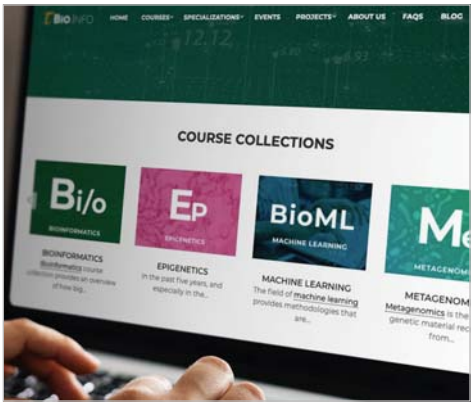
OMICSLOGIC

BIOINFORMATICS TRAINING

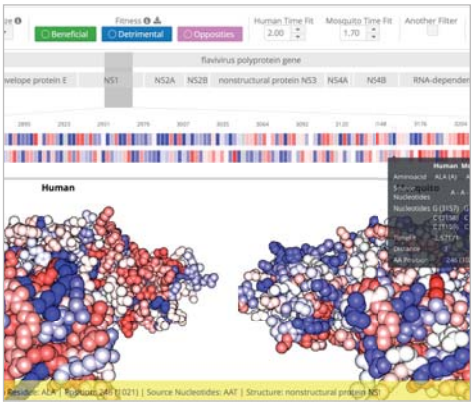
Modular online resources for bioinformatics course development, project-based learning, and biomedical data science training.

BIOINFORMATICS: BIOLOGY AS A **DATA SCIENCE**



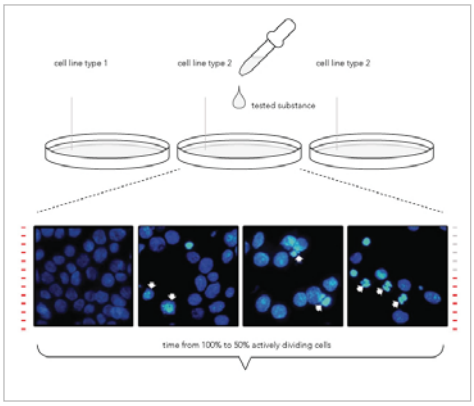
COMPREHENSIVE CURRICULUM

Modular coursework to offer a modern big data bioinformatics course or degree at your lab, department or university



INTUITIVE DATA APPLICATIONS

Interactive analytical tools designed to help students stay on track and receive timely feedback from faculty or teachers



CURATED PROJECT EXAMPLES

Curated datasets from publicly available repositories with easy-to-follow tutorials on a variety of relevant topics

TAUBER BIOINFORMATICS RESEARCH CENTER

אוניברסיטת חיפה University of Haifa جامعة حيفا

LSU BIOMED

Georgetown University

FOR A FULL LIST OF PARTNER INSTITUTIONS, INTERNATIONAL PROGRAMS AND HOST UNIVERSITIES, VISIT OUR WEBSITE AT LEARN.OMICSLOGIC.COM

"Pine Biotech has done a great job putting together concise, informative, project based courses around bioinformatic topics."

Dr. Ian Townley - Professor of Practice, Department of Cell & Molecular Biology, Tulane University, USA

T-BIOPLATFORM BIOINFORMATICS AND DISCOVERY

PINE.BIO OMICS DATA SENSE AND MORE

TAUBER BIOINFORMATICS RESEARCH CENTER

OMICSLOGIC PLATFORM

Modular online resources for bioinformatics course development, project-based learning, and biomedical data science training.

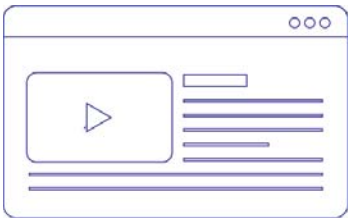
Omics Logic is an **integrated educational and research platform**, where students and faculty can learn, conduct research and collaborate. The platform combines introductory coursework on biological data analysis with data management and analytical tools.

Learning materials cover a variety of topics, such as viral genomics and molecular medicine. Practical exercises introduce basic statistical concepts and advanced analytical methods such as multi-omics integration, network analysis, and machine learning.

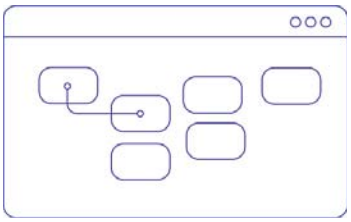
Hands-on assignments are based on a visual interface that links together individual algorithms into bioinformatics pipelines. The pipelines are color-coded and annotated with explanations on analysis methods and logical steps.

Unlike other e-learning platforms, Omics Logic is built around practical, project-based and student-centered learning.

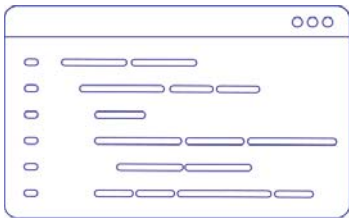
LEARNING **DATA-DRIVEN RESEARCH**: ANALYZE AND INTERPRET **BIG DATA**



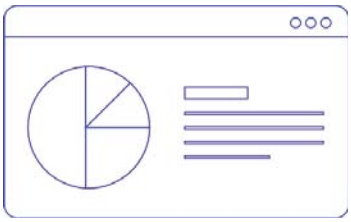
Project-based content built for online learning, enriched with interactive multimedia, explained terms and diagrams. The content is divided up into 5-10 minute modules with videos, quizzes and practical tasks that can be completed independently. Most commonly used omics data types are explained from a biological and data analysis perspectives.



Assignments for each module include a visual interface that helps link together individual algorithms into bioinformatics pipelines while learning about the data analysis methods. These pipelines include color-coded and logical steps for analysis. Complex data processing pipelines that analyze terabytes of raw data become a learning experience.



Once the data is prepared, it can be studied using analytical tools, visualization and biological annotation. Omics Logic Code playground helps develop coding skills while learning popular packages in R and Python to visualize, annotate and analyze complex patterns in gene expression, genomic variant and metagenomic datasets.

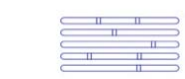


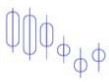
All student learning activity is analyzed, tracking user background, skill improvement and topic understanding. This information is converted into user points and badges that keep users motivated. Analyzing activity data from thousands of students, the platform provides insights into successful learning patterns translated into course recommendations.

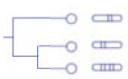
USER-FRIENDLY **MULTI-OMICS ANALYSIS** PLATFORM **AND CODING** PLAYGROUND

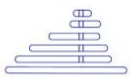
T-BioPLATFORM
BIOINFORMATICS DISCOVERY

USER-FRIENDLY PROCESSING, ANALYSIS, ANNOTATION & VISUALIZATION


SEQUENCE ALIGNMENT

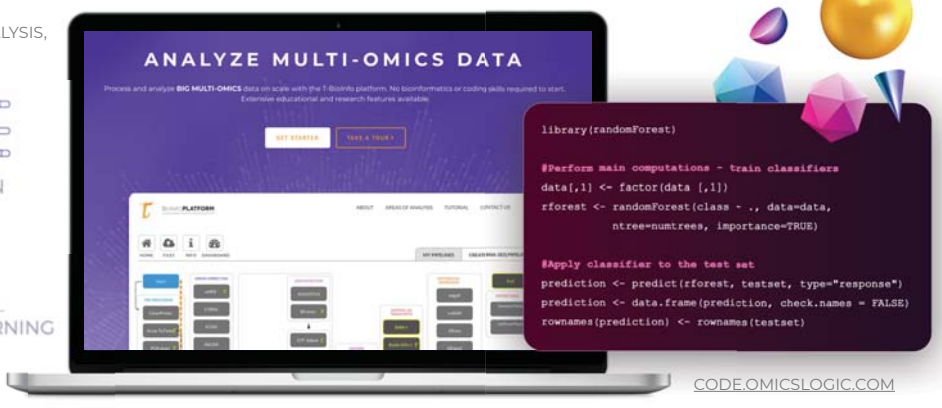

RNA-SEQ


EVOLUTION


VARIANT CALLING


STRUCTURE ANALYSIS


MACHINE LEARNING



LEARN MORE ON SERVER.T-BIO.INFO

CODE.OMICSLOGIC.COM

BIOINFORMATICS COURSEWORK & TRAINING

Bioinformatics resources for student-centered learning, training programs and curriculum enrichment.

COMPREHENSIVE, MODULAR, AND INTERACTIVE **CURRICULUM**

Working with academic partners like the **Tauber Bioinformatics Research Center** at University of Haifa, Israel, **Georgetown University Medical Center** in Washington, D.C. and **Louisiana State University** in Baton Rouge, Pine Biotech has developed a comprehensive resource to make cutting edge bioinformatics accessible. This project-based online curriculum is designed for undergraduate, graduate and post-graduate students without any engineering background. It introduces major -omics data types, as well as approaches for big data processing, analysis and data visualization for effective handling of big data generated in life science research and biotechnology.

PROJECT-BASED LEARNING

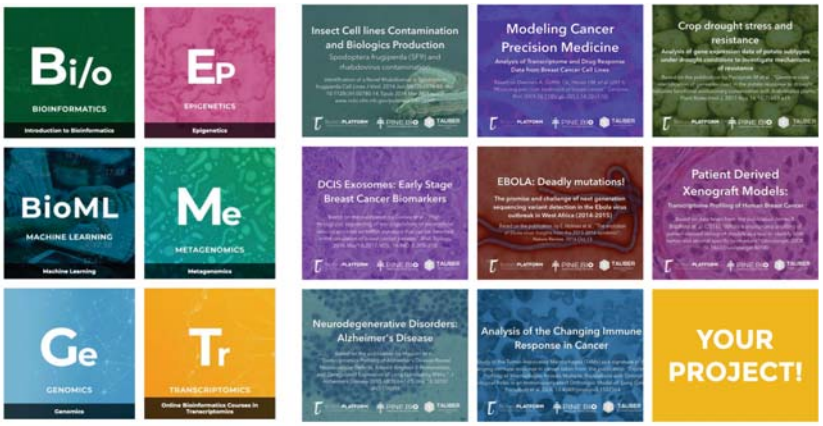
The **Omics Logic curriculum** follows a project-based, student-centered learning model. Introductory courses are divided into modules based on beginner, intermediate and advanced levels. Application of analytical methods is illustrated in projects that can be adapted for personalized, inquiry-based research experiences. Introductory materials:

- ✓ Bytes and Molecules (Biology and Data)
- ✓ Introduction to Big Data Bioinformatics
- ✓ BioML: Machine Learning for Biomedical Data
- ✓ Citizen Science and Public Domain Databases

Basic training in various omics-technologies, methods of statistical analysis and data science skills are offered as interactive tutorials with practical assignments.

- ✓ Genomics (DNA Sequence analysis)
- ✓ Transcriptomics (Gene expression)
- ✓ Epigenomics (DNA Methylation and Histone modification)
- ✓ Metagenomics (Microbiome composition)

The logic of analysis is contextualized by embedding analytical concepts into biological projects (Data Analysis, Management, Visualization). The complexity of analytical approaches is simplified by breaking it down into a series of basic tutorials spanning the student learning journey. As a result, students learn and develop appreciation of research by starting as an observer to becoming a participant, working on a project of their own. This journey begins with identifying an interesting biological research question that can be answered with data, continues with the collection and organization of data, and concludes with students interpreting and drawing conclusions about the data. Projects included in the Omics Logic curriculum can be divided into major applications of bioinformatics: **Oncology, Infectious Diseases, Neuroscience** and **Agriculture**.



Omics Logic training is designed to be delivered online or in a hybrid setting. Modules can be introduced as supplementary learning materials to highlight key data types, biomedical and biotechnology use-cases as well as illustrations for statistical analysis approaches. Practical assignments provide specific guidelines on how to plan and prepare for analysis in integrated settings (online and in-person workshops).

SCHOOL | UNIVERSITY | COLLEGE

Introductory, intermediate, and advanced topics for different levels of learning, including faculty and teacher training.

The future of biomedical discovery, research and biotechnology is in the hands of a new generation of students that will start their careers in the age of data and machine learning. We can help them adapt to data-driven research strategies and develop analytical thinking while making sure they are engaged in real science, and can acquire transferrable skills that will help advance their capabilities.

Bytes & Molecules

Bioinformatics for Everyone: Introduction to Big Data in Biology

Big Data Biology

Biology as a Data Science : Application in Research and Beyond

Omics in Research

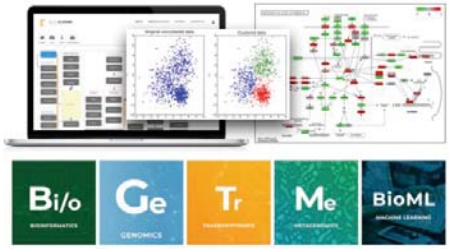
Big Data Discovery - From Analytics to Systems Biology

HIGH SCHOOL LEVEL

OMICSLOGIC @ SCHOOL

For young innovators to learn, experiment, and see the applications of big data in biomedical research

- ✓ be part of an international bioinformatics research community
- ✓ learn from and interact with Ph.D. level industry and academic mentors
- ✓ develop an appreciation of data in life sciences
- ✓ participate in research and contribute as a citizen scientist
- ✓ compete in science fairs and student research conferences

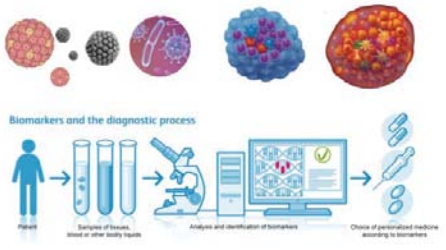


COLLEGE & UNIVERSITY LEVEL

BIOLOGY AS A DATA SCIENCE

For undergraduate students that will shape the future of biotechnology, medicine and agriculture

- ✓ understand how modern biology is shaped by data and analytical thinking
- ✓ learn from research project examples applying advanced bioinformatics to real problems
- ✓ gain broad understanding of high throughput technologies and omics studies
- ✓ gain solid ground in omics processing, analysis, machine learning
- ✓ explore systems biology through multi-omics integration



POST-GRADUATE AND FACULTY LEVEL

BIOINFORMATICS FOR RESEARCH

For researchers who need to handle, analyze and interpret complex datasets to gain insights

- ✓ apply complex analytical tools and models across multiple data types
- ✓ process and integrate large scale datasets for in-depth insights
- ✓ develop reproducible data analysis pipelines for tedious tasks
- ✓ incorporate public domain and proprietary datasets into your research
- ✓ leverage a community of experts and students to offset complex and technical tasks

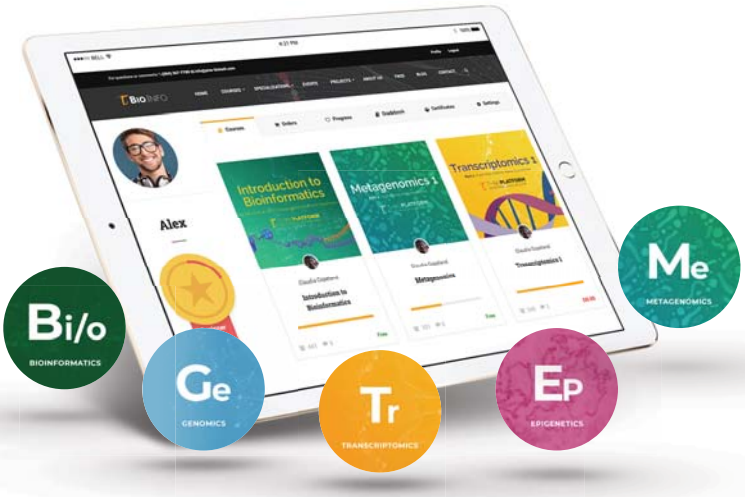
OMICS LOGIC LEVEL 1: Getting Started

Getting started with Bioinformatics: from the very basics to the application of data science in biomedical research and biotechnology

The **Omics Logic Level 1 curriculum** is an introduction to the world of big data in the context of life science technologies (Genomic sequencing, etc.). Introductory materials are divided into modules that are easy to complete without any technical pre-requisites or previous training. Applications of bioinformatics and data science are illustrated in examples that have been widely covered and discussed in popular journalism, such as genomics, personalized medicine and various biotechnological breakthroughs. Level 1 materials include the following introductory asynchronous courses:

- ✓ Bytes and Molecules (Biology and Data)
- ✓ Introduction to Big Data Bioinformatics
- ✓ BioML: Machine Learning for Biomedical Data
- ✓ Citizen Science in the Age of Data-driven Research

These courses prepare the audience for concepts used by computational biologists and bioinformaticians in a variety of research and applied domains.



In addition to these introductory materials, this **level 1 curriculum** offers basic training in various omics-technologies, methods of statistical analysis and data science skills. Each one of these modules is available with theoretical lessons, quizzes and interactive tutorials followed by practical assignments:

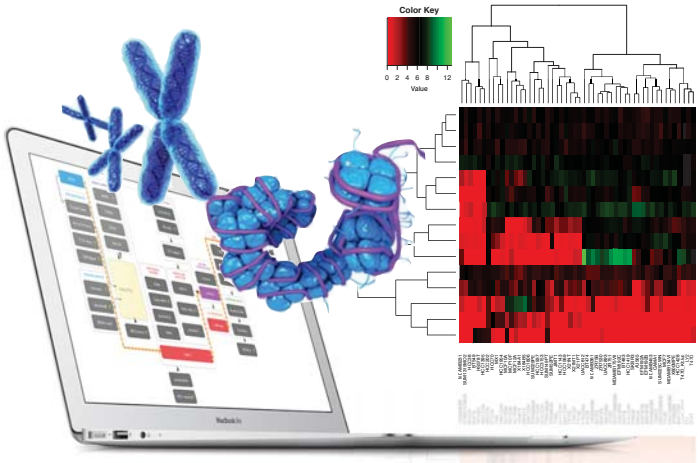
✓Genomics (Introduction to Genomics and Genomics 1)
✓Transcriptomics (Transcriptomics 1)
✓Epigenomics (Introduction to Epigenetics and Epigenomics 1)
✓Metagenomics (Introduction to Metagenomics and Metagenomics 1)

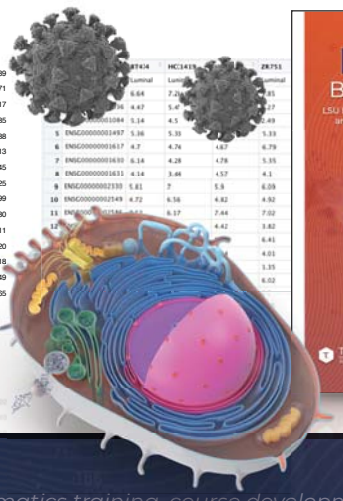
Even though training materials included in this level do not include specialized projects that can be completed by students independently, they will be introduced to several example datasets related to cancer, microbiome and neurodegenerative diseases. This is an important component of the Omics Logic curriculum which is designed to contextualize the logic of analysis by embedding analytical concepts into biological projects. The concepts cover major approaches to Data Analysis, Management of Big Heterogenous Datasets, Effective Visualization. Importantly, the complexity of analytical approaches is simplified by breaking them down into a series of basic tutorials spanning the student learning journey.

The major objective of this **level 1 curriculum** is to provide learners with motivation to continue learning about bioinformatics methods and start developing practical skills to address important research questions in life sciences, biomedical research and biotechnology industry.

Beyond the curriculum, **Omics Logic** will allow learners to

- ✓ be part of an international bioinformatics research community
- ✓ learn from and interact with Ph.D. level industry and academic mentors
- ✓ develop an appreciation of data in life sciences
- ✓ participate in research and contribute as a citizen scientist
- ✓ compete in science fairs and student research conferences





OMICS LOGIC LEVEL 1: Curriculum & Topics

1-month Syllabus: Asynchronous Coursework + Guided Training
Designed to provide a broad introduction and practical experience in omics data analysis

The **Omics Logic Level 1 curriculum** is an introduction to the world of big data in the context of life sciences. Introductory materials are divided into modules that are easy to complete without any technical training. Applications of bioinformatics and data science are illustrated in examples that have been widely covered and discussed in popular journalism, such as genomics, personalized medicine and various biotechnological breakthroughs. Level 1 materials can be delivered in a 1-month program targeting a beginner level of students, organized into 4 weeks of study (1 month)

Weeks:	1. Orientation	2. Genomics	3. Metagenomics	4. Transcriptomics
Main Topic	Applications of Bioinformatics	Analysis of DNA sequences	Microbiome composition	Variation in gene expression
Audience	Undergraduate	Undergraduate	Graduate	Professional
Courses	2 Intro courses: Bytes and Molecules, Introduction to Big Data Bioinformatics	2: Introduction to Genomics, Genomics 1	2: Introduction to Metagenomics, Metagenomics 1	1: Transcriptomics 1 (optional specialization: oncology, neuroscience, infectious diseases)
Topics	▸ Relationship between biological phenomena and data ▸ Big Data Generation, Management and Analysis ▸ BioML: Machine Learning for Biomedical Data ▸ Citizen Science in the Age of Data-driven Research	▸ DNA code, structure and elements ▸ Dna variation types ▸ Next Generation Sequencing: WGS, WES ▸ Analytical approaches to mapping and variant detection ▸ Examples in cancer and genetic diseases	▸ Study of microorganisms using NGS sequencing ▸ Microbiome: communities of microorganisms that live and function together ▸ Analysis of diversity, composition and complexity	▸ RNA Transcription: Gene > Transcript > Protein ▸ Variation of quantity and alt. splicing ▸ Pre-processing and mapping strategies ▸ Quantification and normalization ▸ Analysis of sample variance using gene expression
Teacher Guides	✓ material topics and assignment suggestions	✓ session slides and quiz answer explanation	✓ practical examples with curated datasets	✓ detailed concept maps with customization
Meeting Sessions	2 recommended	1-2 recommended	2-3 recommended	1-2 recommended
Practical Assignments	Literature review and reflection on commonly used genomic terms, Discussion board around topics and themes covered in the asynchronous materials	Literature review (terminology, key words) Mapping and Variant Calling for Somatic Mutations (Oncology Example)	Human Microbiome Project and the variation of “healthy” and non-pathological microbiota, Mapping 16s rRNA on SILVA database for phyla quantification	Patient - derived xenograft (PDX) model Tumor-microenvironment study of gene expression profiles and a comparison between common breast cancer types using PCA
Quizzes and Tests	3 Quizzes	5 Quizzes	4 Quizzes	2 Quizzes, 1 Final Exam

I enjoyed learning about bioinformatics and trying new forms of analysis, Omics Logic was new to me, and I thought it was fun.

Tyler Hayes - Senior Undergraduate at the Southern University and A&M College, Baton Rouge, LA

Knowing about organisms in the genetic level was fun. Also I really enjoyed drawing the pipelines and evaluating the results.

Prasansha Paudel - Undergraduate Student at University of Louisiana, Monroe, LA

OMICS LOGIC LEVEL 1: Case Study

Example of a university course that used Omics Logic modular online training resources for bioinformatics course development and enrichment for undergraduate students.

ELECTIVE **1-CREDIT COURSE** FOR UNDERGRADUATE STUDENTS

An introductory elective course is perfect for the undergraduate students that are interested to learn about the impact of Big Data and High-throughput Experiments across Life Science Domains, including Biomedical Research, Biotechnology and Agrobiological Studies. The Introductory package is most effective for students pursuing undergraduate life sciences degrees and pre-medical students.

COURSE TITLE: **BIG DATA BIOINFORMATICS**

Introductory materials on the T-BioInfo Educational portal offer a glimpse into the world of big data generated by biological systems and high-throughput experiments. These include a broad overview of various applications of bioinformatics in many domains, included in the **Introduction to Bioinformatics course.** The **Transcriptomics** course offers a thorough overview of Next Generation Sequencing Technologies and the algorithms needed to process, analysis and interpret such data. **Introduction to Genomics** is a course dedicated to the basics of genome alignment and identification of variants found in the DNA. These short courses offer easy to follow materials that are designed with a novice in mind- concepts are illustrated with videos and images, terminology is explained in layman terms and additional materials are referenced throughout the course. Additional materials designed for the faculty are offered to make the teaching process simple to follow and implement.

75%	- perceived overall gains in learning bioinformatics concepts	**92%**	- perceived overall gains in learning bioinformatics concepts
83%	- perceived learning from pipelines and data analysis	**74%**	- eager to take another bioinformatics course
92%	- perceived learning from educational modules	**92%**	- interested in learning more about bioinformatics
100%	- perceived learning from reading literature	**58%**	- interested in conducting bioinformatics research

CASE STUDY: **LOYOLA UNIVERSITY OF NEW ORLEANS (LA, USA)**

Undergraduate students with majors in biology, biochemistry, computer science, or psychology participated in a semester-long bioinformatics course emphasizing biomedical applications. As a result, students were enthusiastic to continue participating in bioinformatics research and take similar courses in the future. Students provided feedback in open-ended reflections after the completion of each module; and demonstrated measurable gains in ability to read and analyze bioinformatics research literature. At the conclusion of the course, bioinformatics problem-solving skills were applied to collaborative research projects utilizing published datasets. Students and faculty participated in a final poster session highlighting project results and new avenues of research.

Learn more: https://edu.t-bio.info/portfolio/loyola/

OMICS LOGIC LEVEL 2: Big Data Biology

Exponential growth of big data in biological sciences - practical applications of bioinformatics in research, biomedicine and industry

As a result of effective and affordable techniques to study molecular detail of biological phenomena, high-throughput methods like Next Generation Sequencing (NGS), imaging, mass-spectroscopy and others result in an exponential growth of data across many domains rooted in life sciences. To analyze such data and extract meaningful insights from accumulated databases, biologists are turning to advanced computational algorithms. Many methods in bioinformatics require an in-depth understanding of various machine learning algorithms and tools. In the specialized course on machine learning, we developed a series of courses and practical tutorials that provide a solid foundation for students on these important and often misunderstood approaches. Topics we review in these courses include data preparation, data mining, classification, model training, validation and many others. In this course series, students will learn about computational innovation and algorithmic improvements that are at the forefront of biomedical discovery.

Evaluation

Pre-assessment
Literature review
Self-assessment
Coursework

Mid-assessment
Literature review
Activity and Quizzes
Self-assessment

Post-assessment
Literature review
Activity and Quizzes
Self-assessment

Scoring Strategy

Participation
Session Participation
Activity and Quiz Results

Project submission
Topic
Dataset
Analysis plan

Final Exam
Genomics
Transcriptomics
Metagenomics

ONCOLOGY

Omics data is used in oncology to understand disease onset, risks and progression. In this specialization track, you will learn about how to find cell line, animal model and patient-level data from various cancers and understand how modern oncology is leveraging molecular precision to provide a more precise and personalized treatment for patients.

INFECTIOUS DISEASES

With increasings risks of global pandemics and chronic infectious diseases on the rise, it is important to learn about viral genomics, pathogen drug resistance and vaccine design. This track will allow you to master genomic data analysis, multiple sequence alignment and understand how to study the processes that cause pathogens to infect, replicate and spread.

NEUROSCIENCE

Tremendous efforts are dedicated to the study of the human body, and yet, scientists are puzzled by how our brain works and breaks down. From basic biology to treatment of neurodegenerative diseases, neuroscience is a frontier of research & discovery. In this track, you will learn about the current issues from a data perspective, analyzing genomic, transcriptomic and epigenomic data.

AGRICULTURE

Food security is under threat of a changing climate, pollution and growing demands around the globe. In the study of modern agriculture, molecular data is being used to understand how certain crops can be grown more efficiently, providing the world with a more reliable and healthier future. Here we describe experiments with model organisms and analyze data from crops.

Big Data in Biology
Precision Medicine,
Biomedical Research,
Agriculture, Defense,
and Ecology

RNA-seq
Mapping and Alignment
Expression Quantification
Differential Gene Expression
Gene Signature
Construction

Microbiome
Microbial communities
16s rRNA sequencing
OTUs and Taxonomies
Gut-brain axis project

Machine Learning
Data Science Principles
Curse of Dimensionality
Big Data Mining
Classification

The Omics Logic platform is very comprehensive and intuitive. This course is a good starting point for someone trying to understand the field of bioinformatics or refresh their knowledge.

Kritika Khurana - MS Biotechnology program from Georgetown University, Washington, D.C., USA

Amazing! This course explained vital components used in statistics and how it relates to Bioinformatics in a way that was easy to understand and apply to biological data.

Cindy Pino-Barrios - Data Research Analyst, University of California, Berkley, CA, USA

OMICS LOGIC LEVEL 2: Curriculum & Topics

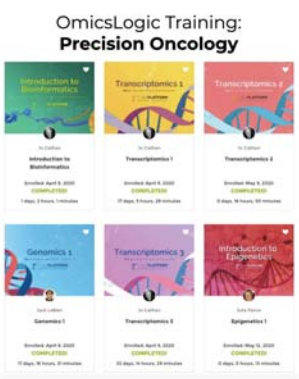
Long-term Curriculum (3-6 months) for a Practical Bioinformatics Training Program, equivalent of a full 3-credit course or specialization.

EXAMPLE PROGRAM: **BIOINFORMATICS FOR INFECTIOUS DISEASES**

Bioinformatics for Infectious Diseases is a course designed to introduce the application of bioinformatics to the study of pathogens that cause communicable diseases and examine their interaction with the host. Using examples from peer-reviewed publications, participants will learn to apply bioinformatics tools to publicly available genomic and transcriptomic data on Ebolavirus, Sars-COV-2, *Mycobacterium tuberculosis*, *Plasmodium falciparum* and other pathogens.

Sessions	Topics
Program overview	Syllabus and program objectives: review sessions, practical assignments, and asynchronous resources
Hands-On Workshop	Bioinformatics analysis of public domain data
Genomics	First- and second- generation sequencing data types, approaches, and resulting file formats
Analytical Challenges	Pathogen genome analysis using examples of viral, bacterial, and parasite pathogens
Sequence Alignment	Pairwise and Multiple Sequence Alignment (MSA)
Evolutionary Analysis	Phylogenetic tree reconstruction, rate of mutation and association with time
Association Studies	Genomic variants and phenotype: PCA, GWAS, biological significance of NT and AA variants
Variant Significance	Working with protein structures to map variants, examine properties and match structures
Host Response	RNA-Seq data analysis to study immune response to infection and compare treatment effects
Final Exam / Review	Review and exam

Similar structure can be adopted for other courses, represented by the types of data and project examples used to illustrate domain-specific topics. These include popular and important research areas in precision medicine, such as "**Bioinformatics for Precision Oncology**" or "**Big Data in Neurodegenerative Diseases**". On the flip side, standard training with more in-depth coverage of technical aspects of data science topics, including methods of processing, analysis and visualization of large and complex datasets can be offered as a "Data Science for Biomedical Data" or "Bioinformatics and Scientific Computing", as seen below.



Bioinformatics and Scientific Computing (BIO101): College Bioinformatics

Course Overview	Processing Transc. Data	Regression Analysis	Dimensionality Reduction	Single Cell RNA-seq	16s rRNA Sequencing
Bioinfo in R and Python	Loading a dataset	Differential Expression	Clust. in R and Python	NGS Project Design	Metagenomics in R
Sequence Analysis	Mapping and Quantification	Biological Interpretation	Class. In R and Python	Cancer Genome Atlas	Intro to Genomics
NGS Data Overview	Norm. & Visualization	ML: Data Mining	Introduction to projects	Intro to Metagenomics	Code of Life
Tumor micr. Case study	Statistical Analysis	Superv. ML: Classification	Modeling Prec. Medicine	Metagenomic Databases	Mutation analysis

Case study/Project R/Python coding

GLENDALE COMMUNITY COLLEGE
A MARICOPA COMMUNITY COLLEGE

OMICS LOGIC LEVEL 2: Case Study

Example of a university course that used the Omics Logic platform to conduct a 3-credit course for graduate students interested in pursuing research and medical careers.

COMPLETE **3-CREDIT** COURSE FOR GRADUATE STUDENTS

An introductory elective course is perfect for the undergraduate students that are interested to learn about the impact of Big Data and High-throughput Experiments across Life Science Domains, including Biomedical Research, Biotechnology and Agrobiological Studies. The Introductory package is most effective for students pursuing undergraduate life sciences degrees and pre-medical students.

Undergraduate students with majors in biology, biochemistry, computer science, or psychology participated in a semester-long bioinformatics course emphasizing biomedical applications. As a result, students were enthusiastic to continue participating in bioinformatics research and take similar courses in the future. Students provided feedback in open-ended reflections after the completion of each module and demonstrated measurable gains in ability to read and analyze bioinformatics research literature. At the conclusion of the course, bioinformatics problem-solving skills were applied to collaborative research projects utilizing published datasets. Students and faculty participated in a final poster session highlighting project results and new avenues of research.

Learn more: https://edu.t-bio.info/portfolio/georgetown/

The machine learning course was an invaluable opportunity. I am grateful to have been able to participate in such an enriching experience

Kian Ghaffari - M.S. Bioinformatics at Georgetown University, Washington, D.C., USA

The Machine Learning course run by Pine Biotech was very well received by our students and I am very glad we were able to include the course as part of our Systems Medicine Program.

Dr. Sona Vasudevan - Program director of the MS programs in Systems Medicine, Georgetown University

CASE STUDY: **BIOINFORMATICS AT AMITY UNIVERSITY IN KOLKATA, INDIA**


The course has received top ratings from Amity University faculty and students that joined online sessions and attended on-site workshops delivered jointly between Pine Biotech team and faculty from Amity University. After 3 months, each student developed an independent project inBioinformatics

While traditional bioinformatics programs in India have existed for decades, new data types, the significance of data science and a growing number of methods make this discipline out of reach for majority of non-engineering majors. Pine Biotech's series of courses on Data Science with examples from a variety of Omics data types in biomedical and basic life science domains is a significant opportunity for students of all backgrounds.

Learn more: https://edu.t-bio.info/portfolio/amity-university/

OMICS LOGIC LEVEL 3: Research Applications

Comprehensive training and research support program designed around specific interests of faculty, departments or universities

TRANSFORM YOUR **DATA-DRIVEN RESEARCH** AND TRAINING

The impact of data-driven research across the organization can help establish successful research programs based on long-term alignment of data infrastructure with trained users from faculty, research and student groups working together to tackle challenges in a meaningful way. Our team has been working with top academic institutions to make this vision a reality.

SPECIALIZED TRAINING PROGRAMS

Expertise to offer an updated, cutting edge bioinformatics course or degree at your lab, department or university

BIOINFORMATICS TOOLS & SERVICES

Technical support to develop specialized bioinformatics tools and curate data around specific topics of research interest

RESEARCH DATA & ANALYSIS SUPPORT

Experienced team to provide advice and guidance on various bioinformatics research projects and overcome challenges.

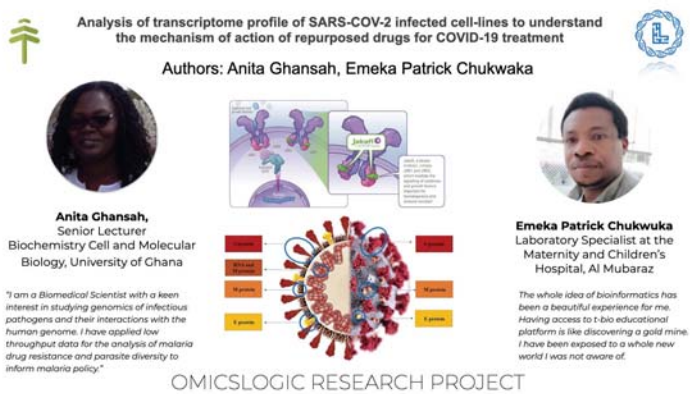
TAUBER BIOINFORMATICS RESEARCH CENTER

LSU BIOMED

UCSF University of California San Francisco

ROSWELL PARK COMPREHENSIVE CANCER CENTER

LBRN

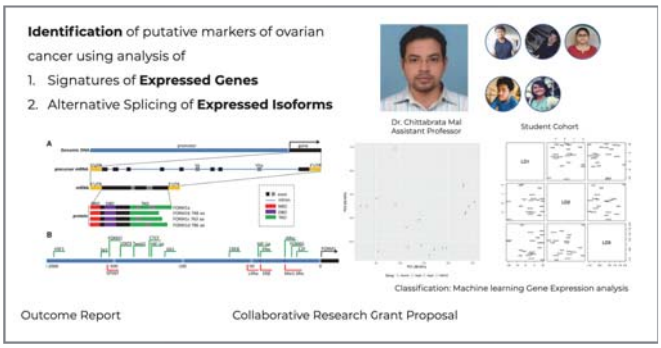


OMICS LOGIC LEVEL 3: Research Applications

Training resources, programs and research support infrastructure to enhance the impact of faculty-student collaborations around data-driven research projects

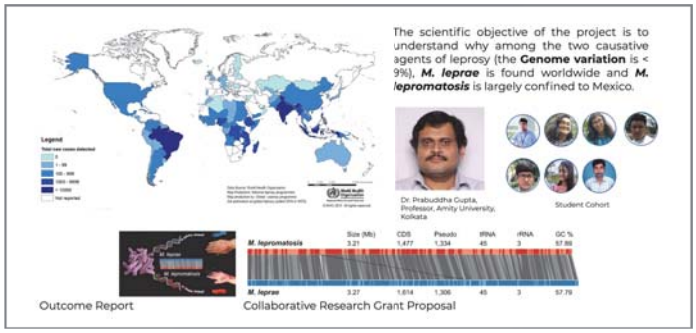
Mentor-Mentee research project model, where students get to participate in real-world research under the guidance of their university faculty, helping accomplish time-consuming research using advanced data analytics tools.

Alternative Splicing Markers of Ovarian Cancer



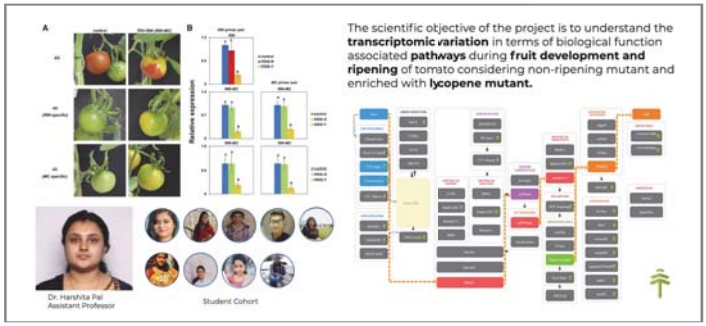
Dr. Chittabrata Mal, assistant professor, Amity University Kolkata is working in the area of **Precision Oncology.** During the program, he wanted to apply **machine learning** to heterogeneous omics datasets. With our collaborative bioinformatics training program and research support, he was able to analyze NGS transcriptomic data on **Ovarian Cancer** patients sourced from the Cancer Genome Atlas **(TCGA)**. To carry out this analysis, he and his students used transcriptomic data analysis pipelines and classification algorithms through the T-BioInfo platform. The ongoing research has led to a grant proposal and several publication drafts.

Genetic determinants of *lepromatosis* susceptibility



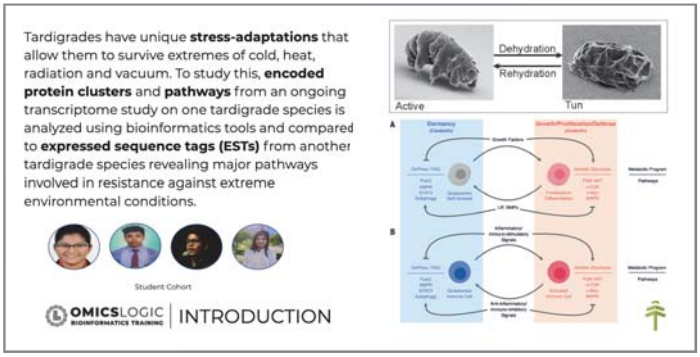
Dr. Prabuddha Gupta is an assistant professor of biochemistry with an interest in genomics. With the help of Omics Logics mentors, Dr. Gupta is was introduced to genomic data analysis concepts and bioinformatics pipelines. Now, he is working on a research project to compare **genomic variation** in the genome of **Mexican** and **Indian** populations. Using whole genome sequences from the **1000 genomes project,** he plans to find mutations that might be associated with *lepromatosis* susceptibility. This ongoing research has been submitted for an international funding opportunity in collaboration with multiple academic partners. Several students from Amity University, Kolkata joined Dr. Gupta in this project.

In-silico Prediction of TF binding Sites for HP1 promoters of fruit ripening



Dr. Harshata Pal, assistant professor at Amity University, Kolkata, is an expert in DNA fingerprinting of medicinal plants and post harvest molecular biology. Her research project focus is on bioprospecting of medicinal plant compound and plant **genomics**, **metabolomics** and **proteomics** under post-harvest stress. In collaboration with Omics Logic trainers & a group of students, she proposed to study **transcriptomic** variation at the pathway level during fruit development. This would be done for ripening of tomato considering non-ripening mutant and enriched with lycopene mutant. The research project utilized transcriptomics data analysis tools on the T-BioInfo platform.

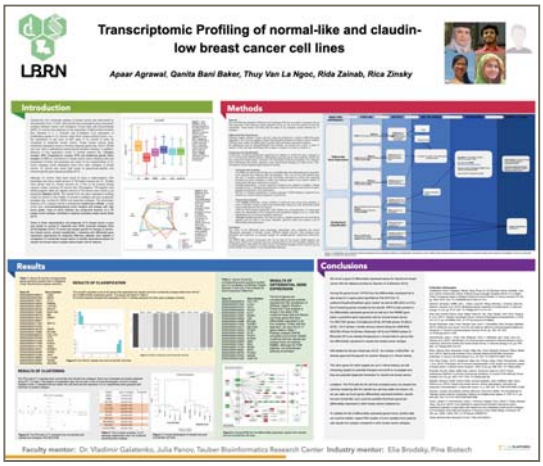
Transcriptomic study of tardigrade stress adaptation



A novel research proposal by **Sarah Embrahim et al.,** from Kolkata (B. Tech Biotechnology, 3rd Semester) to fidentify specific **molecular pathways** which are responsible for **stress adaptation** in Tardigrades. For this analysis, the student team will be comparing **gene expression profiles** of two different types of Tardigrades which show a significant difference in stress adaptation using the information from **Transcriptomics** training and analytical platform.

OMICS LOGIC LEVEL 3: Research Applications

Training resources, programs and research support infrastructure to enhance the impact of faculty-student collaborations around data-driven research projects



Joint development of workshops and modular training programs

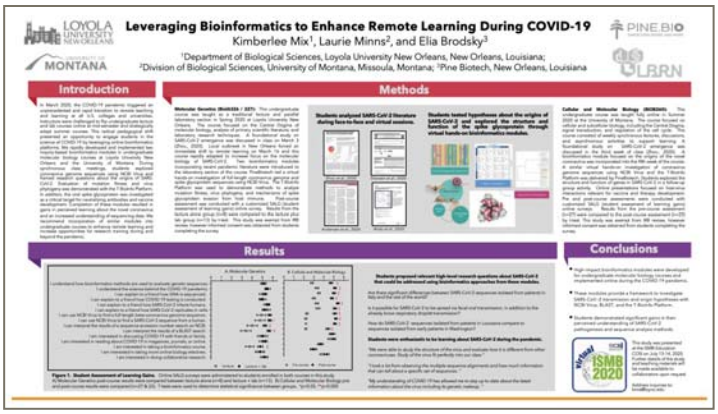
Two inquiry-based bioinformatics modules focused on SARS-CoV-2 were designed and implemented in undergraduate molecular biology courses at Loyola University New Orleans and the University of Montana. In preparation for these interactive sessions, students analyzed emerging scientific literature on the novel coronavirus, which enhanced their understanding of the central dogma of molecular biology. During synchronous class meetings, students explored coronavirus genome sequences using NCBI Virus and framed research questions about the origins of SARS-CoV-2. Evaluation of mutation fitness and virus phylogeny was demonstrated with the T-BioInfo Platform. In addition, the viral spike glycoprotein was investigated as a critical target for neutralizing antibodies and vaccine development. Completion of these modules resulted in gains in perceived learning about the novel coronavirus and an increased understanding of sequencing data.

We recommend the incorporation of similar modules into undergraduate courses to enhance remote learning and increase opportunities for research training during and beyond the pandemic.

Joint Certification

In addition, we have developed a strategy to help universities develop jointly certified coursework where modules from existing Omics Logic curricula are integrated with university-specific training which is virtualized. Thus, universities can quickly advance their students understanding of various topics in addition to learning about bioinformatics.

As a result of training, students find collaborators among faculty, mentors and other students to join forces on research projects. The objective of Omics Logic training is to facilitate the introductions, collaborative plans and effective execution with guidance, technical support and training. Many students develop an appreciation for bioinformatics methods, but have limited opportunities to apply what they have learned to showcase their understanding.



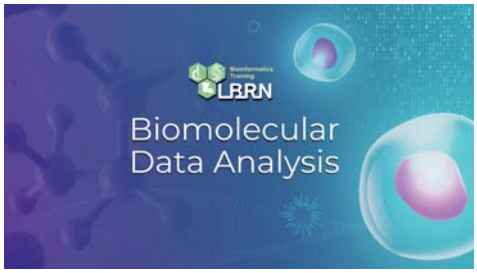
Conference Poster Presentation:

Transcriptomic Profiling of normal-like and claudin-low breast cancer cell lines **Summary**: In this study, several breast cancer cell lines were analyzed using a multi-omics approach to search for differences in response to treatment and finding the best chemotherapy option for a distinct breast cancer subtype, such as PAM50 was used to determine breast cancer subtypes from gene expression data. Least squares-support vector machines and random forest algorithms were used to determine the molecular features.

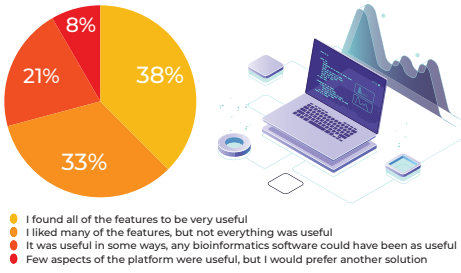
OMICSLOGIC

International hubs developing university-specific programs with local specialty interests and dedicated teams. In each regional hub, we establish a relationship with an anchor organization and form a supporting infrastructure for effective operations.

THE AMERICAS



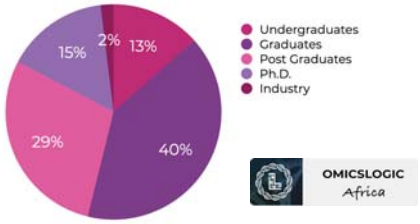
In the Americas, there have been thousands of students who have completed our online coursework, participated in hundreds of online workshops. As a result, we have established programs in several universities across the US, Mexico and South America.
In 2021, we plan to establish a presence in Canada, Brazil, and Peru.



Many of the universities already teach bioinformatics and have established biostatistics and population health schools, or advanced data analytics programs. At the same time, the Omics Logic approach and supportive infrastructure allows these campuses to grow the number of students interested in this domain

INDIA & ASIA

In India, Sri Lanka, Taiwan and other Asian countries, we established a series of programs that allows students from diverse background to learn and apply bioinformatics training into research projects. These programs are established by collaborating with Universities, Institutes and training companies on India, Sri Lanka, Singapore and Malaysia. Similarly we offered students local mentor support by collaborating with training and collaborating with faculty.



M.E. & AFRICA

The Bioinformatics in Africa initiative has helped us enable and scale biomedical, Clinical, Biotechnology, and Agriculture research using Big Data analysis amongst the students, researchers & faculty to develop a research ecosystem and the capacity to address some of the challenging healthcare issues of the continent. These programs with universities and private organizations across Nigeria, Ghana, Kenya and Zimbabwe enabled us to working with more than 300 (Graduate, Post-graduate) students and faculty. Starting 2021, we have several training and research programs designed with the help of faculty and local mentors offered to the participants from our collaborating universities & institutions.

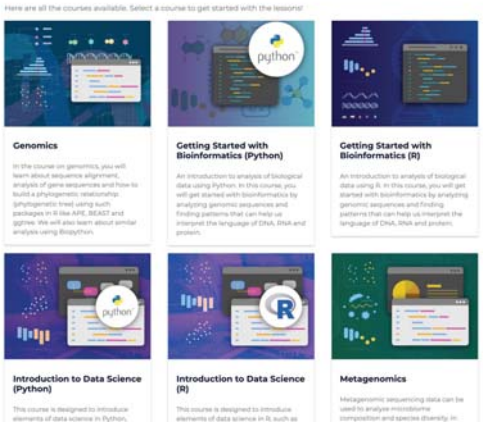
OMICSLOGIC BIOINFORMATICS COURSES

PACKAGE PRICING INFORMATION

TRANSFORM YOUR **DATA-DRIVEN RESEARCH** AND TRAINING

Type	Level 1	Level 2	Level 3	Specialization
Credits	1 credit elective course	2 credit semester	3 credit semester	CME
Audience	Undergraduate	Undergraduate	Graduate	Professional
Theoretical Material	3 Intro courses	1 Intro and 3 Main	Multiple In-depth	custom
Teacher Guides	Slides, videos, PDFs	Slides, videos, PDFs	Slides, videos, PDFs	Slides, videos, PDFs
Meeting Sessions	10	15	25	custom
Practical Assignments	none	4	12	custom
Quizzes and Tests	5	8	10	custom

The impact of data-driven research across the organization can help establish successful research programs based on long-term alignment of data infrastructure with trained users from faculty, research and student groups working together to tackle challenges in a meaningful way. Our team has been working with top academic institutions to make that vision a reality.



Collaborations are essential to Pine Biotech's success in understanding the challenges our customers face and the difference we can make, so we embrace the philosophy that the sum is greater than the parts. As a result, we developed extensive collaborations with research institutions across the US, Europe and India & Africa. We welcome collaborations with Universities & Research organizations, industry and all faculty!