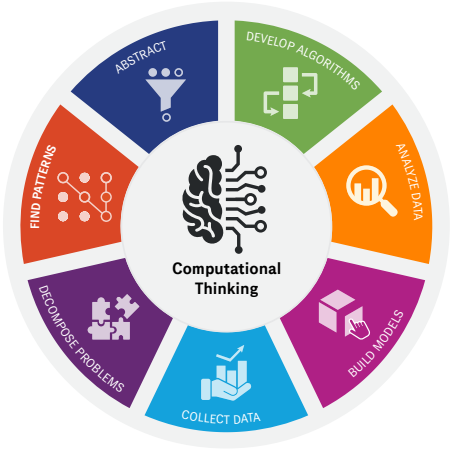
Computational Thinking Practices

In her 2006 essay entitled "Computational Thinking[1]," Carnegie Mellon Professor of Computer Science Jeanette Wing made the case that thinking like computers is a helpful tool for everyone, and not just computer scientists. As Wing stated, there are some things humans can do better than computers, but there are also some things computers do better than humans. Computational thinking allows humans to take the things computers do so well (such as collecting data and building models) and apply them to solving real-world problems.

Since Wing's essay was published, computational thinking has become a mainstay of modern K–12 education and can now be found in curricula across the world. While computational thinking is a philosophical approach based in computer science, it has applications for every discipline.

The following seven computational thinking strategies have been incorporated into this biotechnology curriculum:



Loudoun County Public Schools Computer Science Office

1. **Collecting Data**
What it is: Gathering the right information in order to solve a problem

How it's used: Designing experiments, conducting research, developing surveys, receiving feedback

2. **Analyzing Data**
What it is: Identifying relationships within data; developing predictions based on data

How it's used: Creating graphs, identifying reputable sources, manipulating data models

3. **Finding Patterns**
What it is: Spotting themes and trends; determining cause and effect; sorting data with increasing refinement

How it's used: Identifying examples of systemic inequality; drawing connections between changing environments and the evolution of species

4. **Decomposition**
What it is: Breaking down a problem into more manageable sub-problems

How it's used: Identifying phases in a process, such as mitosis or meiosis; pinpointing gene mutations within a larger DNA sequence

5. **Abstraction**
What it is: Discarding irrelevant data and keeping only what's necessary in order to solve a problem; seeing the big picture

How it's used: Understanding the basic principles behind gene editing; developing summaries and presentations; using graphic organizers and meaning-making tools like Venn Diagrams

6. **Developing Algorithms**
What it is: Creating step-by-step instructions on how to conduct a process or complete a task

How it's used: Explaining the processes of transcription and translation; developing public service announcements with specific calls to action

7. **Building Models**
What it is: Testing a hypothesis; creating simulations; developing replicas

How it's used: Creating 3D models of cell structures; conducting labs

[1] *Wing, J. M. (2006). "Viewpoint: Computational Thinking." COMMUNICATIONS OF THE ACM, 49 (3), 33–35.*