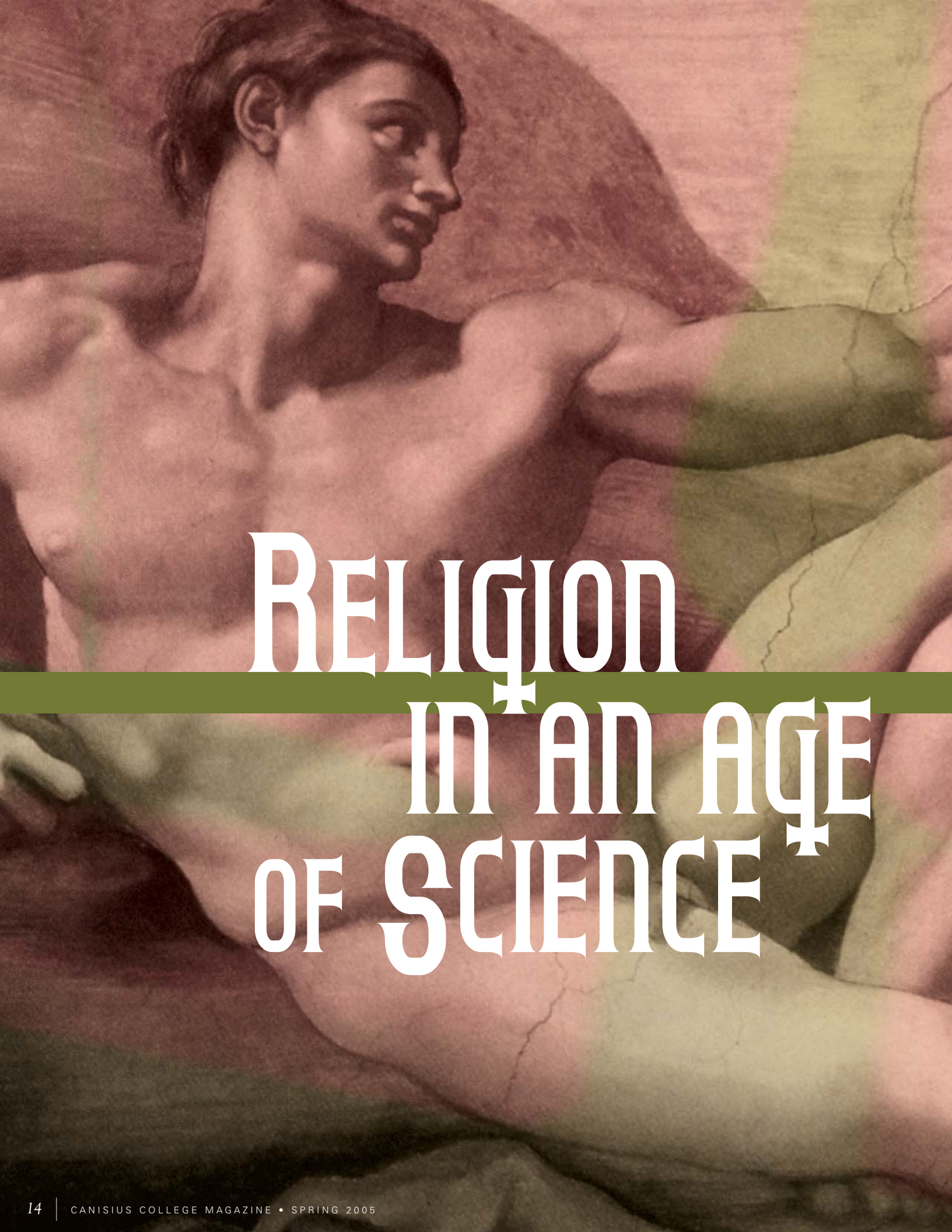


Religion in an Age of Science

Born on July 5, 1996, Dolly was Scotland's fleecy-white scientific breakthrough. Her long, narrow muzzle and pointed ears were comparable to that of a purebred. Her thick, wooly coat was characteristic of her classic Finn Dorset lineage. But Dolly was not your typical lamb. Rather she was a clone in sheep's clothing – the first mammal ever to be successfully cloned from an adult cell.

Since Dolly's creation (and her premature death in 2003), scientists have cloned mice, monkeys, cows, pigs – even cats. In 2002, modern science took its most notable leap forward with the successful mapping of the human genome (*Canisius College Magazine*, spring 2004). And in May this year, the world's first human embryonic stem cells were created by South Korean scientists.

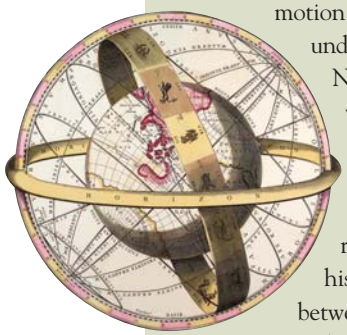
These new discoveries may hold great promise in the treatment or cures of diseases. They may also hold great peril. As scientific research advances into inconceivable realms, the moral and ethical implications of such breakthroughs beg to be considered. When they are, one's personal faith may also be called into question, particularly when religious values influence a person's beliefs or behaviors.

This convergence of science and religion has resulted in a perceived dissension between the two disciplines and caused many to wonder if the two can co-exist peacefully; if they should co-exist; and what role religion plays in an age of science.

These are questions being asked in scientific laboratories, at places of worship, around the family dinner table and in the classrooms at Canisius. But there is a long history to today's relationship between religion and science.

A HARMONIOUS HISTORY

"Much of what we know as 'science' was studied originally by those of religious vocations or those who were deeply religious," says Rev. Martin X. Moleski, S.J., associate professor of religious studies and theology. He notes that the 'father of genetics' was Gregor Mendel, an Austrian monk. The founder of modern astronomy, Nicholas Copernicus, was part of the Augustinian religious order. Johannes Kepler authored the laws of planetary motion and believed it was his Christian duty to understand the works of God. And Sir Isaac Newton, the man who penned the laws of gravity, was an active Protestant who felt his scientific work was completely consistent with his faith in the existence of God.



None of these pioneers believed his religious position or affiliation conflicted with his science, and for centuries the relationship between the two remained peaceful. It wasn't until 1859, when Charles Darwin presented his theory of evolution, that science and religion became at odds. Darwin's theory clashed with the first chapter of Genesis, which states 'on the sixth day, God created all land animals including man and woman.' Darwin's theory led many to believe that modern science was now out to disprove God.

"Much of the perceived conflict between religion and science is the result of literalist attitudes towards the scriptures," explains Moleski, who delves into this subject in his course Religion and the Challenge of Science. "Both Biblical literalists and atheistic scientists want to treat the Bible as if it were a scientific textbook; they want to believe the literal reading of the Bible. But the Roman Catholic Church rejects the literalist interpretation of the Bible because when the stories are interpreted literally, they contradict one another."

One needs to read no further than the second chapter of Genesis to understand Moleski's point. Contrary to Genesis I, which states man and woman were created together on the sixth day, Genesis Chapter II says God created man first and woman last; they are separated by the creation of everything else. At the literal level, the two stories contradict each other but their meanings, Moleski emphasizes, are completely harmonious.

"Both stories assert the fundamental unity of male and female: that male and female were created in the image and likeness of God and the two become one flesh."

Moleski explains Darwin's theory of evolution this way: "Religious literalists want to believe, 'If the scriptures are true, then evolution did not take place.' The atheistic scientists want to say, 'If evolution took place, then there is no God.' What I try to show students and what the Papal document *(L'Osservatore Romano)* says is science studies what God created. Therefore, if Darwin's facts of science are true, that life evolves from life, we have to say God created an evolving universe."

If we are to believe this hypothesis, that science studies what God created, is it fair then to conclude that science and religion can co-exist?

"Science deals with the physical universe – the 'what is' or 'what can be.' Its answers can be substantiated in physical, chemical or biological laboratories," says Moleski, who cites *Gaudium et Spes 57*, the pastoral constitution on the Church in the modern world and one of the chief accomplishments of Vatican II. "Religion deals with the metaphysical universe – the 'what should' or 'what may' be done. So absolutely, science and religion can co-exist."

21st Century Science

Much like the universe has evolved, however, so has science. The invention and innovation of computer technologies enable today's researchers to not only study what God has created but alter it, as well.

Cloning involves a single egg from which the nucleus is removed and DNA from another cell is slipped into the gutted egg. Chemicals or an electrical current coax it into dividing.

Genetic screening is a pre-implantation, which involves removing a single cell from an embryo and testing it for genetic defects.

Embryonic stem cell research entails the isolation and removal of a stem cell from an embryo so that it may be altered into becoming other cell types, including brain and spinal cells, which the adult human body can not make on its own.

Such scientific pursuits are fueled by the potential of treatments or cures that could improve or prolong the lives of human beings. But they also introduce loaded ethical questions that frankly didn't exist during the Copernicus, Kepler or Darwin eras, when scientists were simply trying to grasp the complex workings of the universe

"Even 20 years ago, stem cell research wouldn't have been considered a possibility. Cloning was science fiction. These were the type of things that made up *The Island of Dr. Moreau*," says Biology Professor Edward C. Kisailus, PhD, referring to the classic H.G. Wells novel.

"Nowadays, science is moving forward faster than its moral and ethical implications can be considered."

Debating Bio-Moral Problems

Rev. Paul W. Steller

Edward C. Kisailus, PhD

Ronald J. Foote, MD

While some may consider it imprudent to slow scientific progress, others view it reckless to disregard the moral and ethical dilemmas that may result from it. Commonly, persons of religious faith question the implications of scientific advancements while science defends itself citing the potential of discoveries. When their arguments are depicted in the mainstream media, both are portrayed as being the other's enemy: Science portrays religion as being against medicine; religion deems science to be against God. Neither is true, says Rev. Paul W. Steller, an adjunct professor of religious studies and theology, and pastor of St. Mary of the Assumption in Lancaster.

"God gave humans intelligence and a quest to understand the world better. He wants us – all people, including scientists or researchers, whomever – to use that gift in a wise and positive way."

Kisailus, a scientist and man of deep religious faith, concurs. "It's not that I keep my science and religion separate but I do believe that science is the study of life; we study what God created in order to understand it – not become God."

Kisailus and Steller, along with Ronald J. Foote, MD, a retired obstetrician gynecologist and founding member of the Ethics Committee at Children's Hospital, team teach a course at Canisius called Bio-moral Problems. The area-studies course, open to students from all majors, stimulates discussions about some of today's most widely-debated bio-moral problems, from beginning- to end-of-life issues.

"Science is on the threshold of making some pretty significant discoveries but there are some frontiers that might be better left alone," says Steller. "Isn't it better to talk about these hypothetical issues and their potential implications before they happen, rather than have morality play catch up?"

Perhaps the most contentious bio-moral problem talked about today is that of stem cell research. According to the National Institutes of Health (NIH), stem cells differ from other cells in the body because they are capable of dividing and renewing themselves for long periods. When a stem cell divides, each new cell has the potential to become another stem cell or a more specialized cell, such as a muscle, brain or red blood cell. While there is nothing controversial about research on stem cells, which have the potential to treat such diseases as Alzheimer's and Parkinson's, the source of those stem cells is an enormous issue.

Commonly, scientists work with adult stem cells, which are typically found in bone marrow, as well as blood from umbilical cords that are discarded after childbirth. These cells have the potential to turn into a finite number of new cell types. Therein lies their limit.

More promising are human embryonic stem cells because they can develop into any type of cell in the body, even entire organisms. Human embryonic stem cells are primarily harvested from left over embryos created for in-vitro fertilization procedures. Most recently, however, South Korean scientists used Dolly-style cloning techniques to create a human embryo for stem cell research. When the stem cells are retrieved from the embryos, the embryos die.

The ethical questions that arise as a result of embryonic stem cell research are complicated and it could take years before scientists, academics and ethicists reach a consensus on the argument. Still, it's an issue talked about in Canisius' Bio-moral Problems class

"This is not a science course," says Kisailus. "It's an issues course that introduces students to the scientific (Kisailus), clinical (Foote) and theological (Steller) perspectives and perceptions that surround these complex societal subjects."

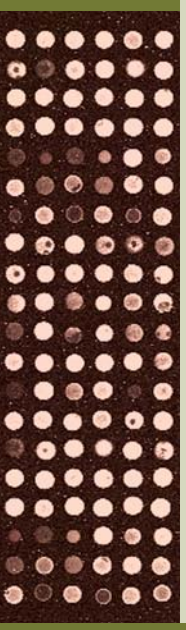
In a recent class involving cloning, Kisailus discussed how and when the scientific procedure began. He outlined the steps

necessary to create a cloned mammal and then noted the scientific advantages of cloning: It could provide a limitless supply of cloned organs for transplantation into humans. Cloned mammals could also be used to study genetic diseases. He concluded by stating science is on the verge of being able to clone human beings.

Foote interjected with a clinician's perspective on cloning. He stated, "As a doctor, I am the person who has to harvest the egg from the woman and there are risks. It requires surgery and some major hormonal manipulation. There are also potential side effects." Furthermore, he said, to clone the perfect person science needs to clone a newborn, "That way, the resulting cloned individual would have a cell population the same age as its donor. If you clone a cell from a 73-year old man, the resulting cloned individual has nuclear genetic material that is 73-years old." (This is the primary reason Dolly the sheep died prematurely.)

Now it was Father Paul Steller's turn. His role was to put the issue of cloning in a wider, philosophical and ethical dimension, so he posed a series of moral and ethical questions to students: What happens to the identity and individuality of the cloned person? What is the relationship between the clone and the cloned person? Does the cloned child know, for example, that he or she was born to produce bone marrow for a sister who suffers from leukemia?

No one in class had a definitive answer to any of these questions and that was o.k. Absolutes are not part of the course objectives for Kisailus, Foote and Steller. Instead, they hope to impart on students the ability to discuss and evaluate complex societal issues so students may make informed, moral and ethical decisions in their lives.



"These young people will almost certainly be confronted with some sort of bio-moral problem at some point in their lives, either personally, in their profession or at the voting booth," says Kisailus. "They have to be aware of the issues. They have to understand the implications of these issues. And they have to be able to make educated decisions based on what they believe is morally and ethically right for them."

At a Catholic, Jesuit college like Canisius, ethics and values are a fundamental part of the core curriculum and have been for years. Bio-moral Problems is in its 30th year at Canisius and was originally taught by Joseph A. Tomasulo, PhD, professor of biology and Robert F. Rizzo, PhD, professor *emeritus* of religious studies. Father Moleski has been talking about religion and the challenge of science for 15 years.

"Courses such as these illustrate the Jesuit philosophy of educating the whole person," says Kisailus. "We are educating a student's mind and spirit."

It is this tradition of educating the whole person that has paired such seemingly polar disciplines of religion and science at Canisius, where scientists and theologians alike reaffirm that the two can and should co-exist because both have very important roles.

RELIGION'S ROLE

"Science will continue to progress and it should because it is something the Creator wants us to do," states Kisailus. "But religion has a very, very important role too and that is to keep reminding us of our moral teachings."

Moleski adds, "Scientific knowledge can be used to do a lot of good. But that same knowledge can be misused. For example, scientists have proven they can eradicate entire cities with a single bomb. The Church, specifically Vatican II, *Gaudium et Spes 80*, says we may not eradicate entire cities with a single bomb because it is a grave, moral evil."

Certainly, there are no literal passages in the Bible about this but what is in the Bible, notes Moleski, are principles that say God is the author of nature and that nature should then serve as the standard for thinking about what is right and wrong. This theory, otherwise known as the Natural Law Theory, "is and has been the standard for which Catholic moral thought is developed," says Steller. When applied to modern science and medicine, it suggests the following: Any procedure that restores the natural health of the body is good. Any procedure that harms the natural health of the body is bad.

So while the Catholic Church believes children have the right to be born of a natural act of love on the part of parents, it is not opposed to fertility or virility treatments and procedures for men and women because they restore the natural powers of the body meant for procreation.

The Church is also not opposed to the use of extraordinary means to keep a person alive. Moleski says, "When Pope John Paul II had trouble breathing, doctors inserted a breathing tube through his throat to help restore his natural breathing." Likewise, says Moleski, Catholics are also not obliged to use every possible medical technique to keep them alive. "The Church says if we do not want to be kept alive by extraordinary means – a ventilator, a heart-lung machine or dialysis – that we do not have to."

This end-of-life issue calls to mind the Terri Schiavo case, which attracted international attention in March, when a Florida court granted Terri's husband, Michael, permission to have his wife's feeding tube removed, after 15 years. Though the story generated passionate pleas from supporters on both sides, the Terri Schiavo story never became a serious topic of discussion in the courses taught here at Canisius.

"From our standpoint, the Terri Schiavo case wasn't really a bio-moral problem, it was a legal problem," says Foote. "Who had the legal rights to Terri Schiavo's life?"

Moleski adds, "I didn't bring it up in my class nor did the students. Her case was so obscure. No one really knew if or when an end-of-life decision was made about or by Terri. Hers just wasn't a clear cut case."

What is clear, however, is that religion and science are meant to complement each other, not clash.

"The knowledge of how life is governed by DNA and RNA – that scientific knowledge is wonderful because it can be used to heal genetic defects or diseases," says Moleski. "Cystic fibrosis; we need a cure for that. Multiple sclerosis; we need a cure for that. So the more we learn about genetics, the more we learn about biochemistry, the more we learn about science, the greater power medicine has to heal."

But in an age when science has the capability of doing more than just restoring the natural health of humans; when it enables us to alter nature, the fundamental question becomes: Should we always do what science says we can do?

"The Church needs to keep people – scientists included – thinking about the moral and ethical implications of such progress," adds Kisailus. "It needs to keep asking 'what if,' 'where is this science headed' and 'do the means justify the ends.'"

These are not questions for science. They are questions for all humanity. ■

The Human Genome Project

Ethical, Legal and Social Issues

Debra T. Burhans, PhD
Director, Bioinformatics Program
Assistant Professor, Computer Science

Today's college students are among those most likely to be affected by the Human Genome Project. They will play a crucial role in determining how this new genetic information is used.

At Canisius College, undergraduates in the Bioinformatics Program are introduced to genetic literacy, as well as key ethical, legal and social implications of human genome research. But who is educating our educators?

Debra T. Burhans, PhD, director of the college's Bioinformatics Program, answers this question in the following essay, based on her experience at the ELSI Summer Faculty Institute at Dartmouth College Ethics Institute.

At the time the Human Genome Project (HGP) was initiated, the government committed itself to funding ELSI (ethical, legal, and social implications/issues) research and training as part of the overall scientific effort. The Dartmouth College Ethics Institute is one organization that has received ELSI funding from the government, and one of their activities has been to organize and offer a series of Summer Faculty Ethics Institutes. These institutes are designed to provide the necessary training to college faculty who are in a position to share their knowledge with students, faculty and others in their academic communities about ELSI issues related to the Human Genome Project.

Faculty who teach at the Summer Institute are drawn from a number of areas, including biological sciences, philosophy, religious studies, and law. Practitioners such as genetic counselors and lawyers are included, and speakers are high profile nationally recognized experts. In summer 2004, the speakers included Dean H. Hamer, PhD, a researcher at the National Institutes of Health whose recently published book, *The God Gene*, has generated considerable controversy, and Adrienne Asch, PhD, the Henry R. Luce Professor in Biology, Ethics and the Politics of Human Reproduction at Wellesley College and an advocate for the rights of the disabled.

The faculty attendees are drawn from a variety of disciplines, including philosophy, religious studies, biology, health and human services, computer science, chemistry, and engineering, among others. Admission to the Summer Institute is highly competitive and I was fortunate to be selected to attend in summer 2004. The goal of the program is to equip attending faculty with enough knowledge about the various disciplines that come together in studying the human genome in order to teach others about ELSI issues. The course of study includes a significant reading component as well as classes in ethics, biology, law, genetics, and broad ranging discussions of ethical, legal, and social issues from a variety of perspectives.

In order to better understand the ELSI component of the Human Genome Project it is helpful to explore the background of the project along with some of the basic scientific concepts. Begun formally in 1990, the U.S. Human Genome Project was a 13-year effort coordinated by the U.S. Department of Energy and the National Institutes of Health. The project originally was planned to last 15 years but rapid technological advances accelerated the completion date to 2003. Project goals were to:

- **IDENTIFY** all the genes in human DNA (now estimated to be 20-25,000 in number);
- **DETERMINE** the sequences of the three billion chemical base pairs that make up human DNA;
- **STORE** this information in databases;
- **IMPROVE** tools for data analysis;
- **TRANSFER** related technologies to the private sector; and
- **ADDRESS** the ethical, legal, and social issues (ELSI) that may arise from the project.

ELSI is an essential component to the Human Genome Project because it supports the dialogue, discussion and education regarding the implications of this modern scientific advancement. It is scientifically possible, though not yet common, to sequence the DNA of anyone. Your DNA sequence contains an enormous amount of information, and the implications of knowing your DNA sequence are broad ranging. There are some, but not many, diseases whose occurrence can be absolutely predicted by examining DNA sequence in a single gene. Sickle Cell Anemia and Huntington's Disease are two such examples. Most diseases result from a more complex set of genetic changes and include environmental influences. In such cases an increased susceptibility to disease may be predicted based on the DNA sequence in certain genes. Diseases that fall into this category are numerous, and include diabetes, breast cancer and heart disease. Recent scientific discoveries have traced human origins back to a very small group of human ancestors. It is possible by examining a person's DNA to determine from which group he or she has descended.

Thus, information about your heredity, characteristics, and disease predilections can be easily gleaned from your DNA sequence. This information can help guide doctors in their choices of particular medications or dosages for certain diseases: the field of 'individualized medicine' is only in its infancy. On the other hand, this information might be used by an employer to deny you a job or to fire you, by insurance companies to deny you coverage, and by anyone who wishes to discriminate against you.

Is someone whose DNA indicates certain or likely disease sick even if they don't yet have the disease? Such questions do not have easy answers. Should the Americans with Disabilities Act (ADA) cover 'genetic disabilities?' What sort of legal safeguards should the government provide regarding our DNA?

Every day each of us leaves a trail of DNA wherever we go. Consider skin cells, hair cells and bodily secretions, all of which can be analyzed to generate a DNA profile. It is this technology that has led to the use of DNA analyses in crime scenes. What if your DNA embodied special features that made it valuable and it was obtained by scientists for experimental use? Do you own your DNA sequence? If you do, how do you feel about leaving copies of it everywhere you go?

These questions are barely the tip of the iceberg, but they illustrate some of the important discussions and policy decisions facing us today.