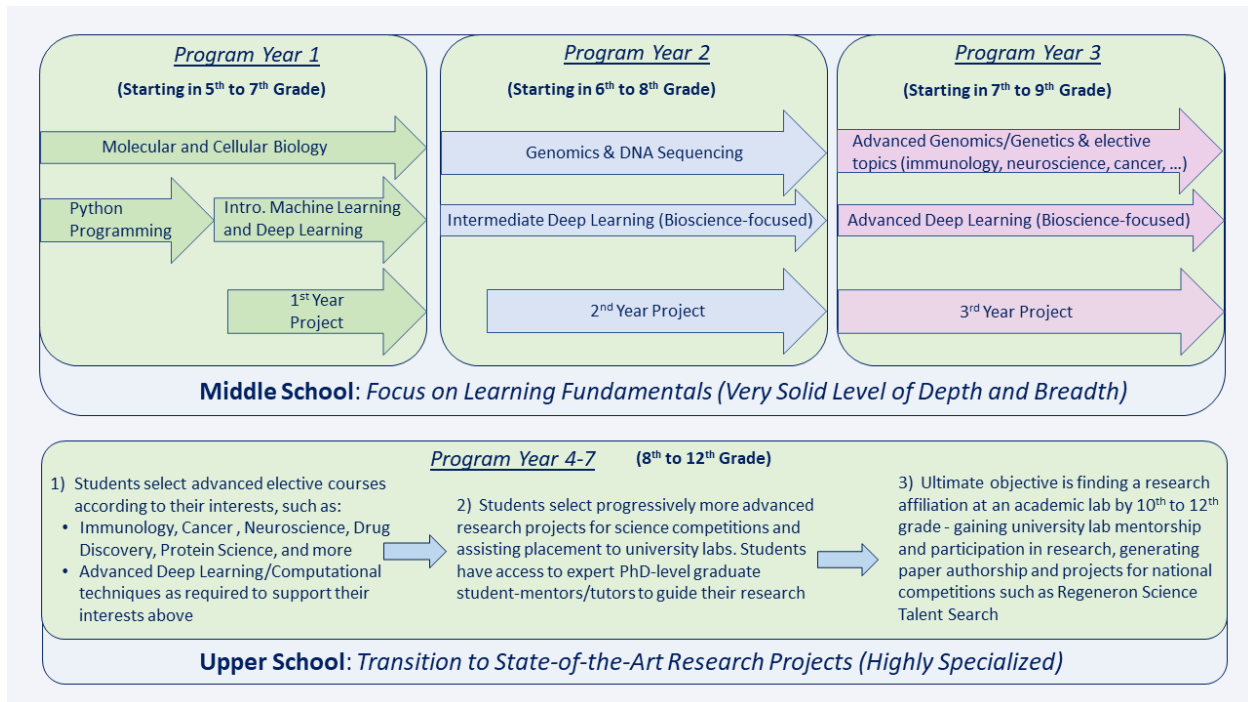


The Bay AI Institute

Stars of STEM

Bioscience / Genomics AI Program



Program Year 1

The Molecular and Cellular Biology track is taught over the entire 1st year and provides a deep (but age appropriate) foundation in modern molecular cell biology.

We actually use a college-level text as our guide and reference material and have found it works with an age-appropriate dilution of complexity as required in the 1st year for younger students. Following this advanced backbone gives a foundations students can return to in the future for review and to go deeper as their academic sophistication matures.

Here are the concepts and material we teach over Year1 in this track:

Bioscience / Genomics AI Program, Year 1 (Continued)

1. DNA, Chromosomes, and genomes
2. DNA Replication, Repair, and Recombination
3. How Cells Read the Genome: From DNA to Protein
4. Control of Gene expression
5. Cellular Membrane Structure
6. Membrane Transport of Small Molecules and the Electrical Properties of Membranes
7. Intracellular Compartments and Protein Sorting
8. Intracellular Membrane Traffic
9. Energy Conversion: Mitochondria and Chloroplasts
10. Cell Signaling
11. The Cell Cytoskeleton
12. The Cell Cycle
13. Cell Death
14. Cell Junctions and the Extracellular Matrix
15. Development of Multicellular Organisms
16. Stem Cells and Tissue Renewal
17. Pathogens and Infection
18. The Innate and Adaptive Immune Systems
19. Cancer

The Python Programming track is taught for half of Year 1, and here is an outline of the material we teach. All topics will include numerous code examples and homework exercises.

0. 'Hello World' setup & coding intro
1. Introduction to basic data structures, variables and constants
 - Integer, float, char, Boolean, lists, sets, tuples, dictionary
 - Concept of data types (and type definition from other languages)
 - Assignment statements
2. Control and decision structure

- If/else, for loops, while loops, break
- 3. String and variable print formatting, screen input
- 4. Boolean logic
 - Basic AND / OR truth table Boolean logic usage
- 5. Intro to NumPy
 - Introduce imports of libraries
 - basic NumPy math functions: sum, average, max, etc.
 - ndarray 1d arrays as most basic 'vector' or 'tensor' array
 - array indexing
 - First intro to fancy indexing methods in Python and NumPy
 - Simple broadcasting
- 6. Introduce mathematical concept of a vector
 - vector addition/subtraction
- 7. Nested for loops, nested lists
- 8. List comprehensions and list appends, dictionary comprehensions
- 9. Use of standalone functions
 - Function basics, definition, parameters, return statements
 - Calling functions and usage
- 10. Basic introduction to object-oriented programming
 - Class concept
 - Methods and attributes
 - `__init__` method constructor
 - How to write and use a basic class
 - How to use classes and methods provided by others
- 11. Introduction to concept of variable scope in programming languages
- 12. Introduction to 2d ndarrays and images
 - How to manipulate multidimensional arrays
 - Shapes of arrays and how to define and manipulate
 - More fancy Python array indexing
 - Counting backwards, image cropping/inlays
- 13. Matplotlib plotting
 - Plotting images and basic scatterplots

