**“Aristotle, Biotechnology, and the Liberal Arts and Sciences” Anne L. Hiskes, American Council on Education Fellow Department of Philosophy, The University of Connecticut The Phi Beta Kappa Initiation Ceremony The College of New Jersey April 7, 2010**

Poetry, history, genetics, evolutionary biology, literature, economics, political science, anthropology, philosophy, women’s and gender studies, and African American studies.

These are just a few of the many different fields in the liberal arts and sciences that you have studied here at the College of New Jersey. Your parents are probably happy that you didn’t major in all of them.

Today we celebrate your scholarly achievements. Congratulations. We also celebrate the ideals of a liberal education which liberate us from the tyranny of ignorance. The liberal arts and sciences provide keys for unlocking the past, for opening doors to other people’s worlds and experiences, for deciphering the code of life, and for mapping a course for the future. The liberal arts and sciences enable us to discover and create our identity as human individuals, as members of a biological species, and as members of cultural groups.

This evening I want to look briefly at an issue connected with stem cell research that has been in the news for several years now and that I grappled with in my role as Chair of the Human Embryonic Stem Cell Research Committee at the University of Connecticut. This issue raises many of the same questions raised by the ancient Greek philosopher Aristotle who lived about 2300 years ago. Aristotle wanted to characterize the essence of human nature to answer the question “what does it mean to be human”? What distinguishes us from all other living things? In Aristotle’s framework, the key to answering this question is to understand the purpose or function of human nature. To be fully human, according to Aristotle, is to achieve excellence in virtue, which is a rational harmony of the soul, a Golden mean in which the desires are ruled by reason. While we may not fully agree with Aristotle’s views about human nature, I believe that he is pointing us in the right direction in answering some of the questions posed by stem cell research. I claim that to fully address Aristotle’s question, as well as the issue raised by stem cell research, we need to deploy all the skills and knowledge embedded in the liberal arts and sciences.

The Problem:

On March 31, 2010, the *Arizona Capital Times* reported that an Arizona House of Representatives panel voted 5 – 2 for a bill outlawing the creation of human-animal hybrids. Those in favor of the bill outlawing the creation of human-animal hybrids said “We are trying to preserve life and not sacrifice it on the altar of research to save another life”. (A hybrid is an organism which is a cross of two different species.)The founder of the Bioethics Defense League added, “There are profound ethical questions about how … much animal does a human embryo have to be before you wonder if it’s still human”.

Those who oppose the bill say that it is really an anti-stem cell research law. The opponents of the bill also point out that the bill would make illegal a routine test for infertility problems which uses a hamster egg to determine if a man’s sperm is able to penetrate the egg.

What is going on here? Is H.G. Wells’ fictional story “The Island of Dr. Moreau” about to become reality? Are we on the verge of creating Stuart Little, the talking mouse?

Admittedly this is an Arizona bill, and not a New Jersey bill. But laws like this have been proposed and passed by Congress. The types of issues raised by this bill will confront us more frequently in the future as we become more adept at engineering the beginnings and ends of human life and creating new combinations of DNA. In your future roles as citizens, professionals, parents, and community leaders you will be faced with questions of this type, which are questions about the wise and just use of science, technology, and medicine.

**How is the hybrid issue connected with stem cell research?**

As you may know, many biomedical researchers believe that stem cell research, particularly human embryonic stem cell research, may ultimately yield cures for diseases like diabetes and therapies for neuro-degenerative diseases such as Alzheimer’s disease and Parkinson’s disease. The list of possible cures is quite long.

Stem cells are cells that are still plastic enough to that they can develop into a variety of different types of tissue or organ cells. Our bodies contain a few types of adult stem cells, such as bone marrow cells that replenish our blood and osteoblasts that repair our bones.

Stem cell therapies consist of transplanting or injecting stem cells of the right type to the area that needs to be repaired. The stem cells then get their instructions on what to do, what to become, from the surrounding cells. But we can’t just inject a bunch of bone stem cells into a patient to repair a traumatic war injury. We can’t just inject pre-neuron stem cells into the brains of Parkinson’s disease patients. First we must know

1. Will the cells live if implanted?
2. Where will they go? Will they stay where we want them? We don’t want the pre-neuron stem cells traveling to the eyes.
3. Will they remain brain cells rather than morphing, for example, into bone? (This gives new meaning to the phrase “bone head”.)
4. Will they integrate with the cells in the brain and function like healthy brain cells?
5. Will they cause a lethal immune rejection response?

To answer these questions before putting the cells into human patients, researchers must first test the human cells in animals. Human bone stem cells are first injected into mice or rats to answer these questions. Similarly, scientists test human brain stem cells in mouse or rat brains at various stages of mouse or rat development, sometimes injecting them into mouse fetuses, sometimes into mice just before they are born, sometimes just after they are born. The earlier in the developmental stage that human stem cells are injected, as in early development of an embryo, the more integrated and intertwined become the mouse and human brain cells. But more definitive results are obtained by injecting human brain stem cells into monkeys – our fellow primates to whom we are closely related genetically, thus allowing for greater integration and function of the human cells in the animal brain.

Creatures who have a mixture of cells that originated from two or more species are called “chimeras”, not hybrids. The creation of chimeras in biomedical research is common and generally accepted. Tendons and heart valves from other species are often transplanted into humans. But when it comes to implanting human brain cells into animals, particularly into baby monkeys or adult monkeys, some ethicists, citizens, and members of Congress object.

Stem cell research ethical oversight committees like the committee that I chaired at the University of Connecticut are charged to review projects of this sort for approval, and if approved, to ensure that they are properly monitored. In the case of injecting human bone stems into mice, virtually no monitoring is required. More rigorous monitoring is required for projects that inject human brain stem cells in animal brains, particularly in monkeys. National and international ethical guidelines recommend that human brain stem cells not be injected into primate embryos at this time. We just don’t know what will happen.

The ethical concern is that injecting human brain stem cells into an animal, particularly an embryonic or fetal primate, may humanize the animal. So we ask the scientists to monitor the animals for signs that they have shifted in some ways towards the human side. But what does this mean? What exactly should these scientists look for? How many brain cells does it take to turn an animal into a human? Is our humanity to be identified with brain structure? With DNA? With certain behaviours? Perhaps we know that the animal is human when it asks for pizza for supper, as my 15 year old son does frequently? What is wrong with humanizing an animal?

Stem cell researchers are also investigating ways of avoiding immune system rejection of stem cells by using cloning techniques of nuclear transfer. The nuclear DNA of a cow egg is replaced with the nuclear DNA of a patient, and the egg is stimulated to divide long enough for stem cells to form. The harvested stem cells will have the same DNA as the patient donor, theoretically avoiding an immune rejection response. All this is done in a Petri dish, and the resulting embryo is called a “cybrid”. Is it a human embryo? A nonhuman embryo? And why does it matter?

These two examples pose the types of questions raised by advances in biomedical research. They pose questions that you as citizens, researchers, policy makers, and parents may face.

1. Is there anything morally problematic with these research practices? Why is injecting human brain cells into animal brains regarded as more morally problematic that injecting bone stem cells? What does it mean to be human?
2. Is it appropriate for government to regulate scientific research of this type, and why?

I claim that in answering questions like these about stem cell research and similar questions about other new biotechnologies, we need to apply the content and skills of a broad range of the liberal arts and sciences and also draw on the insights of Aristotle. Here I agree with Aristotle who says “A man who is educated in one subject is a good judge of the subject, and the man who has received an all-round education is a good judge in general”. (Nicomachean Ethics, Book 1, section 3, *The Internet Classics Archive*)

To understand objections to the creation of human-animal chimeras, hybrids, and their ilk, we must first call upon the **classics and Greek mythology**. Objections to human-animal chimeras may ultimately stem from some deeply rooted cultural fear that violating the norms of nature will unleash evil and chaos. In Greek mythology, the original Chimera was an evil, fire-breathing monster who ravaged the Greek countryside. The Chimera had the head and body of a lion, the head of goat sprouting from its back, and the tail of a serpent.

In another example the Minotaur, a mythical hybrid, is a man with the head of a bull. The Minotaur represents what happens when man defies the gods. The king of Crete violates Poseidon’s orders to return Poseidon’s white bull to the sea. As punishment, the queen falls in love with the white bull, giving birth to the Minotaur who must eat living men to stay alive.

But are there natural, sacrosanct barriers between species? Are species fixed with an immutable essence as Aristotle believed? Is it unnatural for species lines to be blurred and for hybrids to occur? We call on **evolutionary** **biology** to provide us with insights into the nature of species over time and their historical relationships to each other. We need the **zoologist** to tell us whether hybrids occur in nature.

Are there limits beyond which science and bioengineering must not go? Here we call upon the imaginations of the **novelist** to help us explore these issues through books like H.G. Well’s *The Island of Dr. Morneau*, Mary Shelley’s *Frankenstein* and Aldous Huxley’s *Brave New World*.

But the real underlying question is what makes us human? In virtue of what properties are we deserving of rights? At what point in creating hybrids or chimeras should the creature be treated as one of us? I might point out that this question is not new to the twenty-first century, but is posed whenever members of one civilization or culture encounter members of another civilization or culture for the first time. Should we treat them as one of us? And so we might look to **history, cultural studies,** and **global studies** for further insights into the diversity of expression of human capacities.

So what does it mean to be human? Aristotle defines man as the rational animal. The Western tradition of the Enlightenment agrees in identifying the essence of human nature with our rationality, with our cognitive abilities. This explains why we do not feel threatened by the implantation of animal tendons into our knees, or by the implantation of human bone cells into animals. The source of our humanity, the brain, is not affected. So we call on the **neuroscientist** to tell us how the human brain functions and how it differs from those of other animals.

But Aristotle also tells us that the humans are distinctive as a political animal, meaning that we have an innate tendency to live in communities governed by laws. The purpose of communities and government is to enable humans to achieve their full purpose, to flourish and live the good life by achieving excellence in virtue. Part of the process in achieving excellence in virtue, in expressing our human nature, is open and public discussion of important issues among citizens. We do not become fully human in isolation, but only as members of a community that accepts us as human and supports our development. To understand what it really means to be human, we look to **philosophers** to guide us in identifying the good life, and to **social** **scientists** for insights into how communities and governments can best promote human well-being.

As you see, there is no clear and simple answer to the question “when is a chimera humanized”, but then none of the important issues of our time will have clear and simple answers.

As newly inducted members of Phi Beta Kappa, you have traveled far along the Aristotelian path of realizing your full human potential as rational, social beings. None of you are here because of what you achieved in isolation. You are here because of supportive parents, friends, and teachers. You now have the tools to navigate the uncharted waters of new biotechnologies and to serve as leaders in your communities. As Aristotle would say, live long and prosper, flourish and live the good life. Once again congratulations.