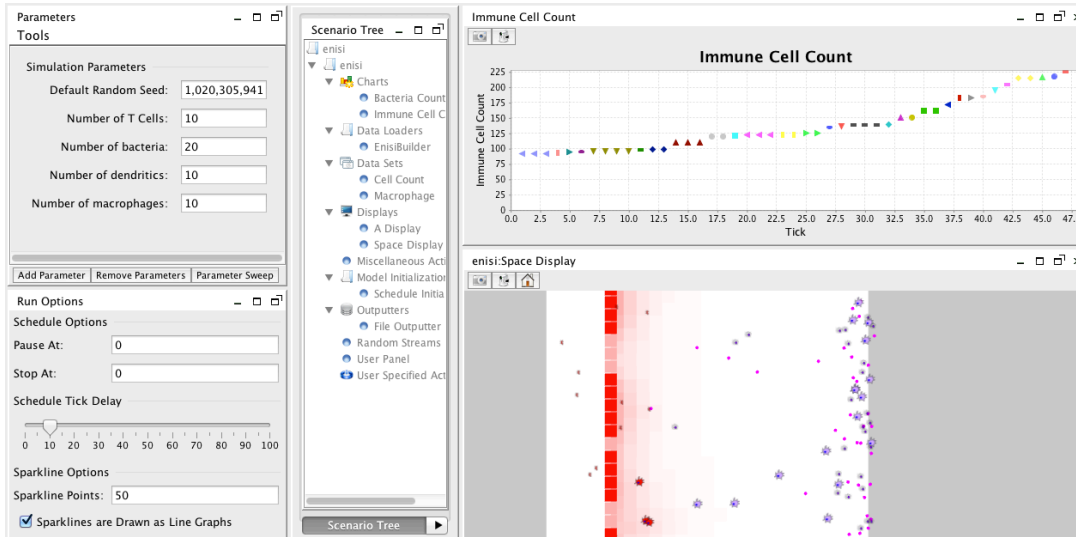


CD4+ T cell Differentiation

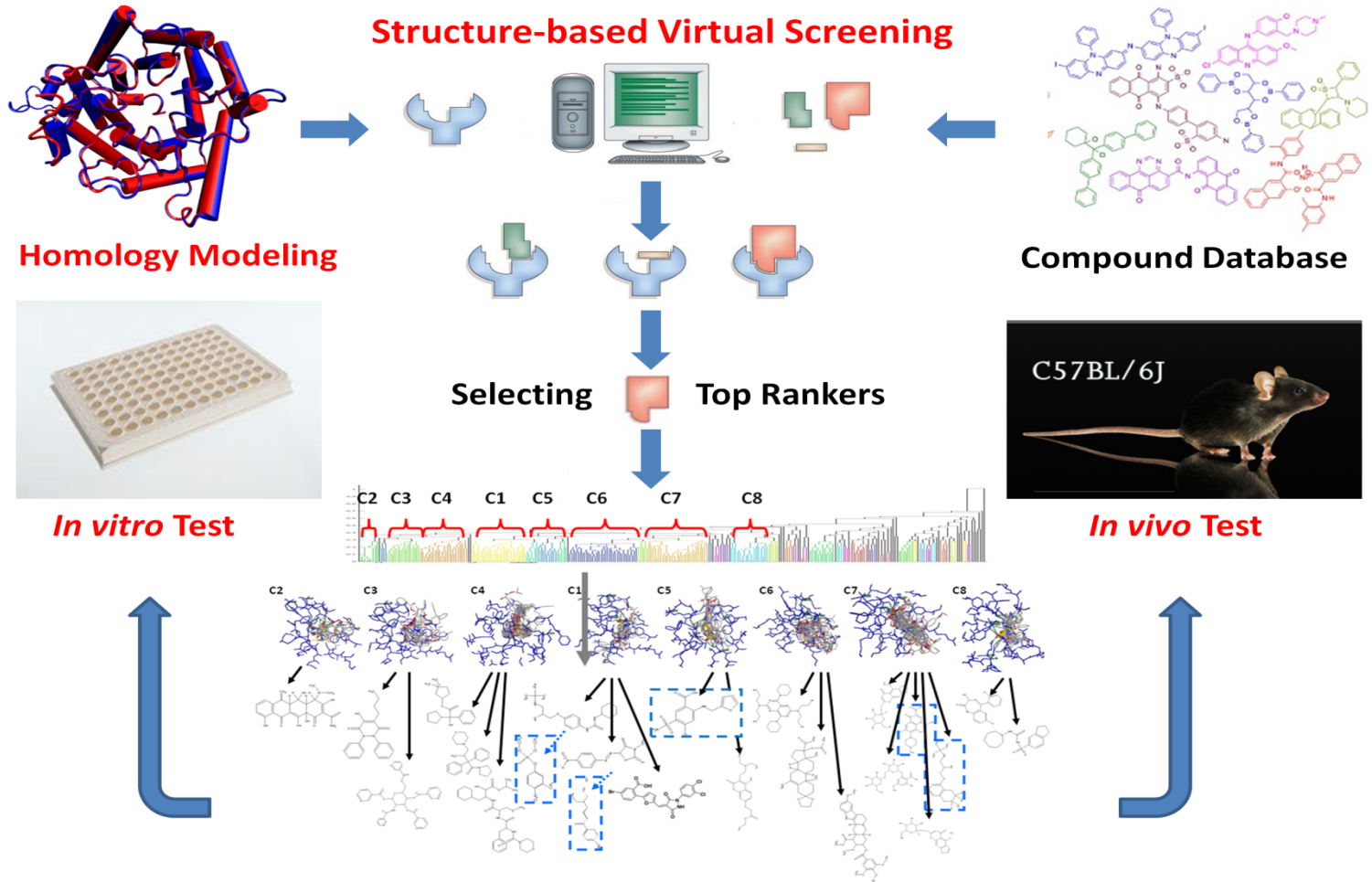


ENISI: Agent Based Simulator for Gut Immunity

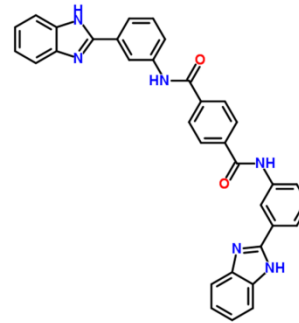
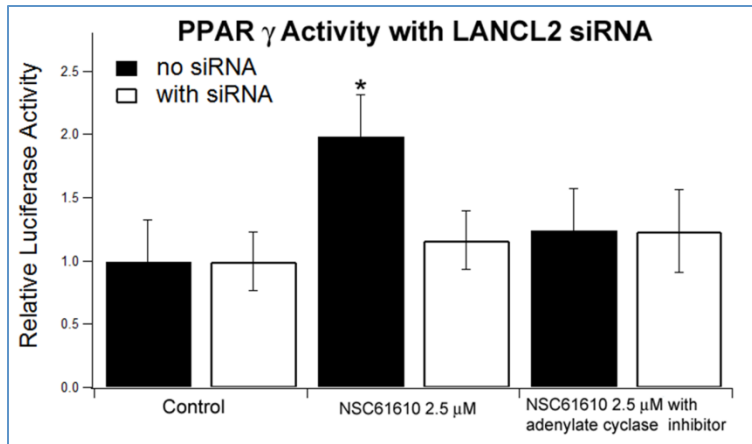
- Agent-based modeling utilizes super computers and simulates fine-grained biological systems
- Challenges: scalability and quality visualizations
- ENISI scales up to 10^8 cells with quality user interfaces, graphics, and animations



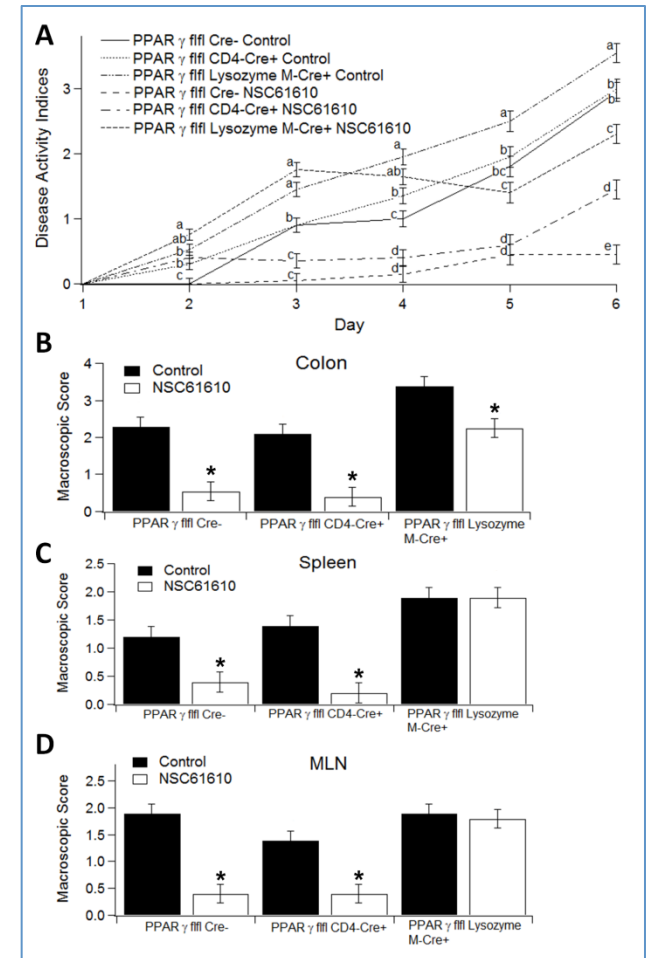
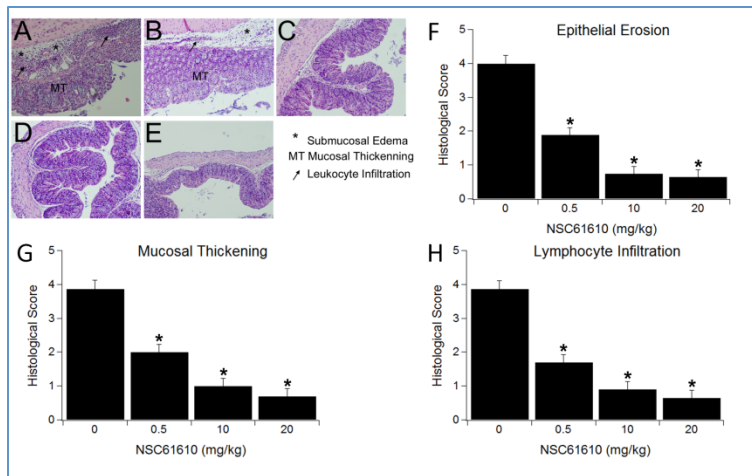
Molecular Modeling in Drug Development



Anti-Inflammatory Efficacy of 61610 in IBD



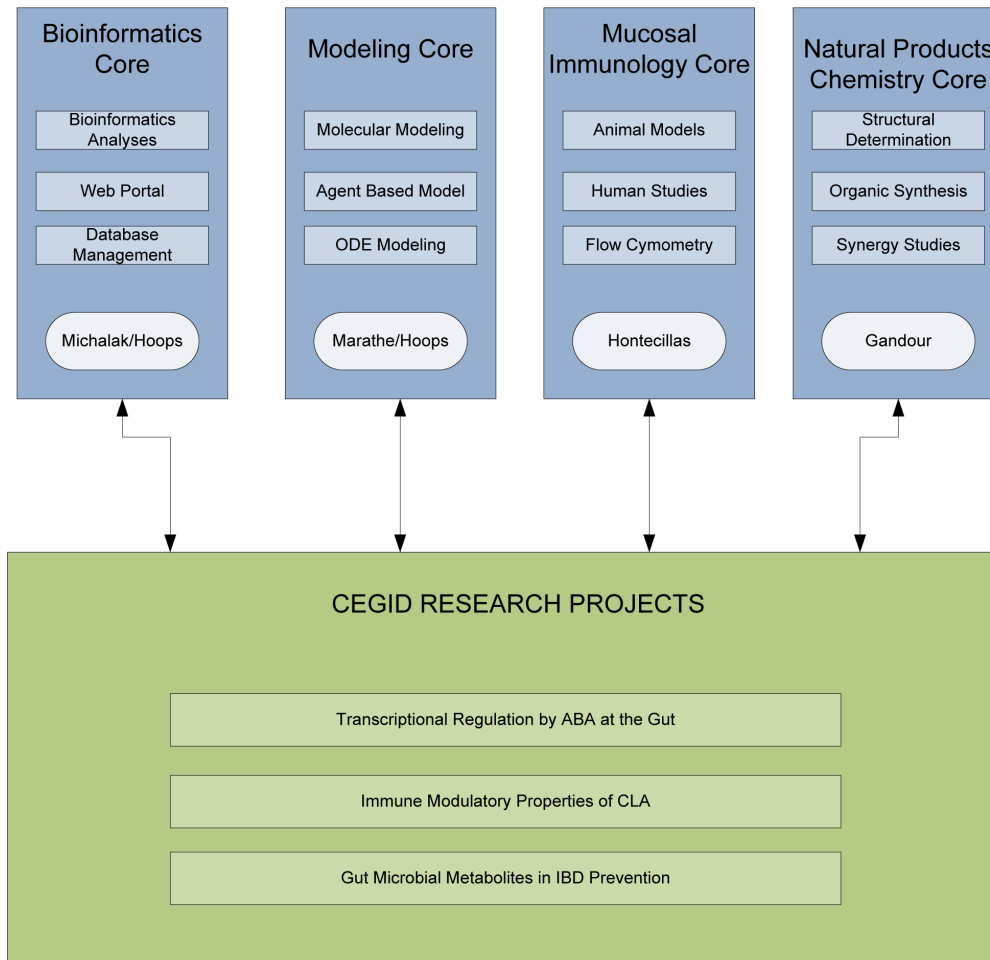
61610



Future Life Science Growth

- Comprehensive systems level mechanistic research
 - Pre-clinical (mouse and pig)
 - Clinical (healthy and patient populations)
- Computational Immunology
 - MIEP/MIB, NDSSL, NIMML, Yale, Mount Sinai, Duke/BU and Rochester
- Center of Excellence in GI diseases
 - VBI, Carilion, UNC Chapel Hill, Biochemistry, Chemistry
- Microbial metabolites in inflammation and cancer
- Immunology community support
 - Bioinformatics/Modeling support for immunology community

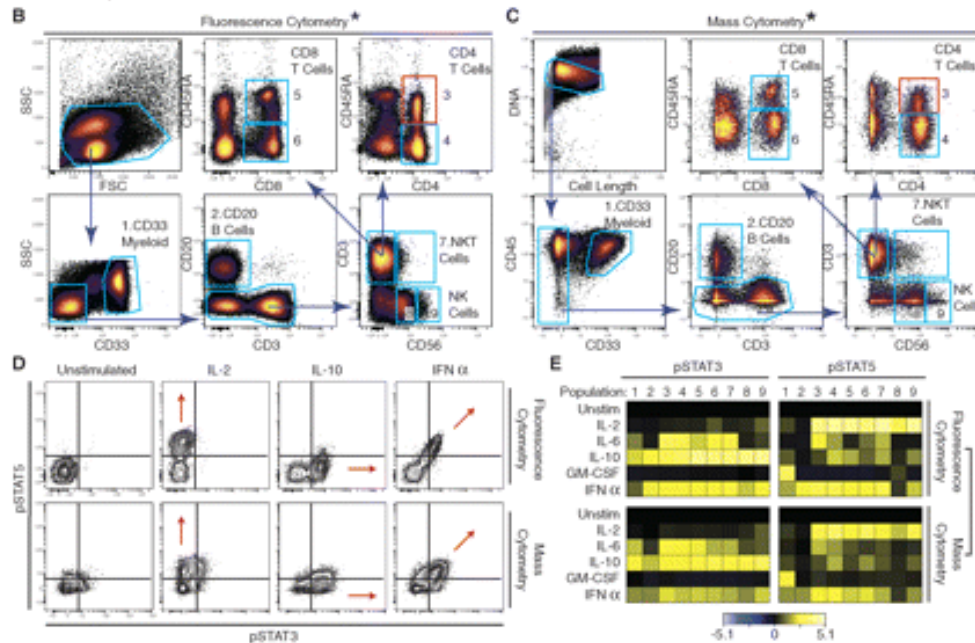
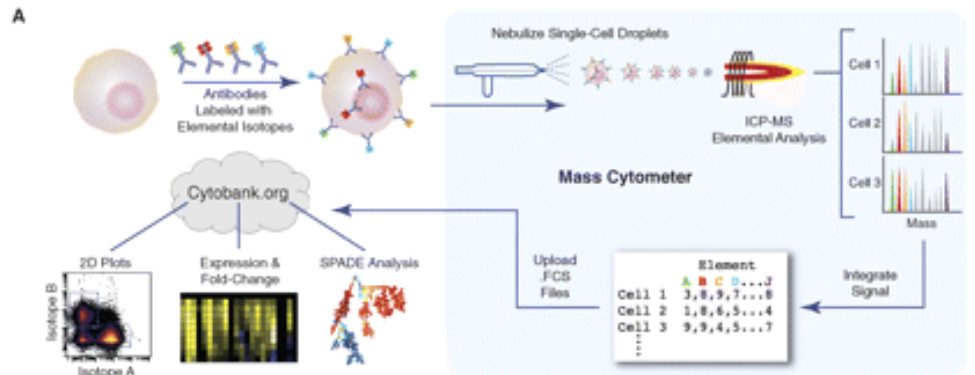
Center of Excellence in Gastrointestinal Diseases (CEGID)



Future Life Science Growth

- Neuroimmunology
 - VTCRI, M. Friedlander
 - Modeling mechanisms of CNS-immune system interactions
- Novel drug development pipelines
 - VTCDD, D.I. Kingston
 - Molecular modeling, D. Bevan and Bin Xu
- Chronic Inflammatory Diseases (obesity and T2D)
 - VT cluster hire in obesity

Single-cell Mass Cytometry



- 17 CYTOF worldwide
- 30 to 100 markers analyzed on a single cell
- Systems-level analyses
 - Signaling
 - Immune profiling
 - Cell division, maturation, differentiation

Summary

- Successful expertise in large-scale programs
- Fully integrated immunology wet lab and computational modeling capabilities
- Proven pre-clinical and clinical study capabilities
 - Translational research
 - Drug and natural product discovery
- From molecular to whole organism level
- Mechanistic and applied research