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About This Curriculum

This curriculum introduces advanced middle school and high school students to how molecular markers are being used to improve traditional plant and animal breeding and diagnose genetic diseases in all organisms. The curriculum consists of three modules that are meant to connect teachers and students with the critical technologies that have led to the widespread use of molecular markers and their social, economic, and ethical implications. One application of these molecular technologies, marker assisted selection (MAS) will be featured in module II.

This curriculum is written in such a way that educators can use it as a complete genetics unit or implement modules independently within their course or unit on genetics. This curriculum is intended for use with students and educators in science, nutrition, agriculture, or family and consumer sciences. Teachers are encouraged to involve language, math, speech, and other instructors in the interdisciplinary activities. Extension educators may find these materials useful for their youth and adult audiences.

Through three lesson modules, participants in the activities learn about

- genetics according to Mendel,
- marker assisted selection, and
- ethical issues associated with diagnosis of genetic diseases

Using an inquiry-based approach and the experiential learning model illustrated below, participants conduct “See For Yourself” activities that reinforce the science principles being taught. The educator information for each activity includes the science content and how it relates to the National Science Education Standards, as well as the science process skills.

![Experiential Learning Model](image-url)
National Science Education Standards and Associated Concepts and Principles

All activities in this curriculum relate to Content Standard A, Science as Inquiry, as developed by the National Research Council. Some activities also relate to Content Standard B, Physical Science; Content Standard C, Life Science; Content Standard F, Science in Personal and Social Perspectives; or Content Standard G, History and Nature of Science. To help educators locate the standards and underlying concepts and principles cited for each activity, the page number and first sentence or two of the applicable principle are cited in the “Science Education Standards” section of the instruction pages for teachers and leaders. All page numbers refer to the seventh printing of the National Science Education Standards, November 1999. The National Science Education Standards are also available on the Internet at http://books.nap.edu/html/nses/pdf/index.html.

Content Standard A – Science as Inquiry
As a result of activities in this curriculum, students in grades 9-12 should develop

- abilities necessary to do scientific inquiry
  - identify questions and concepts that guide scientific investigations
  - design and conduct scientific investigations
  - use technology and mathematics to improve investigations and communications
  - formulate and revise scientific explanations and models using logic and evidence
  - recognize and analyze alternative explanations and models

- understanding about scientific inquiry
  - scientists conduct investigations to
    1. explain new discoveries
    2. test conclusions
    3. explain observed phenomena

Content Standard B – Physical Science
As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of chemical reactions.

Content Standard C – Life Science
As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of

- the cell
- the molecular basis of heredity
- interdependence of organisms
- biological evolution
- matter, energy, and organization in living systems
- behavior of organisms

Content Standard E – Science and Technology
As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of

- abilities of technological design
- understandings about science and technology

Content Standard F – Science in Personal and Social Perspectives
As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of

- personal and community health
- population growth
- natural resources
- environmental quality, specifically natural ecosystems
- science and technology in local, national, and global challenges
Content Standard G – History and Nature of Science

As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of

• science as a human endeavor
• nature of scientific knowledge
• historical perspectives