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Bioinformatics in the 21st century

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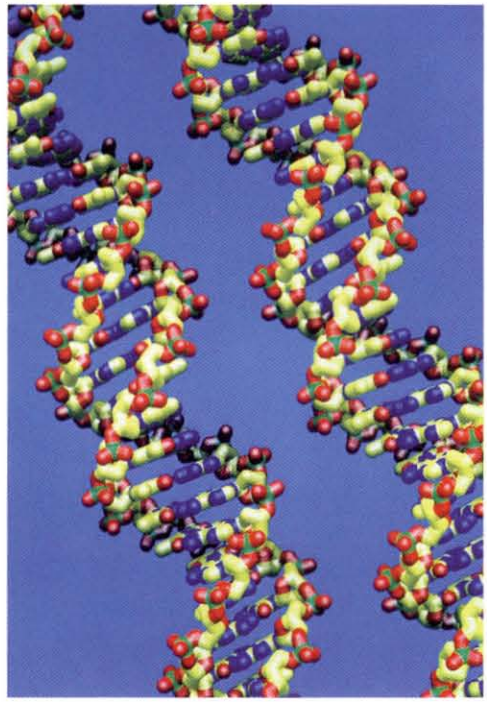
Bioinformatics in the 21st Century: Stewarding a Wealth of Information and Technology



By Heather Kuruvilla, Ph.D.

Not long ago, it was estimated that humans had approximately 100,000 genes. The secrets of our genome remained enshrouded in mystery, mainly because of the sheer volume of information encoded therein. The Human Genome Project, officially begun in 1990 and completed in 2003, has left humankind with a legacy of information and technology. Because of the techniques developed during the Human Genome Project, the genomes of many plant, animal, fungal, and bacterial species are quickly being sequenced. Why the push for so much information?

What can our DNA teach us?

As followers of Christ, our DNA gives us cause to worship the Creator. Some years ago, I had well-meaning atheistic friends argue against a wise Creator by talking about "junk DNA." Junk DNA is DNA that does not code for proteins and was thought by many scientists to be worthless, a waste of cellular energy, thus arguing against wisdom in design. Recent research has revealed that these non-coding regions are critically important for regulating genes; in fact, mutations in these junk DNA regions can even lead to diseases. There is no "junk" DNA!

The prevailing dogma in science has been that there are three "important" types of RNA: tRNA, rRNA, and mRNA. The myriad "small RNA" molecules in the cell were perceived as so much cellular debris. Now these, too, are turning out to be critically important for cell function. What occasion for worship! The cells are declaring the glory of God, and the nucleic acids are showing the work of His hands.

As research continues to advance, other valuable uses of genetic information are currently becoming reality. Finding the function of each gene should prove to be very useful for the fields of biotechnology and medicine. Understanding the genetic problems which underlie disease should result in a deeper grasp of the biochemistry involved. Better biochemical understanding will result in the development of more accurate pharmaceuticals with fewer side effects. In addition, gene therapies for diseases

which currently cripple and debilitate thousands of humans may become reality as genetic data are better understood and as technologies for gene delivery become more advanced.

In addition to our study of the human genome, other genomic information is also proving useful for humans. For example, the genomes of several parasitic protozoans have been sequenced, including the parasites that cause malaria (*Plasmodium*), trichomoniasis (*Trichomonas*), and African sleeping sickness (*Trypanasoma*). Think of the advances in medicine that could be made in the developing world as we better understand these parasites and develop medications that will help humans defend against them.

Many plant genomes, including wheat, rice, and maize, have also been sequenced. Advances in plant genetics should lead to heartier, more pest-resistant, and possibly more nutritious crops. This is important as we seek to balance the nutritional demands of a growing human population with the biblical command to be caretakers of the earth. The information we glean from yeast, bacterial, and animal genomes also stands to benefit humans, as many or all of these organisms are used as research models that directly benefit human and veterinary medicine.

WITH ALL OF THE POTENTIAL BENEFITS OF GENETIC INFORMATION, IS THERE ANY DOWNSIDE?

Certainly privacy will be a major concern. If everyone's DNA is entered into a database, there are a number of potential pitfalls. Should insurance companies have access to this information or just a person's healthcare provider? Would insurance companies be able to deny coverage to a person based on their genetic information? How secure would this information be? All of these problems are in the realm of possibility.

What about genetic therapies? Physicians have been in the business of healing since the fall of mankind. Genetic therapies are simply a new technology that will allow us to heal people from a greater number of diseases. However, with genetic therapy comes the possibility of genetic enhancement. The line between therapy and enhancement can be difficult to draw. Unfortunately, in our society, this line may simply come down to who can afford genetic enhancements and who cannot. As a result, people of lower socioeconomic status could become a genetic subclass, resulting in discrimination.

The ultimate concern centers on what it means to be human. Are we humans more than the sum total of our nucleotide bases and their expression? Do we, as God's image-bearers, have intrinsic value that transcends our biological selves?

We must ensure that our technologies are stewarded well, to promote health and healing to humankind and to the environment. We are obligated, as disciples of a just God, to promote justice in the way that genetic data are used, so that no class of people is discriminated against.

Genetic information is simply that — information. As a creation of God, it is good, even beautiful. Even though our genes, like everything else, have been corrupted by the fall, the information in those genes points to an omniscient, all-wise Creator. Genetic information, then, is certainly nothing to be feared. This information is a valuable, God-given resource with life-giving potential. However, like any resource, it must be used wisely in order to be beneficial. T

Dr. Heather Kuruvilla serves as associate professor of biology at Cedarville University and has been at Cedarville since 1997. She received her B.S. in biology from Houghton College and her Ph.D. in biological sciences from the State University of New York at Buffalo. She is a member of the American Society for Cell Biology, where she presents research at their annual conference and serves on the Congressional Liaison Committee. Kuruvilla and her students continue to work together to publish scientific articles and abstracts on aspects of chemorepellent signaling.