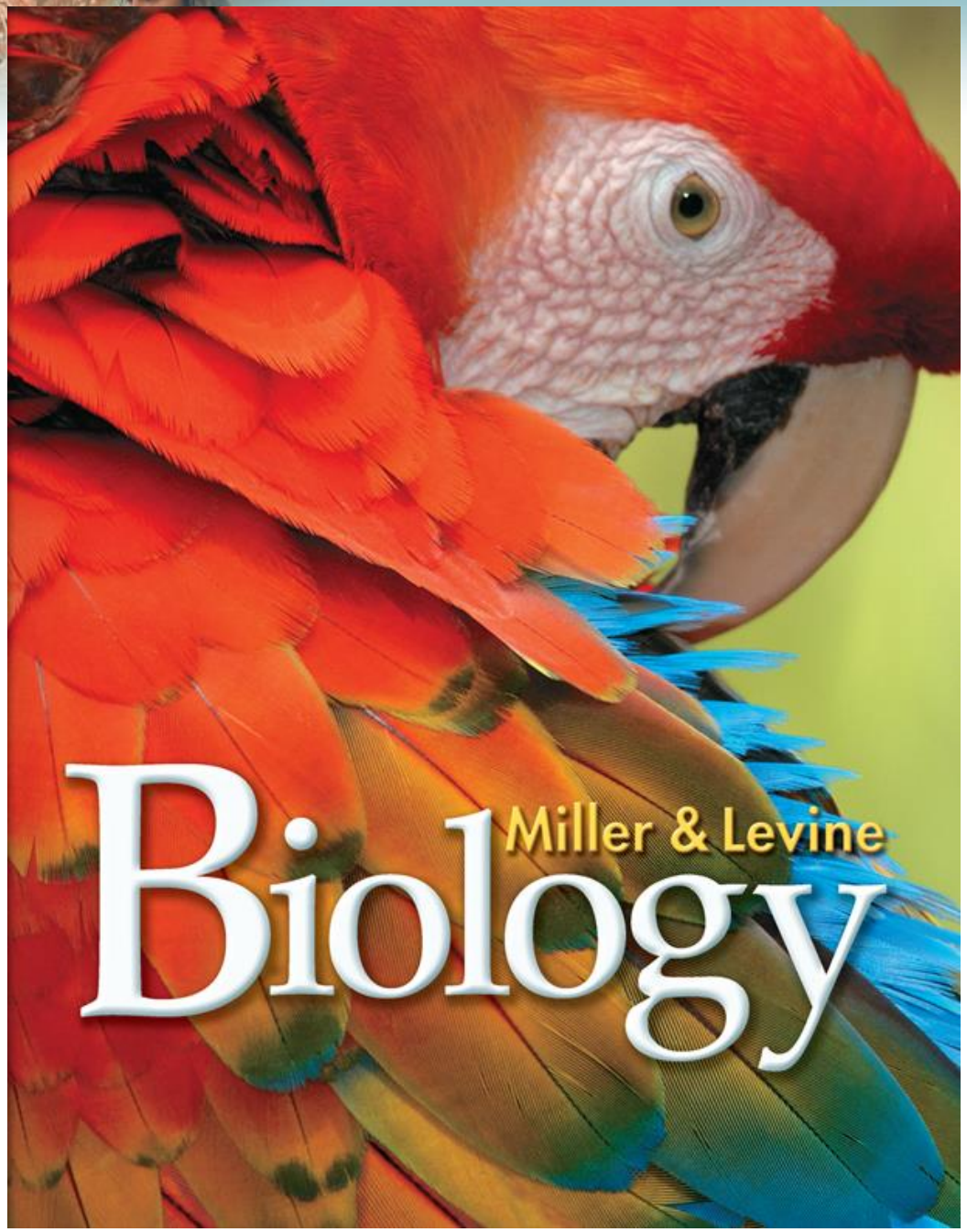


Lesson Overview

15.4 Ethics and
Impacts of Biotechnology

Profits and Privacy

- What privacy issues does biotechnology raise?

- What if the government wants to use an individual's DNA for another purpose, in a criminal investigation or a paternity suit? What if health-insurance providers manage their healthcare policies based on a genetic predisposition to disease?

Profits and Privacy

Private biotechnology and pharmaceutical companies do much of the research involving GM plants and animals. Their goal is largely to develop profitable new crops, drugs, tests, or other products.

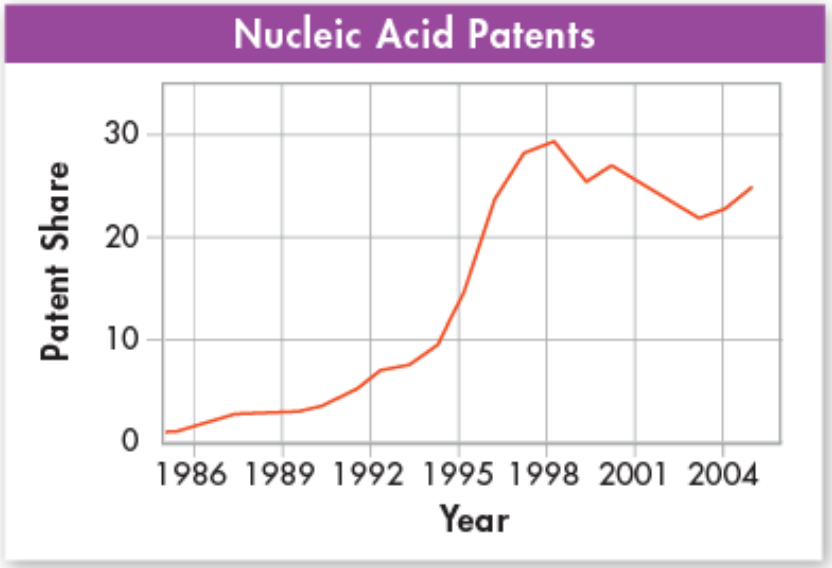
Like most inventors, they protect their discoveries and innovations with patents, a legal tool that gives an individual or company the exclusive right to profit from its innovations for a number of years.

Patenting Life

Molecules and DNA sequences can be patented. In fact, roughly one fifth of the known genes in the human genome are now patented commercially.

Patenting Life

This graph shows the rise in the number of nucleic-acid patents between 1985 and 2005.



Patenting Life

Laboratory techniques like PCR have also been patented. When a scientist wants to run a PCR test, he or she must pay a fee for the license to use this process.

Patenting Life

The ability to patent is meant to spur discovery and advancements in medicine and industry, but sometimes patent holders demand high fees that block other scientists from exploring certain lines of research.

In the case of the development of provitamin A–enriched golden rice, patent disputes kept the rice out of the hands of farmers for years.

Patenting Life

When it comes to your own DNA, how much privacy are you entitled to?

Do you have exclusive rights to your DNA?

Should you, like patent holders, be able to keep your genetic information confidential?

Genetic Ownership

The Tomb of the Unknowns in Arlington National Cemetery, near Washington, D.C., holds the remains of unknown American soldiers who fought our nation's wars.

In order to avoid more unknown soldiers, the U.S. military now requires all personnel to give a DNA sample when they begin their service.

Those DNA samples are kept on file and used, if needed, to identify the remains of individuals who perish in the line of duty.

Genetic Ownership

What if the government wants to use an individual's DNA sample for a criminal investigation or a paternity suit?

What if health-insurance providers manage their healthcare policies based on a genetic predisposition to disease?

Suppose that, years after giving a DNA sample, an individual is barred from employment or rejected for health insurance because of a genetic defect detected in the sample. Would this be a fair and reasonable use of genetic information?

In 2008, the United States Congress passed the Genetic Information Nondiscrimination Act, which protects Americans against discrimination based on their genetic information.

Safety of Transgenics

- Are GM foods safe?

- Careful studies of such foods have provided no scientific support for concerns about their safety, and it does seem that foods made from GM plants are safe to eat.

Pros of GM Foods

Farmers choose GM crops because they produce higher yields, reducing the amount of land and energy that must be devoted to agriculture and lowering the cost of food for everyone.

Insect-resistant GM plants need little, if any, insecticide to grow successfully, reducing the chance that chemical residues will enter the food supply and lessening damage to the environment.

Pros of GM Foods

Careful studies of GM foods have provided no scientific support for concerns about their safety, and it does seem that foods made from GM plants are safe to eat.

Cons of GM Foods

Critics point out that no long-term studies have been made of the hazards these foods might present.

Some worry that the insect resistance engineered into GM plants may threaten beneficial insects, killing them as well as crop pests.

Others express concerns that use of plants resistant to chemical herbicides may lead to overuse of these weed-killing compounds.

Another concern is that the patents held on GM seeds by the companies that produce them may prove costly enough to force small farmers out of business, especially in the developing world.

Cons of GM Foods

In the United States, current federal regulations treat GM foods and non-GM foods equally.

GM foods are not required to undergo special safety testing before entering the market.

No additional labeling is required to identify a product as genetically modified unless its ingredients are significantly different from its conventional counterpart.

The possibility that meat from GM animals may soon enter the food supply has heightened concerns about labeling. As a result, some states have begun to consider legislation to require the labeling of GM foods, thereby providing consumers with an informed choice.

Ethics of the New Biology

- Should genetic modifications to humans and other organisms be closely regulated?
- Just because we have the technology to modify an organism's characteristics, are we justified in doing so?

Ethics of the New Biology

Biotechnology has given us the ability to know ourselves more and more. With this knowledge, however, comes responsibility.

You've seen how the GFP gene can easily be extracted from a jellyfish and spliced onto genes coding for important cellular proteins.

This ability has led to significant new discoveries about how cells function.

Ethics of the New Biology

The same GFP technology was used to create fluorescent zebra fish.

These fish—along with fluorescent mice, tadpoles, rabbits, and even cats—have all contributed to our understanding of cells and proteins.

Ethics of the New Biology

But the ability to alter life forms for any purpose, scientific or nonscientific, raises important questions. Just because we have the technology to modify an organism's characteristics, are we justified in doing so?

Ethics of the New Biology

If human cells can be manipulated to cure disease, should biologists try to engineer taller people or change their eye color, hair texture, sex, blood group, or appearance?

What will happen to the human species when we gain the opportunity to design our bodies or those of our children?

What will be the consequences if biologists develop the ability to clone human beings by making identical copies of their cells?

These are questions with which society must come to grips.

Ethics of the New Biology

The goal of biology is to gain a better understanding of the nature of life.

As our knowledge increases, however, so does our ability to manipulate the genetics of living things, including ourselves.

In a democratic nation, all citizens are responsible for ensuring that the tools science has given us are used wisely.

We should all be prepared to help develop a thoughtful and ethical consensus of what should and should not be done with the human genome.