

Thesis Portfolio

**A COMPUTATIONAL PIPELINE FOR STUDYING FUNCTIONAL GENOME
ORGANIZATION**
(Technical Report)

ETHICAL CONSIDERATIONS FOR HOME DNA TESTING
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Zachary Thomas
Spring, 2021

Department of Biomedical Engineering

Table of Contents

Sociotechnical Synthesis

A Computational Pipeline for Studying Functional Genome Organization

Ethical Considerations for Home DNA Testing

Thesis Prospect

Sociotechnical Synthesis

Colorectal cancer is the third most diagnosed cancer in the United States. It has been projected that by 2030 the incidence rates for colon and rectal cancer will increase by 90 percent and 124.2 percent for patients 24 to 32 years of age. Cancer in general is a complex disease involving multiple layers of malfunctioning systems in the genome, epigenome, and higher-order genome organization. A number of computational frameworks have been developed to study functional regulators at these different levels. For example, Binding Analysis for Regulation of Transcription (BART), was developed to predict functional transcriptional regulators that regulate gene expression. Like many other data science approaches to studying genomics, BART relies on data collected from the public domain.

The technical project and loosely coupled STS project seek to provide a better understanding of cancer and the data used to develop research tools. More specifically, with the help of Biomedical Engineer Alexandra Hickman, Research Associate Zhenjia Wang, and Chongzhi Zang of the Departments of Public Health Sciences, Biomedical Engineering, and Biochemistry and Molecular Genetics, the technical project aims to develop a computational pipeline for 3D genome analysis. The pipeline will then be applied to colorectal cancer using data collected from the public domain. The loosely coupled STS project focuses on the ethical issues surrounding genetic data in a data driven world. Specifically, the project aims to understand the concept of privacy as it pertains to genomic data sets. This problem will be analyzed using a social construction of technology approach.