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## ***Genomics Education at the Mayo Clinic: A New Model for Data and Information***

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I have been presented with a significant challenge, having been asked to discuss how genomics, specifically medical genomics, is being integrated into medical practice at the Mayo Clinic, a tertiary care, a highly scientific, and—if you are familiar with the people who are there—a very formal type of institution. I will explain the approach we are taking to provide some insight into:

- how an institution like the Mayo Clinic tries to assimilate new information that's important in diagnosis and treatment, but yet somewhat problematic for the physicians involved, and
- the possibility that there are overlapping areas of interest between nutraceuticals and the effects of diet on health, and genomics.

I believe that diet has very strong effects on health. I believe that it is also true that disease is almost exclusively determined by genes and abnormalities in genes. I don't think that these are contradictory positions, and I think that the challenge for conference attendees, and the challenge for those of us who are more classically interested researchers, is to find areas of overlap.

Sequencing of the human genome has had a profound impact in the medical community. The effects have been to focus attention on medical genomics, and it is clear that there are significant implications for clinical practice.

### **EVOLUTION OF MEDICAL GENOMICS**

Major advances in medical genomics began in the late 1940s and the 50s with progress in genetics, and with genetic engineering in the 1970s. The human-genome project represented a major conceptual step forward, and when it was

completed, it was clear that there was tremendous potential for impact on the diagnosis and treatment of disease. This new information will gain entrance to medical practice through cardiomics and bioinformatics, and will assist in the diagnosis of disease, the identification of diseases in relation to genes, the identification of predisposition to disease, the identification of new therapeutics, and understanding of individual responses of particular patients to particular therapeutics.

The key then is that using the new medical-genomics information is going to transform diagnosis, therapy, and treatment, and approaches to predisposition to disease in practices such as we have at the Mayo Clinic.

We have always known that some diseases are genetic, or have a genetic component. Since the early '90s, there has been an exponential increase in the identification of diseases that have a strong genetic contribution. There has been, as another example, quite a bit of interest in pharmacogenomics, where it has been determined that specific genes or specific polymorphisms in genes will determine the response of a particular individual to a drug. Why, for example, will one person take aspirin and have success in treating their arthritic pain, while another patient will not? The most likely answer is that differences in the genes that those patients have determine those variable responses.

Along with these opportunities, however, there are challenges and, indeed, problems. The potential exists for a loss of patient privacy and confidentiality of medical information, which is of concern to all physicians in all institutions. There is also the potential for a loss of control on the part of the patient over their medical care. Some would argue that this is already occurring. The potential is certainly there for this to get worse. Discrimination on the basis of genetics and on the basis of finances is, of course, real. Expectations are going to change from the physician perspective in a way that is unpredictable, and, unfortunately, as it always has been in the past, more-technical medical care will be associated with much higher costs.

## **MAYO'S MISSION**

These changes and opportunities are reflected in our mission statement, "The Mayo Clinic prides itself in its ability to elucidate the goals that it has," and one of the current major goals is to include genomics in the integrated practice of medicine. The difficulty is that for the majority of physicians there is very little understanding of genetics, little understanding of its principals, little understanding of the practice, and little understanding of the tests. And so the challenge for the individual physician, for the clinic, and for the medical community at large, is to develop paradigms and opportunities to educate physicians in practice about the new opportunities, and also the new responsibilities and problems.

The guiding principal at our institution is that all physicians, not just medical geneticists as a subspecialty, but all physicians can participate in this

process. But without a strong knowledge base, to achieve that goal is going to require a significant educational effort. To achieve this educational effort a Genomics Education Steering Committee was formed with three goals and charges:

- to transmit information to all physicians of the clinic,
- to transmit to the clinicians the significance and importance of this information, and
- to develop an educational plan to maintain the standards of education and the standards of care.

The group, of which I am a member, has initiated efforts in several areas. There has been provision of resources, primarily on a Web-site. There have been educational activities, including seminars. There is also coordination of research activities at the clinic, which is being done in consultation with the communications department.

One of the first things that we did as a committee was assay the level of knowledge and the level of comfort of our physicians with genomic tests and with ethical, legal, and social issues, termed “elsi.” Interestingly, a high number of the physicians were not at all comfortable. As a corollary, a high number of physicians expressed strong desire for educational materials, reinforcing our initial concept of both a strong need for education and also a very good opportunity for education.

There has been significant activity in continuing education. We have organized a large number of lectures and several symposiums, videos are available to physicians and we are coordinating activities with allied health staff. We will continue these activities to bring new genomics information to our clinicians. We have given a major introductory course on medical genomics, in which a large number of people from the committee participated. We are planning a major continuing educational course; Alan Bradley, the director of one of the major genome-sequencing centers in the world, the Wellcome Sanger Center in the UK, will be our keynote speaker.

We have also put together as a second area of activity, a group of interested faculty members who are supporting the effort as liaisons between our committee and the different departments and committees. Clearly there is a need for information that is specific for particular physicians’ practices or the practice of a particular group or division. And, by identifying interested individuals in each group, we hope to facilitate the educational process.

We have put together a web site, which, unfortunately, is not yet available outside the clinic. We are working diligently to construct something that will be transportable and will be usable by physicians other than those at the clinic. As the director of this process, I have to say that this is an incredibly time-consuming and resource-consuming activity, and it will be some time before we will be fully operational.

## THE CHALLENGE

In conclusion, the Mayo Clinic is engaged in what I think is reasonably termed an aggressive effort to prepare the staff and the allied healthcare for changes in medicine, with genomics and medical genomics becoming a central part of the therapies that we will offer. To reach this goal, to effect this education, we are expending effort as I've described, we are identifying key staff developing web sites and supporting material for those individuals.

This is a little different from the interests of most of those attending this conference, but I would stress the need for integration of the new genomics information, new nutraceuticals information and foods-for-health information towards a more comprehensive understanding of health and of disease. That's a challenge for all of us.